Behaviour Change Update: Stage 3

BCT analysis of behaviour change interventions reported in studies of cost effectiveness

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1. Executive Summary

Using a search strategy of studies with economic analyses by Bazian, 251 interventions targeting smoking cessation, diet, physical activity, sexual health, alcohol and multiple health-related behaviours were identified. Of these, 102 provided cost-utility (CUA) estimates and 85.3% were considered to be cost-effective based on a conservative NICE threshold.

Overall, smoking cessation interventions provided lower CUA values and were more likely to be cost-effective than interventions for multiple health-related behaviours. Across all interventions, those targeting the general population had lower CUA results and were more likely to be cost-effective than those aimed at vulnerable populations. In addition, interventions featuring behaviour change techniques (BCTs) related to "Reduce negative emotions" had higher CUA values and those featuring the BCT "Monitoring outcome(s) of behaviour by others without feedback" were less likely to be cost-effective.

When looking at health-related behaviours separately, diet interventions that provided medication only had higher CUA outcomes than other types of diet interventions. Moreover, diet interventions including BCTs related to "Comparison of outcomes" and interventions for multiple health-related behaviours that used electronic supporting material were less likely to be cost-effective than interventions that did not.

Cost-effective interventions included in this report had CUA estimates broadly similar to interventions already appraised as cost-effective by NICE (reported in Stage 1). However, a higher proportion of interventions in this report focused on multiple health-related behaviours, were set in primary care, aimed at vulnerable populations, involved training and included BCTs pertaining to practical and social support and to discussing body changes. By contrast, fewer interventions than in Stage 1 focused on alcohol, were set in the work place, delivered at population level, used self-help material or incentives, and featured 'choice architecture' (CA). In general, interventions in this report served fewer functions, covered fewer BCT clusters and included fewer individual BCTs compared with Stage 1 interventions. Based on the present analysis, there is no consistent and little association between the presence of an individual BCT or BCT cluster and an intervention being considered cost-effective.

These findings need to be interpreted cautiously given 1) different search strategies for this and the Stage 1 report, 2) reliance on incomplete information in published papers, 3) heterogeneity in economic analyses, 4) lack of consensus for a definition of CA and 5) bias in reporting of study findings.

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3. Background

NICE has received a referral to update its guidance on behaviour change. The update will focus on evidence-based, individual-level behaviour-change techniques and interventions based on modifying the decision environment (or 'choice architecture') specifically in relation to smoking, alcohol, diet, physical activity and sexual health. It will include interventions for different population groups aged 16 years and older. There will be a particular emphasis on the techniques and skills practitioners require to help people sustain their new behaviour.

NICE uses economic analyses to compare the costs and benefits of an intervention to determine whether it provides value for money. The overall aim is to maximise the benefits relative to the resources available. The main method used by NICE is cost utility analysis which considers the length of life someone will gain, adjusted for quality of life experienced, as a result of intervening in a particular way (i.e. the 'quality-adjusted life year'; QALY). Other methods such as cost consequence analysis or cost benefit analysis may be used as appropriate.

Three reviews have been commissioned to inform the development of an update of the guidance on behaviour change (undertaken by Bazian). It is anticipated that a number of the interventions and behaviour change techniques (BCTs) that are likely to be identified in these reviews will be covered by NICE's existing economic analyses. However, it is also recognised that the three reviews might identify interventions and BCTs not already considered by NICE.

For the updated guidance a four-step approach to the economic analysis is proposed which seeks to maximise the use of existing evidence whilst ensuring there are no significant gaps. Should any significant gaps be identified, it may be possible to use NICE's existing models to fill those gaps. Should existing economic analyses and models be insufficient, a bespoke analysis will be commissioned to supplement existing analyses.

Stage 1

The first stage entails an analysis of interventions already assessed by NICE as cost effective with the aim of identifying and classifying the behaviour change techniques therein, including whether they are based on choice architecture. This analysis together with stage 2 will be used to determine whether there are any significant gaps that need to be addressed with a commissioned piece of work.

Stage 2

In stage 2, which will run contemporaneously with stage 1, the searches developed by Bazian and the NICE team for the effectiveness reviews will be adapted and run by NICE information services in the economic databases ECONLIT, NHS EED and HEED. The aim of this stage is to determine whether there are any studies of cost effectiveness that address the areas covered by the effectiveness reviews for the guidance update.

Stage 3

The outputs from stage 1 and 2 will be used to determine whether there are any significant gaps in the interventions and behaviour change techniques in NICE's existing economic evidence base which need to be addressed to support the development of the guidance. If timelines allow, information from the effectiveness searches will also inform this stage.

Stage 4

The last stage will synthesize relevant existing NICE economic analyses and, if necessary, supplement these with a bespoke (commissioned) analysis to fill any significant gaps

The current report presents findings that contribute to Stage 3 of this process. Specifically, this report aims to:

1) Describe the content and classify BCTs of interventions identified in Stage 2, including whether interventions are based on choice architecture[1]
2) Compare BCTs of interventions appraised as cost-effective and cost-ineffective according to NICE threshold[2]
3) Compare BCTs of cost-effective interventions identified in Stage 1 with cost-effective interventions identified in Stage 2

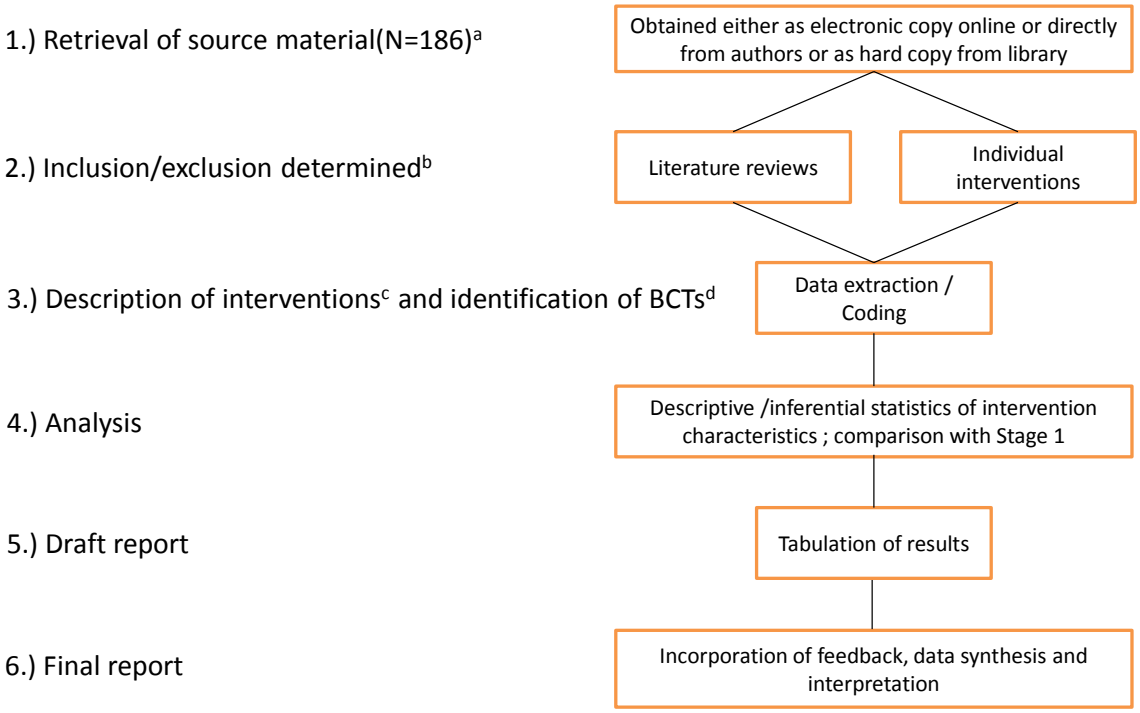
[1] Please note that the search strategy in stage 2 was not designed to specifically identify choice architecture studies (but would not have explicitly excluded such studies as relevant if meeting other inclusion criteria detailed in Table 1).

[2] Interventions above £20.000-30.000 per quality adjusted life year (QALY) saved are usually considered cost-ineffective (*cf.* Footnote 5). Studies that did not provide information in £/QALY were included if they provided some other data on cost-effectiveness (see 4.1 Review of papers identified by Bazian search strategy for further information)

4. Methodology

The sequence of steps taken in the production of this report is provided in Figure 1.

FIGURE 1: REPORT PROCEDURE



[a]Based on Bazian search strategy of economic databases and Medline carried out by NICE information services; material that could not be obtained in the ways described was not included.
[b]Inclusion/exclusion criteria: see section 4.1 for details
[c]Interventions were characterised according to the same categories as in Stage 1 [1] to maintain consistency across reports. Interventions reported in reviews were coded directly from reviews.
[d]BCTs were classified according to latest BCT taxonomy [2]. In line with previous analyses, at least 25% of source material was double coded to establish good agreement.

4.1 Review of papers identified by Bazian search strategy

The scoping of this report produced several inclusion and exclusion criteria. The initial sift through of papers identified with the Bazian search strategy was carried out by NICE. Only papers that reported an economic analysis of interventions[3] designed to change behaviour in

[3] Econometric analyses generally compare the impact of two or more alternative courses of action with regards to their costs and outcomes. Depending on the outcome and techniques used, different terminology is applied [3]. Cost-benefit analysis (CBA) expresses all direct and indirect costs and benefits in a common unit, usually in monetary terms, and enables calculation of net benefit (unit difference of benefits minus costs). Thus the alternative with the greatest net benefit (which of course can be negative) would be chosen. A problem of CBA is the need to put monetary value on sometimes intangible outcomes and the assumption that benefits and costs are quantitatively but not qualitatively different. Cost-consequence analysis (CCA) is a special form of CBA which does not attempt to express all costs and benefits in the same unit of measurement and therefore to aggregate findings into single indicator. Thus different benefits and different costs may be measured using different units and a decision as to which alternative course of action to take is dependent on weights or importance placed on different benefits and costs. Cost-effectiveness analysis (CEA) differs from both CBA and CCA, expressing outcomes in natural units. It therefore does not take into account all possible

one of the following six domains were included: Smoking, Diet, Physical Activity, Alcohol, Sexual Health and Multiple Health-related Behaviours. The exclusion criteria applied by NICE are provided in Table 1. Following the screening of papers, a total of 186 were included on a preliminary basis. All papers that could be retrieved were reviewed again on the basis of full-texts and further papers excluded as outlined in Figure 2.

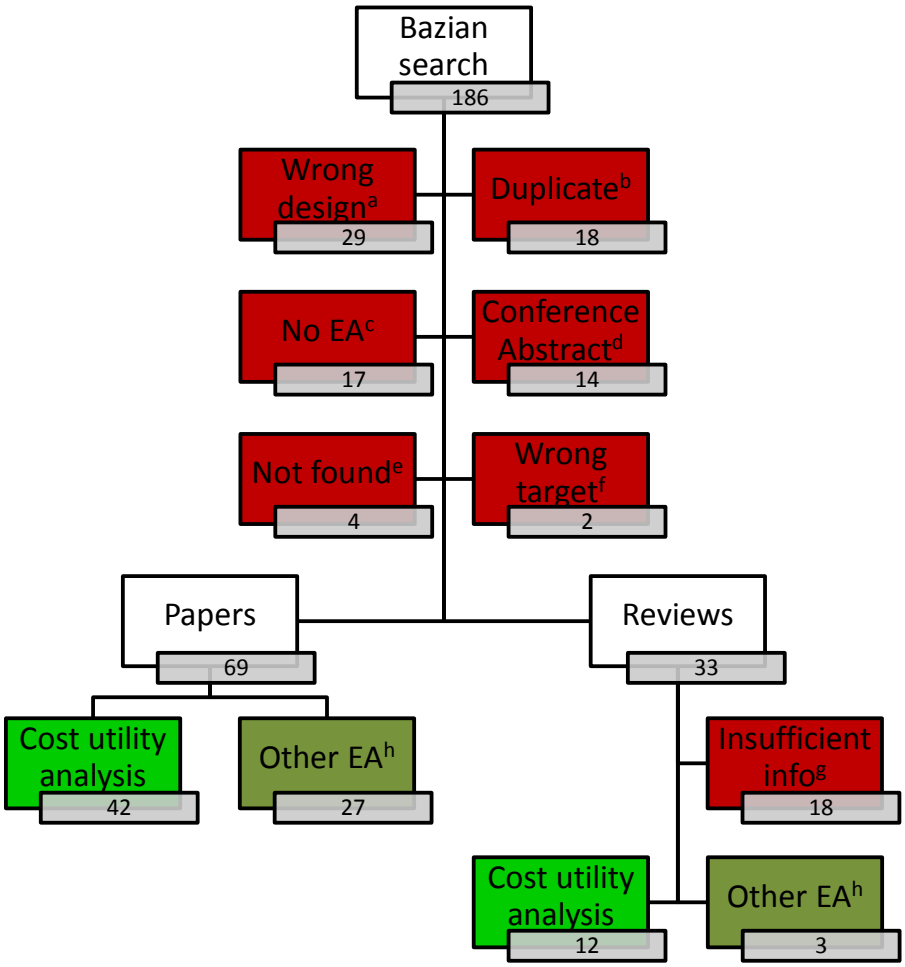
TABLE 1: NICE EXCLUSION CRITERIA

Reason for exclusion	Explanation	Additional comments
Wrong question	Study does not assess the cost effectiveness of a behaviour change intervention in the areas of diet, physical activity, smoking, alcohol, or sexual health	
Wrong study design	Not a CUA, CCA, CBA or CEA[a]	
Wrong level of intervention	Not an individual level behaviour change intervention	This includes studies which are community or population level, including those that do not select participants based on their behaviour or health status
Wrong type of intervention	Not an intervention targeting a health behaviour/health behaviour change	This includes studies not targeting health behaviour/health behaviour change, e.g. those targeting unrelated behaviours/outcomes
Wrong population	Not in adults aged 16 and over	Do not tag non-individual level intervention studies with this tag, use WLI
Wrong comparator	Studies comparing two clearly non-standard behaviour change interventions and no "No intervention/Waiting list/usual/standard care" or similar control	(note: studies must compare the intervention with no intervention, or with usual practice, or compare two or more intervention types)
Wrong outcome	Studies not reporting a CUA, CBA, CCA or CEA on the behavioural outcome targeted by the intervention	This includes: - studies which describe a behavioural outcome which is not the target of the intervention - studies reporting non-behavioural outcomes only - studies not reporting any outcomes (e.g. RCT rationale and methods descriptions only)

[a]CBA: cost-benefit analysis; CCA: cost-consequence analysis; CEA: cost-effectiveness analysis; CUA: cost-utility analysis (see Footnote 3 for details).

benefits (e.g. indirect ones), using a single unit of measure for benefits. Within the health care setting such cost-effectiveness analysis usually focuses on the additional cost per additional unit of health gain (e.g. life saved, case averted) created by one compared with another intervention: the incremental cost-effectiveness ratio (ICER). Cost-utility analysis (CUA) is a special form of CEA which adjusts health benefits for quality of life (see Footnote 4).

FIGURE 2: SELECTION TREE



[a] Papers excluded if:

- costs and effects of individual interventions are inseparable (cannot be linked to intervention components)
- analysis not based on direct health behaviour-related outcome but on indirect consequences (e.g. on insurance claims) as confounding effects of other variables cannot be excluded
- outcome of analysis is unclear, i.e. in the absence of standard criteria (see Footnote 5), authors do not provide judgement on cost-effectiveness of intervention
- control condition to which intervention condition is compared to evaluate cost-effectiveness is not specified
- analysis is purely hypothetical, i.e. no actual effectiveness data exist

[b] Papers that were included in Stage 1 or which were duplicate in the Bazian search were excluded

[c] No economic analysis (EA): papers reporting only intervention costs (but not its effectiveness) or papers that simply stated that an intervention is cost-effective without providing actual data were excluded

[d] Conference abstracts were excluded due to insufficient details on intervention content

[e] Papers that could not be obtained and thus only abstract was available were excluded due to insufficient details on intervention content

[f] Papers that reported interventions aimed at changing provider behaviour rather than health-related behaviour of recipient

[g] Reviews that provided insufficient information to code interventions included with any detail were excluded

[h] This refers to economic analysis other than cost-utility analyses, reporting costs per unit change or on cost saving interventions etc. (e.g. CBA, CCA, CEA)

The majority of papers after review of the abstract or full text were excluded because the design used did not fit with inclusion criteria (see Table 1), because papers had already been included in Stage 1 [1] or were duplicates in this search or because papers and reviews that were retrieved either provided no explicit information on cost-effectiveness or too little information for interventions to be coded. A total of 84 papers were included and 108 were excluded (for details see Appendix 9 and Appendix 10, respectively). Of 84 included papers, 15 were reviews that covered 198 individual interventions. Of these, 78 interventions were not analysed, mostly because they did not include an economic analysis (N=36) or because the design was wrong (e.g. economic analysis was amalgamated and could not be linked to intervention components or control condition was unspecified, N=36). The remainder were excluded as they had the wrong target, or focused on participants below 16 years of age. In addition to the review papers, the 69 non-review papers covered 136 interventions of which five were excluded because they did not include an economic analysis, duplicated an intervention or because the intervention focused on children. Thus this report included 84 papers covering 251 eligible interventions. Details of both are provided in Appendix 1.

4.2 Review of economic analyses

Papers in this report were identified with a search strategy developed by Bazian that focused on cost-effectiveness analyses. A total of 84 papers reporting some form of economic analysis were identified. Cost-effectiveness information was extracted where available, mostly in the form of incremental cost-effectiveness ratios (ICER, see Footnote 3), measured in cost per adjusted life years gained[4]. Data were derived directly from figures in reports (Appendix 1 reports original data), representing costs for the average intervention user and, where necessary, converted into GBP at time of original analysis or, when this information was not available, at the time of the paper publication. As some of the economic analyses carried out sensitivity analysis, varying cost-effectiveness estimates based on various factors such as user characteristics and time horizons, both lower (most optimistic) and upper (most pessimistic) limits of CEA estimates were recorded where available and cost-effectiveness determined according to NICE guidelines[5]. In cases where no such sensitivity analysis was carried out, the single CEA estimate was included as both the lower and upper limit.[6]

[4] CEA/CUA uses either life-years (LY) or quality/disability adjusted life years (QALY/DALY) gained [4]. The former simply counts the additional years added to a person's life due to an intervention while the latter weights these years according to the perceived life quality in terms of a number of factors such as pain/discomfort, mobility and mental well-being [5]. Each QALY/DALY is assigned a value between 1.0 (perfect health) and 0.0 (death). The fact that the worth of extended life in the future is considered to be less than if immediately realised due to the uncertainties we associate with future events is also considered in CEA/CUA [6]. Each LY or QALY/DALY is therefore discounted by a fixed amount per year, typically between 1.5%-3.5% [7].

[5] NICE evaluates the effectiveness as well as cost-effectiveness of treatments so as to make recommendations about the implementation in the UK National Health Service [8]. NICE has adopted a cost-effectiveness threshold of £20,000-£30,000 per QALY above which interventions are unlikely to be recommended. However, there is debate about the correct level of this threshold which is considered implicit rather than explicit [9] and varies enormously between countries [10]. In fact, in NHS settings the cost-effectiveness threshold for circulatory diseases and cancers is below £20,000 [11] whilst NICE recommendations in practice have a much higher threshold [12].

[6] Where ICER are reported, interventions can be recorded as dominant (i.e. both less costly and more effective than the comparison condition) or dominated (i.e. both more costly and less effective than the comparison condition). For this reason, dominant interventions were recorded as £0 per QALY gained and CUA estimates for dominated interventions derived from comparison with other control condition, if provided, or no estimate was recorded.

However, not all papers reported information in the required form (i.e. conducted cost-utility or cost-effectiveness analyses). Of all interventions included (N=251), 167 used CEA that expressed outcomes in (adjusted) life-years saved, with 60% gaving a single CEA estimate and 40% providing multiple estimates. Of these 167 interventions, 25 used life-years saved, 40 used disability-adjusted life-years saved and the remainder (N=102) used cost-utility analysis (i.e. expressed outcomes in QALY). The rest of the 251 interventions (N=84) used some form of economic analysis (e.g. CCA/CBA) that yielded data not expressed in (adjusted) life-years saved. In all cases it was possible to establish whether an intervention was cost-effective or not, either based on CUA following NICE guidelines or, in the absence of CUA, based on authors' conclusions resulting from the evaluation of some other economic analysis (CEA/CBA/CCC) presented in their paper. However, in order to meaningfully interpret data and maintain consistency with NICE guidelines, the 149 interventions[7] where cost-effectiveness status was based on analyses not expressed in cost per QALY gained were not included in analyses relating to report aim 2), i.e. the comparison of BCTs of interventions appraised as cost-effective and cost-ineffective according to NICE threshold, and to report aim 3), i.e. the comparison of BCTs of cost-effective interventions identified in Stage 1 with cost-effective interventions identified in Stage 2.

Based on descriptions in included papers, interventions were characterised in a number of broad categories derived by consensus among the authors of this report, outlined below:

Intervention intensity (low; medium; high): *Low*: one face-to-face contact or other direct contact lasting up to 5 minutes or any non-specific (impersonal, e.g. through media) contact; *Medium:* one face-to-face contact or other direct contact lasting more than 5 minutes, or one face-to-face contact or other direct contact lasting up to 5 minutes on more than one occasion; *High:* any face-to-face contact or other direct contact lasting more than 5 minutes on more than one occasion.

Setting (primary or secondary care; community, workplace or other): Interventions were classified according to the main location/physical environment in which interventions took place.

Mode of delivery (physician; health professional; media; combination; other/not specified): The main route that was used to deliver the intervention was recorded. Note that health professionals included nurses, pharmacists, psychologists, dieticians and other qualified personnel.

Target level (individual; group; population): Interventions were characterised according to the target recipient of delivery.

Supporting material (none; self-help; electronic; mixture): The use of supporting material was recorded including written (self-help) or electronic (e.g. telephone, mobile phone, computer) material.

Other categories: Interventions were also characterised according to whether they used pharmacological support, incentives or social marketing and whether they targeted the general population or vulnerable populations (e.g. pregnant women, individuals at risk of disease, those from low socio-economic groups).

[7] This figure is derived by adding interventions presenting cost-effectiveness in LY or DALY saved (N=25+40=65) to interventions reporting other economic analyses, not expressed in (adjusted) life-years saved (N=84).

Given the large number of individual interventions considered, the extracted information was used to group all interventions into six exhaustive categories determined by consensus:

1) Medication
2) Brief intervention
3) Brief intervention and medication
4) Comprehensive intervention
5) Comprehensive intervention and medication
6) Mass media intervention

In addition to interventions, information on control conditions was also obtained and content categorised in relation to the active intervention condition as follows:

1) Nothing/Usual Care (e.g. waitlist control, normal treatment)
2) Lower impact control (either non-matched or placebo control condition)
3) Matched control (control condition of comparable intensity)

Finally, interventions as described in papers were characterised with regards to their main functions according to the behaviour change wheel (BCW) framework [13]. Interventions could have several of the functions shown in Table 2.

TABLE 2: INTERVENTION FUNCTIONS

Intervention type	Definition	Examples
Education	Increasing knowledge or understanding	Providing information to promote healthy eating
Persuasion	Using communication to induce positive or negative feelings or stimulate action	Using imagery to motivate increases in physical activity
Incentivisation	Creating expectation of reward	Using prize draws to induce attempts to stop smoking
Coercion	Creating expectation of punishment or cost	Raising the financial cost to reduce excessive alcohol consumption
Training	Imparting skills	Advanced driver training to increase safe driving
Restriction	Using rules to reduce the opportunity to engage in the target behaviour (or to increase the target behaviour by reducing the opportunity to engage in competing behaviours)	Prohibiting sales of solvents to people under 18 to reduce use for intoxication
Environmental restructuring	Changing the physical or social context	Providing on-screen prompts for GPs to ask about smoking behaviour
Modelling	Providing an example for people to aspire to or imitate	Using TV drama scenes involving safe-sex practices to increase condom use
Enablement	Increasing means/reducing barriers to increase capability or opportunity[1]	Behavioural support for smoking cessation, medication for cognitive deficits, surgery to reduce obesity, prostheses to promote physical activity

Adapted from [13]

4.3 Retrieval of source material

As detailed in 4.1, information from abstracts were used to determine inclusion or exclusion of papers. In cases where the abstract did not provide sufficient information, the full text was obtained to come to a decision. Information extracted about interventions content or characteristics could either be from publications reporting primary data pertaining to the interventions, or secondary summaries located in systematic reviews/meta-analyses. A total of 251 relevant interventions were identified (see Appendix 1). In cases where insufficient detail was provided on intervention content in systematic reviews/meta-analyses, such reviews were excluded as limited resources did not allow retrieval of all primary data and the limited information provided would have biased results. A list of included individual papers and reviews is provided in Appendix 9.

Retrieval of source material followed a specific schedule. Material was primarily retrieved online. Where electronic versions of the articles of interest were unavailable, corresponding authors, co-authors and educational institutions within London were contacted and hard full-text copies obtained if possible. When hard copies were unavailable, it was decided not to code interventions based on limited information provided in online abstracts so as to avoid biasing results. A list of excluded papers and reviews is provided in Appendix 10.

4.4 Identification of BCTs

Interventions were coded using a taxonomy of 93 BCTs (BCT taxonomy v1) developed by Michie and colleagues [2], presented in Appendix 11. The taxonomy was developed through a process of consensus among a large expert panel of international academics and behaviour change practitioners, and aims to provide a comprehensive list of discrete generic techniques that may be used in behaviour change interventions. Techniques are included within the taxonomy if they (a) are used with the aim of changing behaviour, (b) are the proposed 'active ingredient' of an intervention, (c) are the smallest component compatible with retaining the proposed active ingredient, (d) can be used alone or in combination with other BCTs, (e) are observable and replicable, (f) can have a measurable effect on a specified behaviour, and (g) are the smallest unit that has the potential to bring about behaviour change [2].

The taxonomy remains under development, and an earlier 89-item BCT taxonomy (May 2012)[8] is being used by Bazian as part of the evidence reviews for the present NICE public health guidance update. Techniques within the taxonomy are organised hierarchically into 16 theoretical clusters: 1) social support, 2) regulation, 3) feedback and monitoring, 4) associations, 5) repetition and substitution, 6) antecedents, 7) shaping knowledge, 8) self-belief, 9) scheduled consequences, 10) reward and threat, 11) goals and planning; 12)

[8] Specifically, BCT taxonomy v1 differs from the 89-item BCT taxonomy (May 2012) in that one item from the 89-item taxonomy ('incentive', defined as 'inform that future rewards or removal of punishment will be contingent on performance of behaviour') has been partitioned into five discrete BCTs in BCT taxonomy v1. These are: *material incentive for behaviour* (BCT60); *material incentive for outcome* (BCT61); *social incentives* (BCT62); *non-specific incentives* (BCT63); and *self-incentives* (BCT64; these are defined in Appendix 11). As Appendices 2-11 show, three of these BCTs (61, 62, 64) were not present in any of the coded papers. BCT60 was coded in 9 papers and BCT63 in 4 papers. Aside from adding specificity to our coding, the distinction between types of incentives thus had minimal impact on our findings.

comparison of outcomes; 13) identity, 14) natural consequences, 15) comparison of behaviour and 16) covert learning. The taxonomy includes a standard definition of and detailed coding instructions for each BCT, including examples of instances in which each BCT should or should not be coded.

Coding followed standard guidelines [14]: BCTs were coded only where coders believed that there was unequivocal evidence for their inclusion in a given intervention. In total 96 papers were coded detailing 329 separate interventions for six types of health-related behaviours (smoking, diet, exercise, alcohol use, sexual health, and multiple behaviours). A subset of 28 papers (29.2%) was coded in batches by a second coder with disagreements resolved through discussion after each batch. Agreement was 99.2%, with a mean Cohen's Kappa of 0.89, indicating good inter-rater reliability. Details of BCTs identified in each intervention according to the health-related behaviour targeted are provided in Appendix 2 - Appendix 7.

4.5 Identification of 'choice architecture'

The term 'choice architecture' as described in the popular text *Nudge* [15] has no precise, operational definition, but is generally used to refer to elements of a decisional context, and/or the configuration of those elements, that influence the behavioural decisions taken by an individual, and the modification of these which may thereby have the potential to change people's behaviours [16]. It may be defined as a collection of environmental tools that "alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" [15]. This involves several principles including defaults, expecting error, understanding mapping, structuring complex choices and creating incentives through which decisions are influenced based on how choices are presented.

As the Bazian search did not explicitly seek out to identify interventions using 'choice architecture', interventions considered in this report did not generally make explicit references to 'choice architecture'. The current report therefore operationalized this construct on the basis of particular BCTs that were identified by consensus among the authors of the Stage 1 report [1] so as to maintain consistency. In particular, evidence of 'choice architecture' is provided if interventions included any of the BCTs presented in Table 3.

TABLE 3: OPERATIONALISATION OF CHOICE ARCHITECTURE ACCORDING TO BCTS

BCT Number	Description	Definition	Examples
15	Prompts/Cues	Introduce or define environmental or social stimulus with the purpose of prompting or cueing the behaviour. The prompt or cue would normally occur at the time or place of performance	Put a sticker on the bathroom mirror to remind people to brush their teeth

BCT Number	Description	Definition	Examples
16	Reduce prompts/cues	Withdraw gradually prompts to perform the behaviour (includes 'Fading')	Reduce gradually the number of reminders used to take medication
30	Restructuring the physical environment	Change, or advise to change the environment in order to facilitate performance of the wanted behaviour or create barriers to the unwanted behaviour (other than prompts/cues, rewards and punishments)	Advise to keep biscuits and snacks in a cupboard that is inconvenient to get to Arrange to move vending machine out of the school
31	Restructuring the social environment[9]	Change, or advise to change the social environment in order to facilitate performance of the wanted behaviour or create barriers to the unwanted behaviour (other than prompts/cues, rewards and punishments)	Advise to minimise time spent with friends who drink heavily to reduce alcohol consumption
32	Avoidance/ reducing exposure to cues for the behaviour	Advise on how to avoid exposure to specific social and contextual/physical cues for the behaviour, including changing daily or weekly routines	Suggest to a person who wants to quit smoking that their social life focus on activities other than pubs and bars which have been associated with smoking
34	Adding objects to the environment	Add objects to the environment in order to facilitate performance of the behaviour	Provide free condoms to facilitate safe sex Provide attractive toothbrush to improve tooth brushing technique
79	Framing/ reframing	Suggest the deliberate adoption of a perspective or new perspective on behaviour (e.g. its purpose) in order to change cognitions or emotions about performing the behaviour (includes 'Cognitive restructuring')	Suggest that the person might think of the tasks as reducing sedentary behaviour (rather than increasing activity)

Adapted from [2]

As an example, the 'nudging' commonly seen in commercial contexts such as placing sweets at the end of checkouts in supermarkets in the line of sight of children would involve 'prompts/cues' (BCT 15), in that the sweets act as a prompt to ask parents to buy them. It would also involve 'restructuring the physical environment' (BCT 30), in so far as the sweets are placed within easy reach of children, as well 'adding objects to the environment' (BCT 34). Similarly, the lack of mirrors in casinos to maintain the illusion of a glamorous lifestyle [17] may be seen as an example of reducing prompts and cues (BCT 15) or avoidance/reducing exposure to cues (BCT 32) to nudge people into a behaviour (i.e. continuing to gamble). Likewise, increasing the visual (if not actual) presence of police

[9] Note that 'restructuring the social environment' (BCT 31) does not include provision of normative information to change behaviour as this is captured by 'social comparison' (BCT 89) and/or 'information about others' approval (BCT 90) which was judged not to form part of choice architecture (but see [16] regarding the inherent problem arising from the vague definition of a 'nudge').

officers to reduce criminal behaviour provides an example of restructuring the social environment (BCT 31). Lastly, putting the emphasis on the percentage of fat-free (as opposed to fat-containing) content in various foods to persuade people to purchase items would be an example of framing/re-framing (BCT 79; see Table 3 for further examples).

However, given the lack of a clear definition of 'choice architecture' and nudging, in sensitivity analysis 'choice architecture' was restricted to those BCTs in Table 3 that were significantly correlated across all interventions, suggesting that they relate to the same underlying construct, in agreement with procedures from the Stage 1 report.

4.6 Analysis of findings

Data from economic reports were recorded in a MS Word file and individual papers were analysed and BCT recorded in a standardised coding form before being transferred into a MS Word file. All data were then entered into IBM SPSS v.20. Descriptive statistics were used to describe interventions and associated BCTs. Where appropriate, differences according to intervention characteristics were analysed using t-tests or one-way ANOVAs and χ^2- or Fisher Exact tests for continuous and categorical variables, respectively. Given that univariate associations may overestimate the importance of individual variables, multivariate logistic and multiple linear regression analyses were carried out to evaluate the independent association of intervention characteristics and the presence of BCTs with cost-effectiveness estimates and to compare cost-effective interventions identified in this with the Stage 1 report. The Bonferroni correction was applied in post hoc analyses.

5. Results

5.1 Descriptive analysis of BCTs included in interventions

5.1.1 General characteristics of interventions

Overall, 251 interventions were identified from 84 papers and reviews. Over a third of these (92), reported in 27 papers (including five reviews)[10] were smoking cessation interventions. This was followed by interventions with multiple health-related behaviour targets (48 interventions from 26 papers, including four reviews), interventions to improve sexual health (44 interventions from 11 papers, including four reviews) or for diet (39 interventions from 11 papers, including three reviews), interventions for physical activity (28 interventions from eight papers, including one review) and, lastly, alcohol interventions (eight interventions from six papers, no reviews). Table 4 provides broad characteristics of these interventions (see Appendix 1 for further details of individual interventions). There was a fairly equal split between different intervention categories with the exception of mass media interventions which featured only five times and which may be a by-product of the search strategy. Control conditions mostly consisted of nothing or usual care[11] and less than one in ten intervention studies used a matched control condition. Over a third of interventions were classified as being of low intensity (i.e. mostly brief or pharmacological interventions), mainly set in primary care and delivered by health professionals. Interventions mostly targeted individuals from both general and vulnerable populations.

TABLE 4: INTERVENTION CHARACTERISTICS BY HEALTH-RELATED BEHAVIOUR

	All (N=251)	Smoking (N=92)	Diet (N=39)	Physical Activity (N=20)	Alcohol (N=8)	Sexual Health (N=44)	Multiple targets (N=48)	P*
				% (N)				
Category		[a]	[b]	[b,c]	[b,c]	[c]	[b,c]	
Med	**14.7 (37)**	29.3 (27)	20.5 (8)	0.0 (0)	0.0 (0)	2.3 (1)	2.1 (1)	
BI	**22.3 (56)**	13.0 (12)	30.8 (12)	55.0 (10)	75.0 (6)	15.9 (7)	18.8 (9)	
Med+BI	**13.9 (35)**	26.1 (24)	2.6 (1)	0.0 (0)	0.0 (0)	18.2 (8)	4.2 (2)	*<0.001*
Comp	**34.7 (87)**	10.9 (10)	38.5 (15)	45.0 (9)	25.0 (2)	43.2 (19)	66.7 (32)	
Med+Comp	**12.4 (31)**	20.7 (19)	2.6 (1)	0.0 (0)	0.0 (0)	15.9 (7)	8.3 (4)	
Mass Media	**2.0 (5)**	0.0 (0)	5.1 (2)	5.0 (1)	0.0 (0)	4.5 (2)	0.0 (0)	
Control condition		[a]	[a,b]	[a,b]	[a,b]	[b]	[a,b]	
Nothing/UC	**66.9 (168)**	55.4 (51)	61.5 (24)	75.0 (15)	50.0 (4)	88.6 (39)	72.9 (35)	*<0.001*
Lower Impact	**25.1 (63)**	34.8 (32)	33.3 (13)	20.0 (4)	37.5 (3)	6.8 (3)	16.7 (8)	
Matched Impact	**8.0 (20)**	9.8 (9)	5.1 (2)	5.0 (1)	12.5 (1)	4.5 (2)	10.4 (5)	

[10] Please note some reviews reported on several health-related behaviours

[11] Usual care is likely to vary considerably, depending on the country/region in which interventions were delivered and for this reason, where information was available, a more detailed description of control conditions was extracted (see Appendix 1).

	All (N=251)	Smoking (N=92)	Diet (N=39)	Physical Activity (N=20)	Alcohol (N=8)	Sexual Health (N=44)	Multiple targets (N=48)	P*
Intervention Intensity		[a]	[b]	[a,b]	[a,b,c]	[a]	[c]	
Unclear	**4.8 (12)**	0.0 (0)	12.8 (5)	5.0 (1)	0.0 (0)	2.3 (1)	10.4 (5)	*<0.001*
Low	**38.2 (96)**	57.6 (53)	43.6 (17)	40.0 (8)	25.0 (2)	29.5 (13)	6.2 (3)	
Medium	**24.3 (61)**	20.7 (19)	10.3 (4)	30.0 (6)	25.0 (2)	40.9 (18)	25.0 (12)	
High	**32.7 (82)**	21.7 (20)	33.3 (13)	25.0 (5)	50.0 (4)	27.3 (12)	58.3 (28)	
Setting		[a]	[b,c]	[c]	[a,b]	[b,c]	[b,c]	
Primary Care	**65.3 (164)**	85.9 (79)	53.8 (21)	40.0 (8)	75.0 (6)	65.9 (29)	43.1 (21)	
Secondary Care	**6.4 (16)**	2.2 (2)	15.4 (6)	0.0 (0)	25.0(2)	0.0 (0)	12.5 (6)	*<0.001*
Community	**17.1 (43)**	7.6 (7)	15.4 (6)	35.0 (7)	0.0 (0)	20.5 (9)	29.2 (14)	
Workplace	**1.6 (4)**	3.3 (3)	2.6 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	
Unclear/other[≠]	**9.6 (24)**	1.1 (1)	12.8 (5)	25.0 (5)	0.0 (0)	13.6 (6)	14.6 (7)	
Delivery Mode		[a]	[a,b]	[b]	[a,b]	[a,b]	[a,b]	
Physician	**9.2 (23)**	15.4 (14)	17.9 (7)	0.0 (0)	0.0 (0)	2.3 (1)	2.1 (1)	
HP	**66.4 (166)**	65.9 (60)	43.6 (17)	65.0 (13)	100.0 (15)	77.3 (34)	70.8 (34)	*0.015*
Media	**4.0 (10)**	0.0 (0)	7.7 (3)	15.0 (3)	0.0 (0)	4.5 (2)	4.2 (2)	
Mix	**4.4 (11)**	4.4 (4)	7.7 (3)	5.0 (1)	0.0 (0)	2.3 (1)	4.2 (2)	
Unclear/other[±]	**16.0 (40)**	14.3 (13)	23.1 (9)	15.0 (3)	0.0 (0)	13.6 (6)	18.8 (9)	
Target Level								
Individual	**84.1 (211)**	94.6 (87)	74.4 (29)	85.0 (17)	62.5 (5)	79.5 (35)	79.2 (38)	
Groups	**8.4 (21)**	3.3 (3)	10.3 (4)	10.0 (2)	37.5 (3)	6.8 (3)	12.5 (6)	*0.037*
Population	**2.4 (6)**	0.0 (0)	5.1 (2)	5.0 (1)	0.0 (0)	4.5 (2)	2.1 (1)	
Mix	**5.2 (13)**	2.2 (2)	10.3 (4)	0.0 (0)	0.0 (0)	9.1 (4)	6.2 (3)	
Population		[a]	[b,c]	[b,c]	[b,c]	[b]	[c]	
General	**49.0 (123)**	14.1 (13)	64.1 (25	55.0 (11)	87.5 (7)	56.8 (25)	87.5 (42)	*<0.001*
Vulnerable	**51.0 (128)**	85.9 (79)	35.9 (14)	45.0 (9)	12.5 (1)	43.2 (19)	12.5 (6)	
Supporting Material								
None	**70.5 (177)**	69.6 (64)	76.9 (30)	55.0 (11)	87.5 (7)	79.5 (35)	62.5 (30)	0.178
Self-help	**9.2 (23)**	14.1 (13)	7.7 (3)	15.0 (3)	12.5 (1)	2.3 (1)	4.2 (2)	
Electronic	**10.4 (26)**	8.7 (8)	5.1 (2)	15.0 (3)	0.0 (0)	9.1 (4)	18.8 (9)	
Mix	**10.0 (25)**	7.6 (7)	10.3 (4)	15.0 (3)	0.0 (0)	9.1 (4)	14.6 (7)	
Pharmacological support	**43.8 (110)**	78.3 (72)[a]	33.3 (13)[b]	0 (0)[c]	0.0 (0)[b,c]	36.4 (16)[b]	18.8(9)[b,c]	*<0.001*
Social marketing	**4.0 (10)**	0 (0)	5.1 (2)	15.0 (3)	0 (0)	6.8 (3)	4.2 (2)	*0.025*
Incentives	**4.4 (11)**	4.3 (4)	2.6 (1)	20.0 (4)	0 (0)	2.3 (1)	2.1 (1)	0.116
Cost-effective^	**87.6 (220)**	93.5 (86)[a]	84.6 (35)[a,b]	95.0 (21)[a,b]	100.0 (8)[a,b]	88.6 (44)[a,b]	72.9 (36)[b]	*0.012*

*Significant overall differences are in italics; [≠]Refers to state/policy level interventions (e.g. changes in legislation/physical infrastructure) or interventions in non-specific settings (e.g. online/phone interventions), [±]This refers to delivery by peers, teachers, researchers or the state; ^ Based on CUA (N=102) and non-CUA (N=149) cost-effectiveness studies; [a,b,c]Comparison of interventions targeting different health-related behaviours, different letters indicate significant difference at p<0.05 (Bonferroni-corrected); *BI* – Brief intervention; *Med* – Medication; *Comp* – Comprehensive; *UC* – Usual care; *HP* – Health professional (nurse, pharmacist, psychologist etc.).

Nearly half of all interventions included involved testing of some medication or included pharmacological support but generally most interventions used little supporting material, incentives or social marketing strategies. Based on conclusions based on a variety of economic analyses, including CCA, CBA and CUA, over four fifths of interventions were

considered cost-effective. More detailed analysis of cost-effectiveness based on cost-utility analyses according to NICE criteria is presented in Section 5.2 Factors associated with cost-effectiveness.

There were some differences between health-related behaviour interventions. Compared with all others, smoking cessation interventions had the largest proportion categorised as involving medication (i.e. medication alone and/or in conjunction with brief or comprehensive interventions) and interventions with multiple health-related behavioural targets were most likely to be comprehensive. In terms of control conditions, smoking cessation and alcohol interventions were tested most rigorously with almost half being tested against fully or partially matched control treatment, whilst sexual health interventions were nearly exclusively compared with usual care or no control intervention (Table 4). Perhaps unsurprisingly, half of interventions targeting multiple behaviours were classified as high in intensity compared with around a quarter of smoking cessation, diet or sexual health interventions. The majority of smoking cessation and alcohol interventions but less than half of physical activity interventions were set in primary care and the rest more equally spread across other settings. Consequently, the former was significantly more likely to be delivered by a physician than the latter.

There were no individual disparities between health-related behaviour interventions as a function of the target level, use of supporting material, social marketing (despite overall differences) or incentives (Table 4). However, smoking cessation interventions were more likely than any other type of intervention to involve pharmacological support. While the majority of smoking cessation and sexual health intervention was aimed at vulnerable populations (possibly reflecting particularly strong socio-economic gradients in these behavioural outcomes), other heath behaviour interventions tended to target the general population, in particular those aimed at changing multiple behaviours. These interventions were also judged to be less cost-effective than smoking cessation interventions (see Table 4).

5.1.2 Main functions of interventions

Overall, the most common functions, identified in three quarters of interventions, were to increase knowledge and/or understanding as well as the imparting of skills through training (Table 5). Nearly half of interventions aimed to increase capability and/or opportunity and a quarter of interventions used communication persuasively to stimulate action. Restructuring the environment by changing physical or social contexts or using incentives to create an expectation of reward was relatively uncommon, and the use of restriction and modelling virtually, and coercion completely, non-existent.

Intervention functions differed significantly according to the health-related behaviour targeted. The use of training was significantly more prevalent in diet interventions and interventions aimed at changing multiple behaviours than in physical activity and sexual health interventions with smoking cessation interventions falling in between these two groups. The use of education was lowest in smoking cessation interventions – significantly so compared with multiple behaviour interventions as shown in post-hoc analysis.

TABLE 5: INTERVENTION FUNCTIONS BY HEALTH-RELATED BEHAVIOUR

	All (N=251)	Smoking (N=92)	Diet (N=39)	Physical Activity (N=20)	Alcohol (N=8)	Sexual Health (N=44)	Multiple targets (N=48)	P*
				% (N)				
Training	**74.9 (188)**	78.2 (72)^{a,c}	92.3 (36)^{c}	35.0 (7)^{b}	50.0 (4)^{a,b,c}	56.8 (25)^{a,b}	91.7 (42)^{c}	*<0.001*
Education	**72.1 (181)**	62.0 (57)^{a}	66.7 (26)^{a,b}	65.0 (13)^{a,b}	100.0 (8)^{a,b}	77.3 (34)^{a,b}	89.6 (43)^{b}	*0.001*
Enablement	**45.8 (115)**	72.8 (67)^{a}	30.8 (12)^{b}	10.0 (2)^{b}	0 (0)^{b}	36.4 (16)^{b}	37.5 (18)^{b}	*<0.001*
Persuasion	**24.7 (62)**	33.7 (31)^{a,c}	2.6 (1)^{b}	35.0 (7)^{a,c}	62.5 (5)^{a}	27.3 (12)^{a,c}	12.5 (6)^{b,c}	*<0.001*
Environmental restructuring	**5.2 (13)**	6.5 (6)	7.7 (3)	15.0 (3)	0 (0)	0 (0)	2.1 (1)	0.071
Incentivisation	**4.0 (10)**	4.3 (4)	2.6 (1)	10.0 (2)	0 (0)	2.3 (1)	4.2 (2)	0.730
Restriction	**2.8 (7)**	0 (0)^{a}	15.4 (6)^{b}	0 (0)^{a,b}	0 (0)^{a,b}	0 (0)^{a,b}	2.1 (1)^{a,b}	*0.001*
Modelling	**1.2 (3)**	0 (0)	0 (0)	0 (0)	0 (0)	2.3 (1)	4.2 (2)	0.273
Coercion	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	NC

*Significant overall differences are in italics; ^{a,b,c,} Comparison of interventions targeting different health-related behaviours, different letters indicate significant difference at p<0.05 (Bonferroni-corrected); *NC – cannot be computed*

By contrast, smoking cessation interventions were much more likely than interventions aimed at changing any other health-related behaviour to employ enablement techniques (Table 5). Alcohol and smoking cessation interventions were also more likely than interventions targeting multiple health-related behaviours or diet interventions whereas restriction was more common in the latter than in smoking cessation interventions. No other differences were apparent as a function of the health-related behaviour targeted (see Table 5).

5.1.3 BCT clusters in interventions

BCTs were clustered into superordinate categories as shown in Table 6. Out of a total of 16 BCT clusters, four (shaping knowledge, antecedents, regulation and social support) were particularly prevalent, coded for in about half of the interventions considered. A further five BCT clusters (comparison of outcomes, feedback and monitoring, goals and planning, natural consequences and self-beliefs) were commonly identified, coded for in between a fifth to a third of interventions. The remainder was coded in less than ten percent of interventions and the use of BCTs pertaining to identity, scheduled consequences and covert learning was particularly sparse or non-existent. On average, BCTs included in interventions came from four clusters with a maximum of nine out of 16 possible BCT clusters present in a given intervention (Table 6).

TABLE 6: BCT CLUSTERS AND TOTAL NUMBER OF BCTS BY HEALTH-RELATED BEHAVIOUR

	All (N=251)	Smoking (N=92)	Diet (N=39)	Physical Activity (N=20)	Alcohol (N=8)	Sexual Health (N=44)	Multiple targets (N=48)	P*
				% (N)				
Shaping knowledge (BCT36-39)	**86.5 (217)**	92.4 (85)^{a,c}	89.7 (35)^{a,b,c}	55.0 (11)^{b}	50.0(4)^{a,b}	95.5 (42)^{c}	83.3 (40)^{a,b,c}	*<0.001*
Antecedents (BCT30-35)	**53.0 (133)**	76.1 (70)^{a}	56.4 (22)^{a,b}	35.0 (7)^{b,c}	0 (0)^{c}	43.2 (19)^{b,c}	31.2 (15)^{b,c}	*<0.001*
Regulation (BCT4-7)	**47.7 (119)**	78.3 (72)^{a}	35.9 (14)^{b,d}	0 (0)^{c}	0 (0)^{b,c}	52.3 (23)^{b}	20.8 (10)^{c,d}	*<0.001*
Social support (BCT1-3)	**44.6 (112)**	43.5 (40)	33.3 (13)	50.0 (10)	87.5 (7)	38.6 (17)	52.1 (25)	0.062
Comparison of outcomes (BCT74-BCT76)	**37.1 (93)**	44.6 (41)^{a,b}	20.5 (8)^{a}	25.0 (5)^{a,b}	25.0 (2)^{a,b}	22.7 (10)^{a}	56.3 (27)^{b}	*0.001*
Feedback and monitoring (BCT8-14)	**27.1 (68)**	9.8 (9)^{a}	38.5 (15)^{b}	20.0 (4)^{a,b}	75.0 (6)^{b}	25.0 (11)^{a,b}	47.9 (23)^{b}	*<0.001*
Goals and planning (BCT65-73)	**26.7 (67)**	16.3 (15)^{a}	20.5 (8)^{a}	30.0 (6)^{a,b}	50.0 (4)^{a,b}	20.5 (9)^{a}	52.1 (25)^{b}	*<0.001*
Natural consequences (BCT82-87)	**22.7 (57)**	8.7 (8)^{a}	23.1 (9)^{a,b}	15.0 (3)^{a,b}	12.5 (1)^{a,b}	45.5 (20)^{b}	33.3 (16)^{b}	*<0.001*
Self-beliefs (BCT40-43)	**22.3 (56)**	28.3 (26)^{a}	2.6 (1)^{b}	40.0 (8)^{a}	37.5 (3)^{a,b}	27.3 (12)^{a}	12.5 (6)^{a,b}	*<0.001*
Repetition and substitution (BCT23-29)	**10.0 (25)**	0 (0)^{a}	7.7 (3)^{a}	10.0 (2)^{a,b}	0 (0)^{a,b}	4.5 (2)^{a}	37.5 (18)^{b}	*<0.001*
Comparison of behaviour (BCT88-90)	**9.6 (24)**	1.1 (1)^{a}	7.7 (3)^{a,b}	0 (0)^{a,b}	0 (0)^{a,b}	13.6 (6)^{a,b}	29.2 (14)^{b}	*<0.001*
Associations (BCT15-22)	**9.2 (23)**	8.7 (8)	7.7 (3)	15.0 (3)	0 (0)	9.1 (4)	10.4 (5)	0.783
Reward and threat (BCT54-64)	**6.8 (17)**	6.5 (6)	2.6 (1)	20.0 (4)	0 (0)	2.3 (1)	10.4 (5)	0.107
Identity (BCT77-81)	**0.8(2)**	1.1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	2.1 (1)	0.768
Scheduled consequences (BCT44-53)	**0 (0)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	NC
Covert learning (BCT91-93)	**0 (0)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	NC
				Mean (Range)				
Number of BCT clusters	**4.0 (1-9)**	4.2 (1-8)^{a,b}	3.5 (1-6)^{a}	3.2 (1-7)^{a}	3.4 (2-4)^{a,b}	4.0 (2-7)^{a,b}	4.8 (1-9)^{b}	*<0.001*

*Significant overall differences are in italics; ^{a,b,c,d}Comparison of interventions targeting different health-related behaviours, different letters indicate significant difference at p<0.05 (Bonferroni-corrected); *NC – cannot be computed*

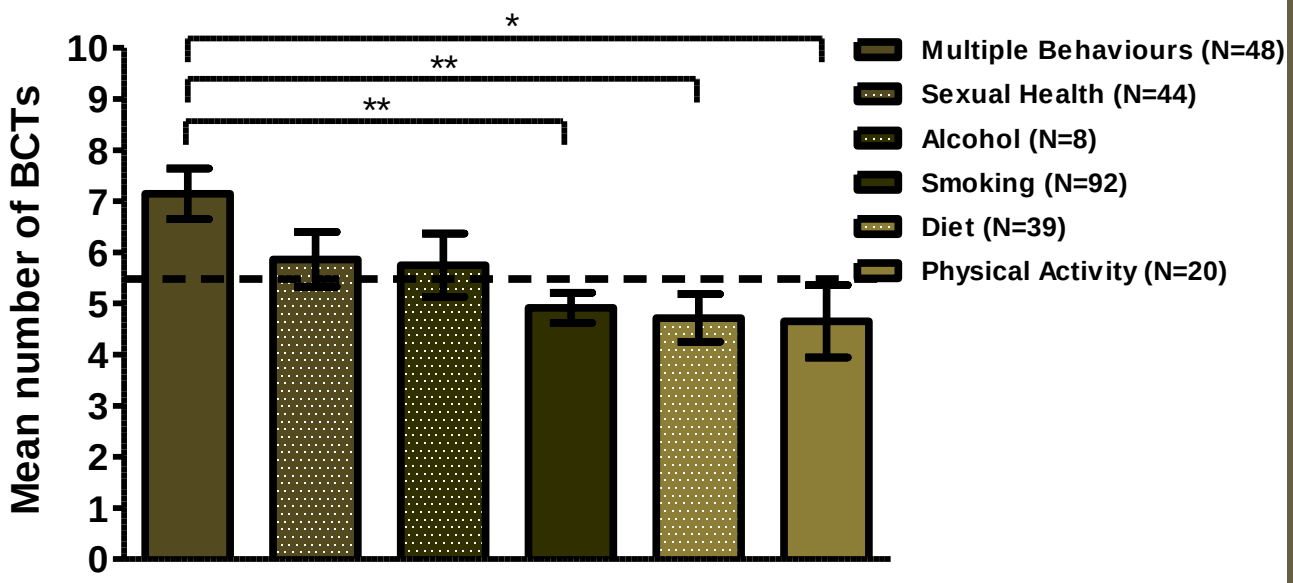
The prevalence of BCT clusters differed between interventions. Shaping knowledge was most common in smoking, diet and sexual health interventions as was the use of antecedents (Table 6). Regulatory BCTs were particularly common in smoking cessation interventions but not at all present in physical activity or alcohol interventions, possibly reflecting the big differential in the use of pharmacological support in these interventions (see Table 4). Interventions with multiple behavioural targets often focused on comparison of outcomes and goals and planning, the former being less prevalent in diet and sexual health interventions and the latter in smoking cessation, diet and sexual health interventions. The use of feedback and monitoring was commonest in interventions for diet, alcohol and multiple health-related behaviour targets but relatively rare in smoking cessation interventions. BCTs concerning self-beliefs were particularly uncommon in diet interventions. BCTs that highlighted natural consequences were present in nearly half of sexual health interventions and a third of interventions with multiple behavioural targets but relatively uncommon in other interventions, particularly smoking cessation interventions. Smoking cessation interventions also barely ever included BCTs that involved repetition and substitution or which instigated comparison of behaviour, particularly when compared with multiple health-related behaviour interventions (see Table 6). The only common cluster which was equally present across all health-related behavioural interventions was social support.

Overall, there was a significant difference in the number of BCT clusters used by interventions targeting different health-related behaviours ($F(5,245)=4.77$, $p<0.001$). In agreement with differences in the level of intensity of interventions by health-related behaviour target (see Table 4), interventions to change multiple behavioural targets included the largest number of BCT clusters, significantly more than diet or physical activity interventions (for both $p=0.003$).

5.1.4 Prevalence of individual BCTs across all interventions

Out of the total of 93 possible BCTs, the average intervention contained just over five BCTs. There was a wide range across individual interventions with some containing only one behaviour change interventions and others evidencing 16 different BCTs. As can be seen in Figure 3, multiple behaviour change interventions included the largest number of BCTs on average (mean=7.1, median=6.5, mode=4) as would be expected from findings presented in Table 6, followed by interventions to improve sexual health (mean=5.9, median=5, mode=3), alcohol interventions (mean=5.8, median=6, mode=7), smoking cessation interventions (mean=4.9, median=4, mode=4) and diet interventions (mean=4.7, median=4, mode=3), while physical activity interventions included the smallest number of BCTs (mean=4.6, median=4, mode=4). There was an overall difference as a function of the health-related behaviour targeted ($F(5, 245)=4.29$, $p=0.001$) and post-hoc comparison revealed that interventions with multiple behaviour targets included significantly more BCTs than smoking cessation ($p=0.001$), diet ($p=0.005$) and physical activity ($p=0.042$) interventions.

FIGURE 3: NUMBER OF RECORDED BCTS BY HEALTH-RELATED BEHAVIOUR

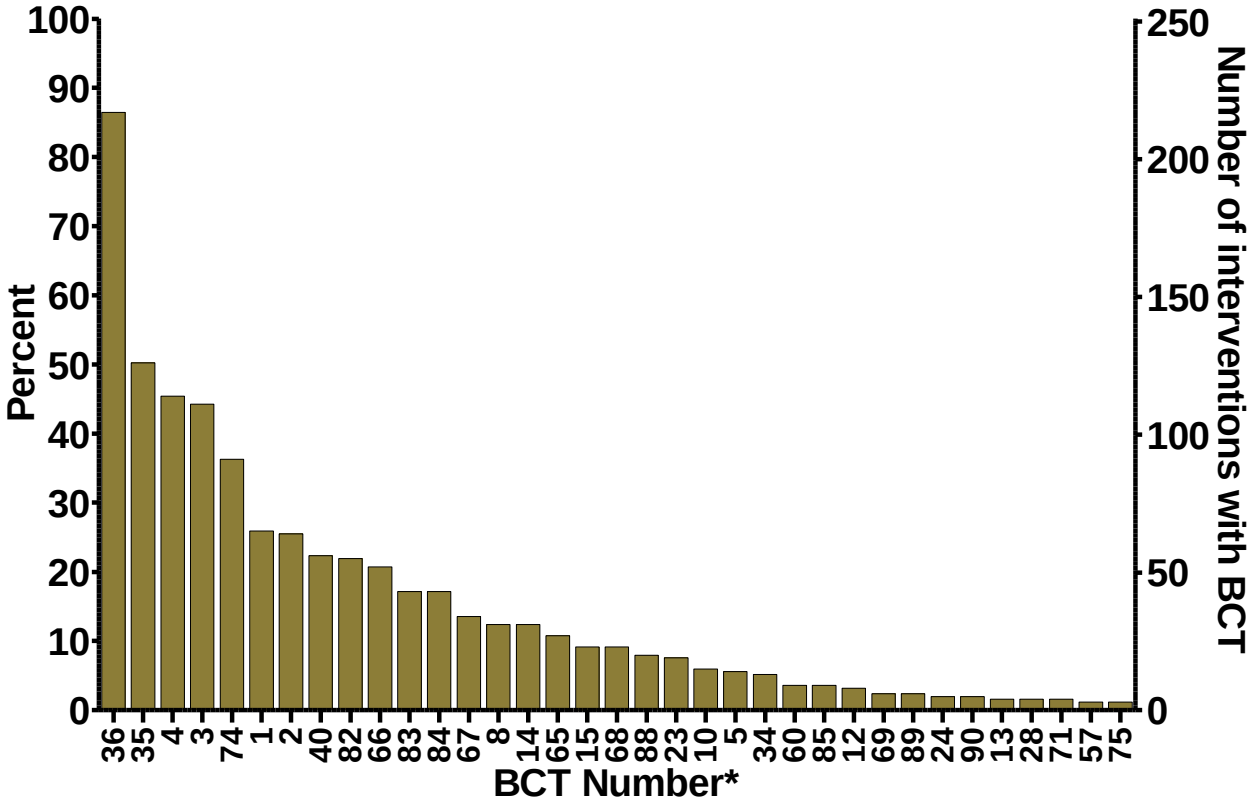


Dotted line indicates average across all interventions (N=251); Bars are standard error of the mean; Line indicates comparator groups (*p<0.05, **p<0.01 in Bonferroni-corrected post-hoc comparison)

A total of 35 BCTs were coded for in at least one percent (N=3) of all included 251 interventions (presented in Figure 4). An additional 16 BCTs were coded in at least one intervention targeting one of the health-related behaviours: eight BCTs [9, 11, 29, 30, 38, 54, 55, 61] were mentioned in two interventions and eight BCTs [6, 25, 58, 59, 62, 80, 81, 86] in only one intervention. This means that 42 BCTs were not coded for at all: BCTs [7, 16-22, 26, 27, 31-33, 37, 39, 41-53, 56, 63, 64, 70, 72, 73, 76-79, 87, 91-93].

Instructions on how to perform a behaviour (BCT 36) was by far the most prevalent of BCTs, being included in nearly nine out of ten interventions. Body changes (BCT 35), pharmacological support (BCT 4) and unspecified social support (BCT 3) were also common and present in nearly half of all interventions analysed (Figure 4). A third of interventions made use of a persuasive source (BCT 74) and a quarter included practical (BCT 1) or emotional (BCT 2) social support or used verbal persuasion to increase capability (BCT 40).

FIGURE 4: PREVALENCE OF INDIVIDUAL BCTS ACROSS ALL INTERVENTIONS[#]



[#]Only BCTs (N=35) described in at least one percent (N=3) of interventions are shown; *See Appendix 11 for details of BCTs

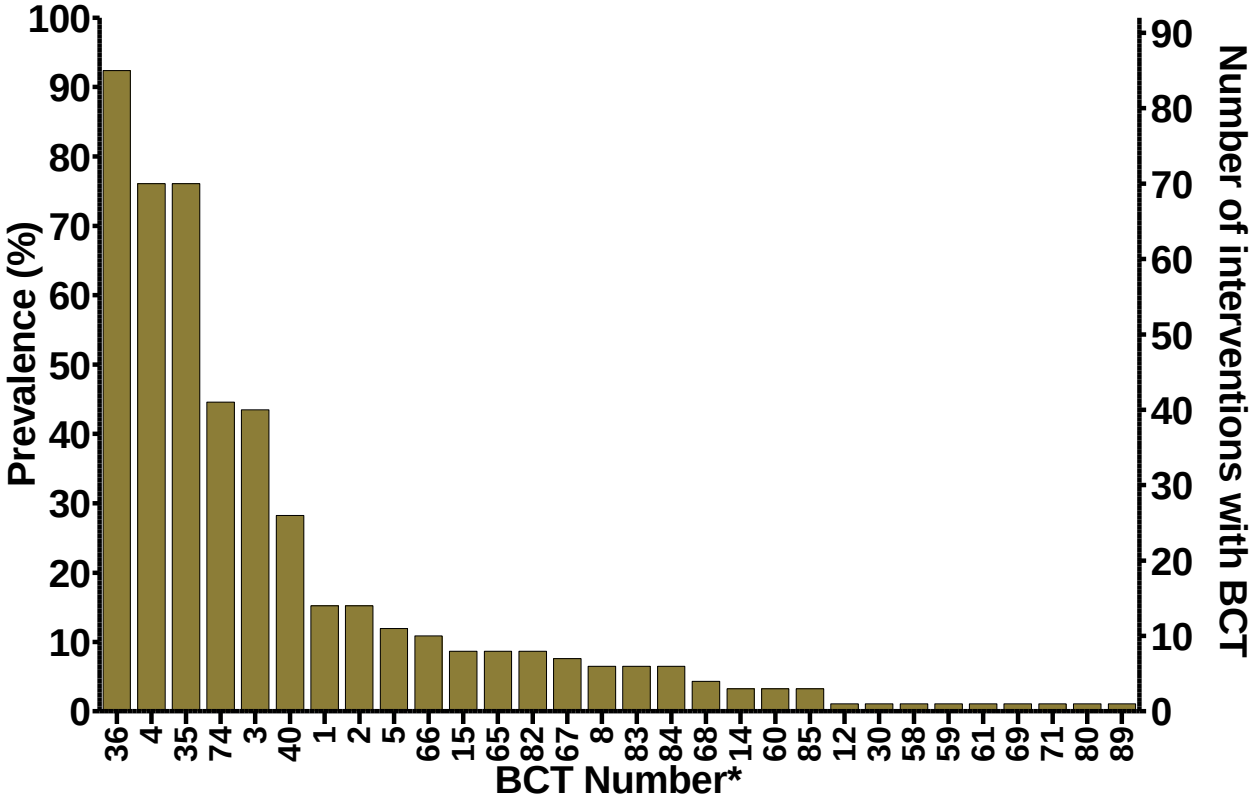
Around one in five interventions, provided information about health consequences (BCT 82), involved setting goals for behaviour change (BCT 66) and offered information about emotional (BCT 83) or social and environmental consequences (BCT 84, see Figure 4). In around ten percent of interventions, goals for positive outcomes of behaviour change were set (BCT 67), feedback on behaviour was provided (BCT 8) in addition to using biomarker feedback (BCT 14), problem solving techniques (BCT 65), prompts and cues (BCT 15), and action planning (BCT 68). The remaining BCTs were used much more infrequently.

5.1.5 Prevalence of individual BCTs in smoking cessation interventions

A total of 30 distinct BCTs, listed in Figure 5, were coded at least once in 92 smoking cessation interventions (for further details see Appendix 2). The most prevalent BCT (recorded in over 90% of smoking cessation interventions) was the inclusion of instructions on how to perform a behaviour (BCT 36). Three quarters of smoking cessation interventions also discussed body changes (BCT 35) and provided pharmacological support (BCT 4). Just under half of interventions involved the inclusion of a persuasive source (BCT 74) and also provided non-specific social support (BCT 3). Related to this, nearly a third of interventions

used verbal persuasion about a person's capability to strengthen their self-beliefs (BCT 40). Lastly, in at least ten percent of interventions, practical (BCT 1) or emotional (BCT 2) social support was provided, negative emotions reduced (BCT 5), and goal setting for desired behaviour encouraged (BCT 66) applied (Figure 5).

FIGURE 5: OCCURRENCE OF INDIVIDUAL BCTS IN SMOKING CESSATION INTERVENTIONS[#]

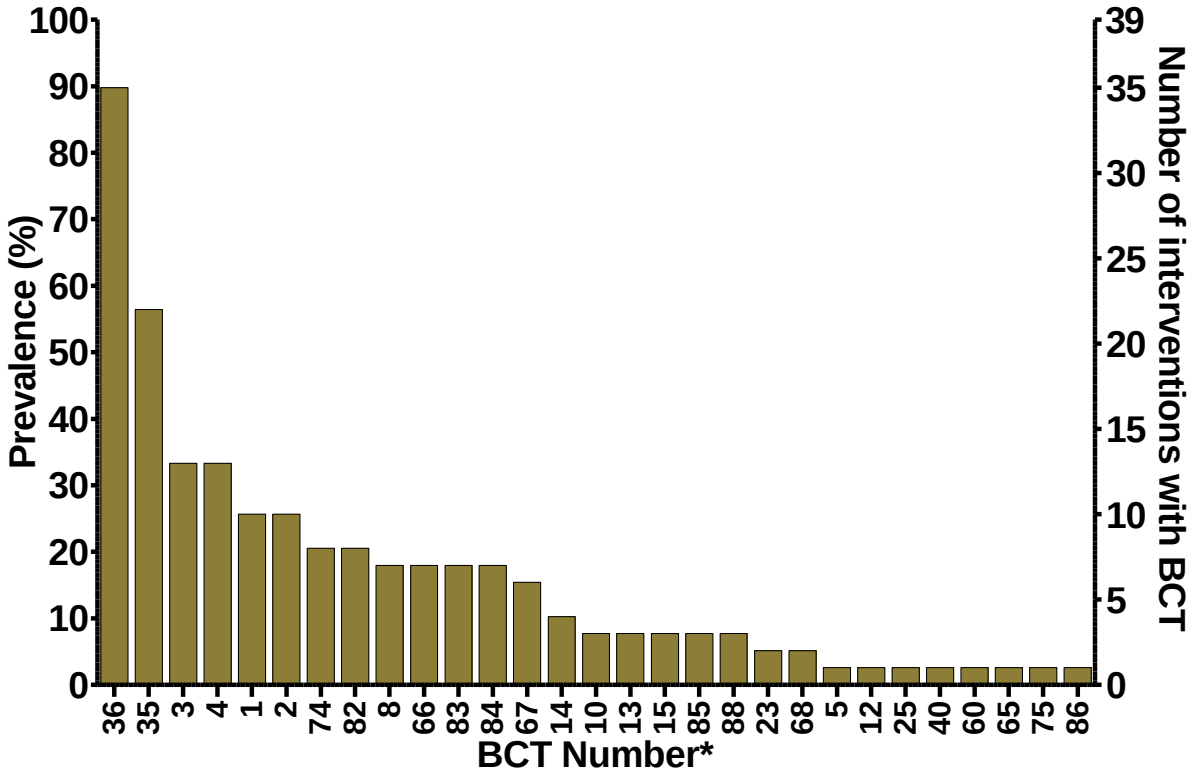


[#]BCTs (N=30) described in at least one smoking cessation intervention are shown; *See Appendix 11 for details of BCTs

5.1.6 Prevalence of individual BCTs in diet interventions

Altogether 29 BCTs were detailed in 39 diet interventions as shown in Figure 6 (for further details see Appendix 3). As for smoking cessation interventions, the most prevalent BCTs were instructions on how to perform a behaviour (BCT 36), being present in 90% of interventions, and the discussion of body changes (BCT 35) included in over half (N=22) of interventions. A third of interventions provided unspecified social support (BCT 3) and pharmacological support (BCT 4) and a quarter included practical (BCT 1) and emotional (BCT 2) social support. Around one in five diet interventions used a persuasive source (BCT 74), provided information about health consequences (BCT 82), gave feedback on behaviour (BCT 8), set behavioural goals (BCT 66), offered information on emotional (BCT 83) and social and environmental consequences (BCT 84; Figure 6).

FIGURE 6: OCCURRENCE OF INDIVIDUAL BCTS IN DIET INTERVENTIONS[#]

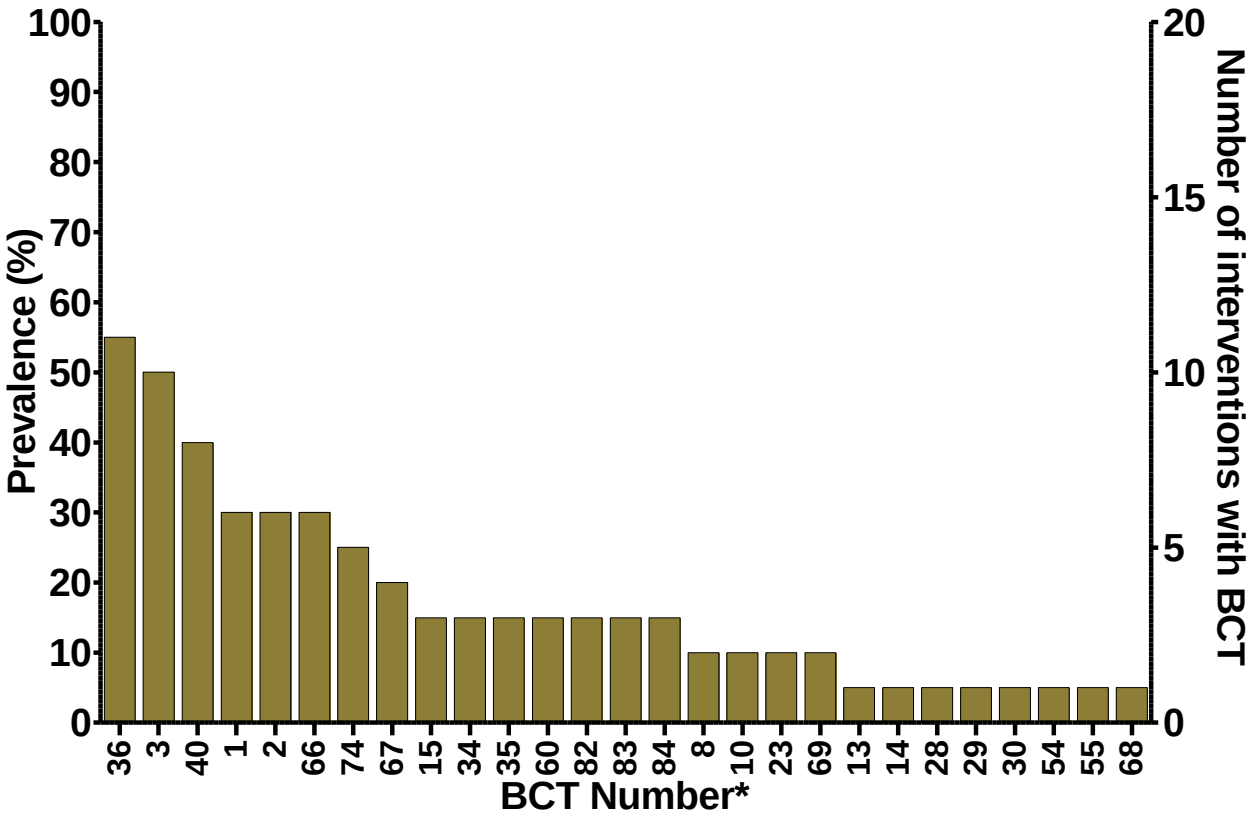


[#]BCTs (N=29) described in at least one diet intervention are shown; *See Appendix 11 for details of BCTs

5.1.7 Prevalence of individual BCTs in physical activity interventions

Physical activity interventions included a total of 27 BCTs (Figure 7), comparable to interventions targeted other health-related behaviours (for further details see Appendix 4). However, whilst instructions on how to perform a behaviour (BCT 36) was again the most prevalent BCT, mentioned in nearly six out of ten physical activity interventions, only one other BCT, non-specific support (BCT 3), was also commonly coded and present in at least half of interventions. In just under half used verbal persuasion about a person's capability to strengthen their self-beliefs (BCT 40). Practical (BCT 1) and emotional (BCT 2) social support as well as goal setting for behaviours (BCT 66) were included in around a third of interventions. Lastly, one in five interventions included a persuasive source (BCT 74) and set goals for a desired outcome (BCT 67; Figure 7).

FIGURE 7: OCCURRENCE OF INDIVIDUAL BCTS IN PHYSICAL ACTIVITY INTERVENTIONS[#]

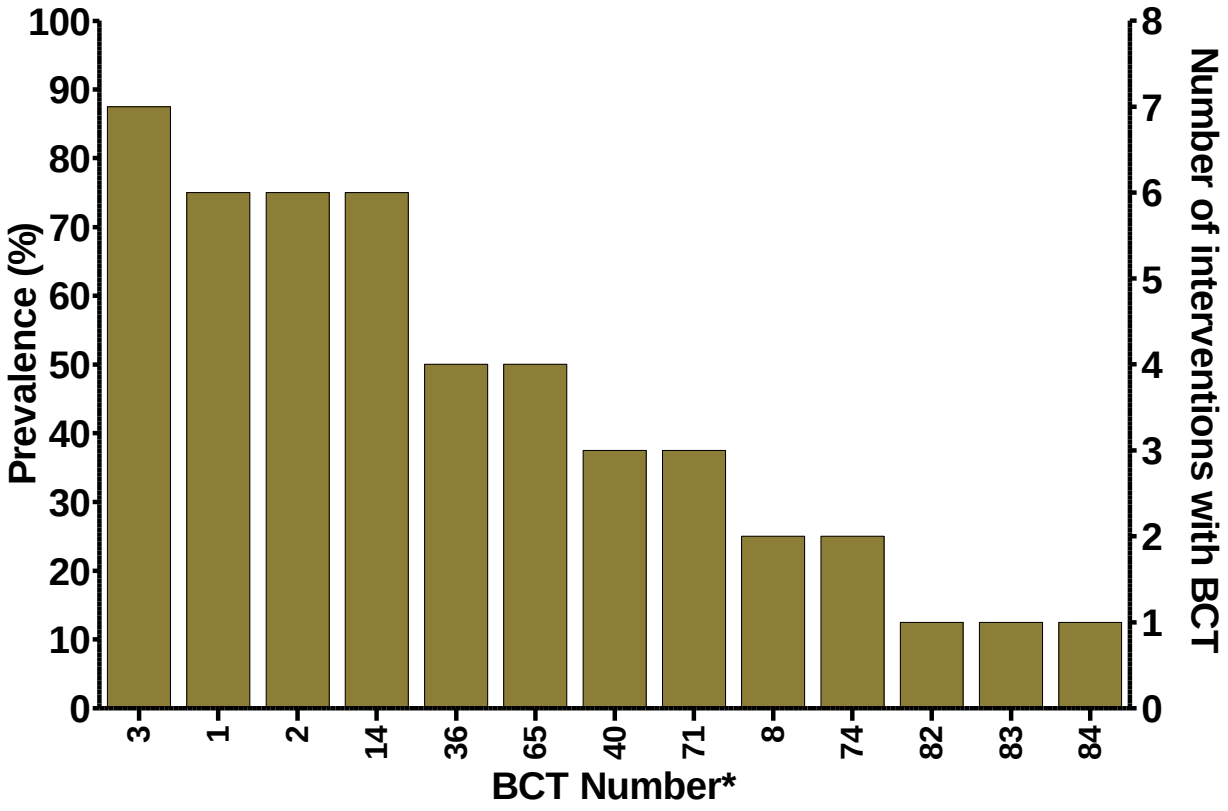


[#]BCTs (N=27) described in at least one physical activity intervention are shown; *See Appendix 11 for details of BCTs

5.1.8 Prevalence of individual BCTs in alcohol interventions

Alcohol interventions included the fewest number of BCTs but this was also the behaviour related to health with the smallest number of interventions coded (for further details see Appendix 5). A total of 13 BCTs were found at least once in eight alcohol interventions (Figure 8). Nearly all interventions provided unspecified social support (BCT 3) and three quarters also offered practical (BCT 1) and emotional (BCT 2) social support and provided biomarker feedback (BCT 14). Unlike for other health-related behaviours, instructions on how to perform a behaviour (BCT 36) was only in half of interventions as was the use of problem solving techniques (BCT 65). Around a third of alcohol interventions (N=3) used verbal persuasion to strengthen self-beliefs and self-efficacy (BCT 40) or included a behavioural contract (BCT 71). Lastly, a quarter of interventions provided feedback on behaviour (BCT 8) or used a persuasive source (BCT 74; Figure 8).

FIGURE 8: OCCURRENCE OF INDIVIDUAL BCTS IN ALCOHOL INTERVENTIONS[#]

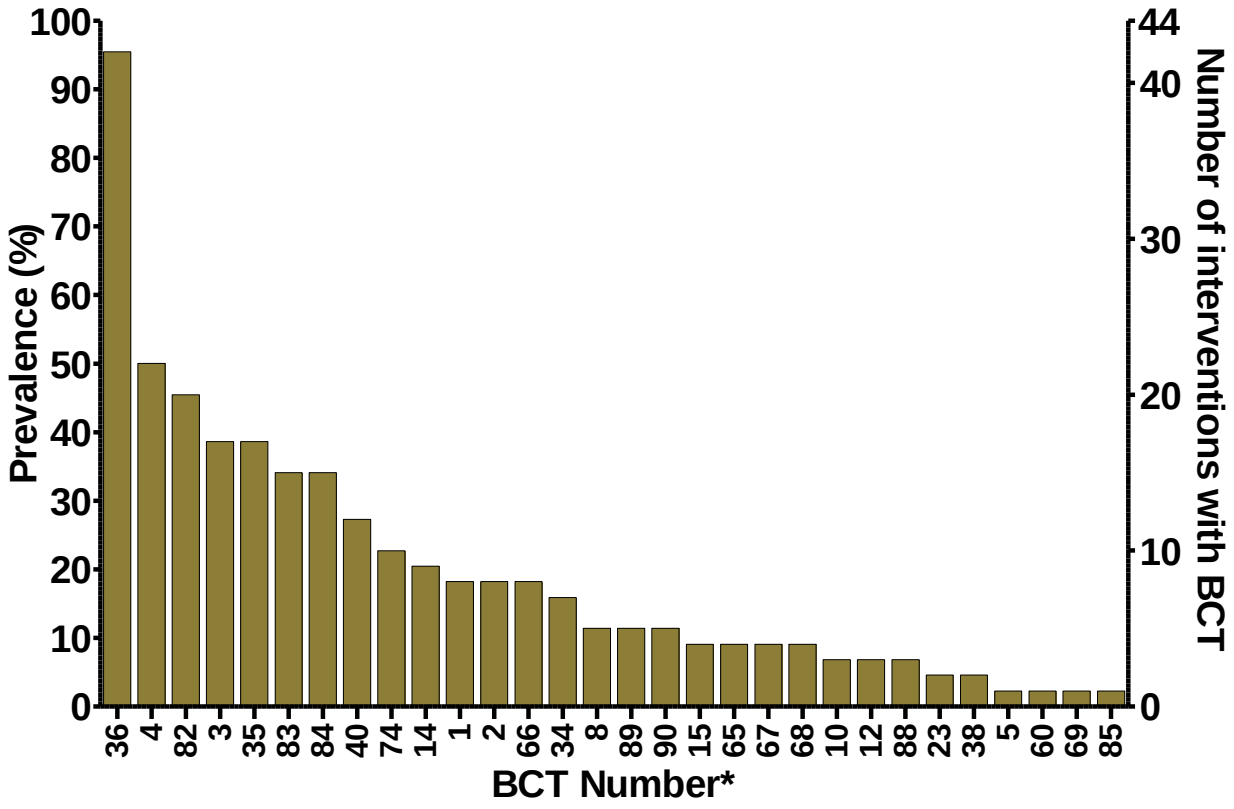


[#]BCTs (N=13) described in at least one alcohol intervention are shown; *See Appendix 11 for details of BCTs

5.1.9 Prevalence of individual BCTs in sexual health interventions

Thirty BCTs were coded across 44 interventions to improve sexual health as shown in Figure 9 (for further details see Appendix 6). Nearly all interventions (N=42) included instructions on how to perform a desired behaviour (BCT 36) and around half also provided pharmacological support (BCT 4) or information about health consequences (BCT 82). Over a third of interventions offered non-specific support (BCT 3), discussed body changes (BCT 35), included information on emotional (BCT 83) as well as social and environmental consequences (BCT 84) and over a quarter used verbal persuasion to increase capability (BCT 40). Lastly, around a fifth of interventions involved a persuasive source (BCT 74), provided biomarker feedback (BCT 14), practical (BCT 1) and emotional (BCT 2) social support and set behavioural goals (BCT 66; Figure 9).

FIGURE 9: OCCURRENCE OF INDIVIDUAL BCTS IN SEXUAL HEALTH INTERVENTIONS[#]

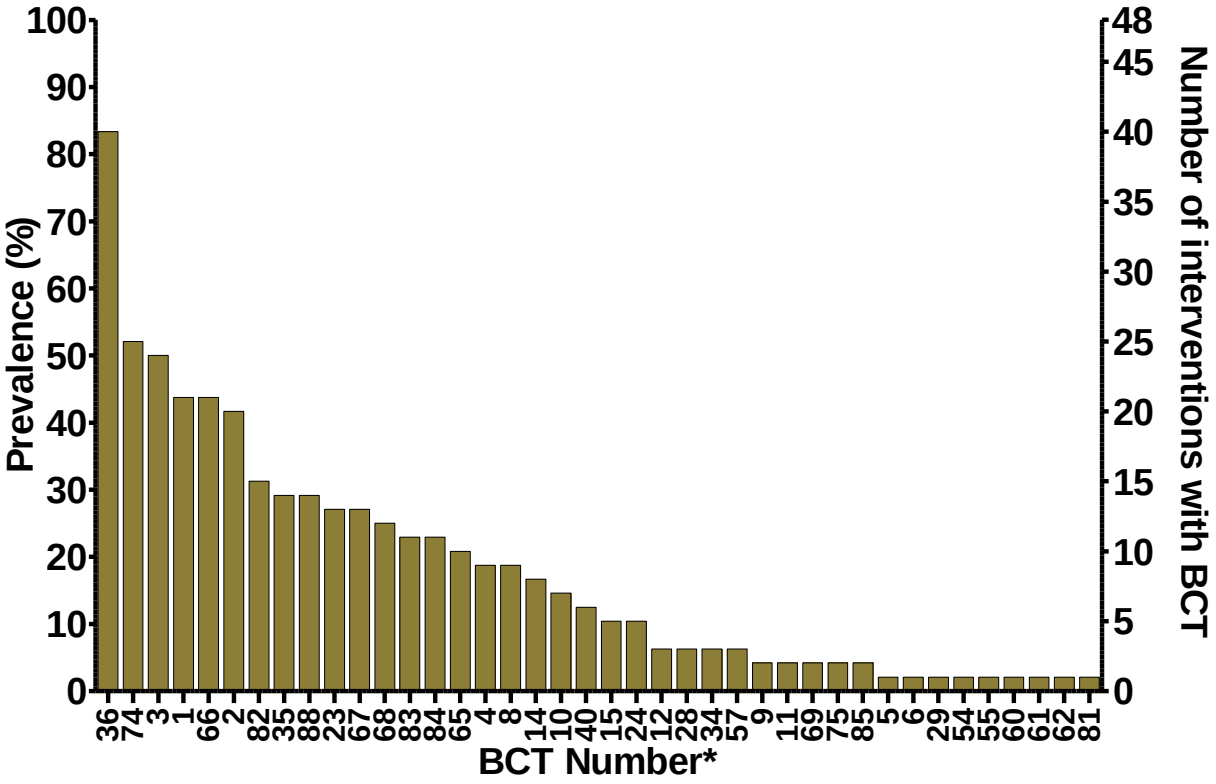


[#]BCTs (N=30) described in at least one sexual health intervention are shown; *See Appendix 11 for details of BCTs

5.1.10 Prevalence of individual BCTs in interventions targeting multiple behaviours

The largest number of BCTs (N=40) was coded across the 48 cost-effective interventions targeting multiple behaviours (for further details see Appendix 7). As can be see Figure 10, instructions on how to perform a behaviour (BCT 36) was the most prevalent BCT included in four fifths of interventions. Half of interventions included a persuasive source (BCT 74) and provided some social support (BCT 3). Just under half offered practical (BCT 1) and emotional (BCT 2) social support and encouraged the setting of behavioural goals (BCT 66). Three in ten interventions to change multiple health-related behaviours gave information about health consequences (BCT 82), discussed body changes (BCT 35) and demonstrated behaviour (BCT 88). Around a quarter used behavioural or practical rehearsal (BCT 23), involved goal setting for desired outcomes (BCT 67) and action planning (BCT 68) and at least a fifth of interventions provided information on emotional (BCT 83) or social and environmental consequences (BCT 84) and used problem solving techniques (BCT 65; see Figure 10).

FIGURE 10: OCCURRENCE OF INDIVIDUAL BCTS IN INTERVENTIONS TO CHANGE MULTIPLE BEHAVIOURS[#]

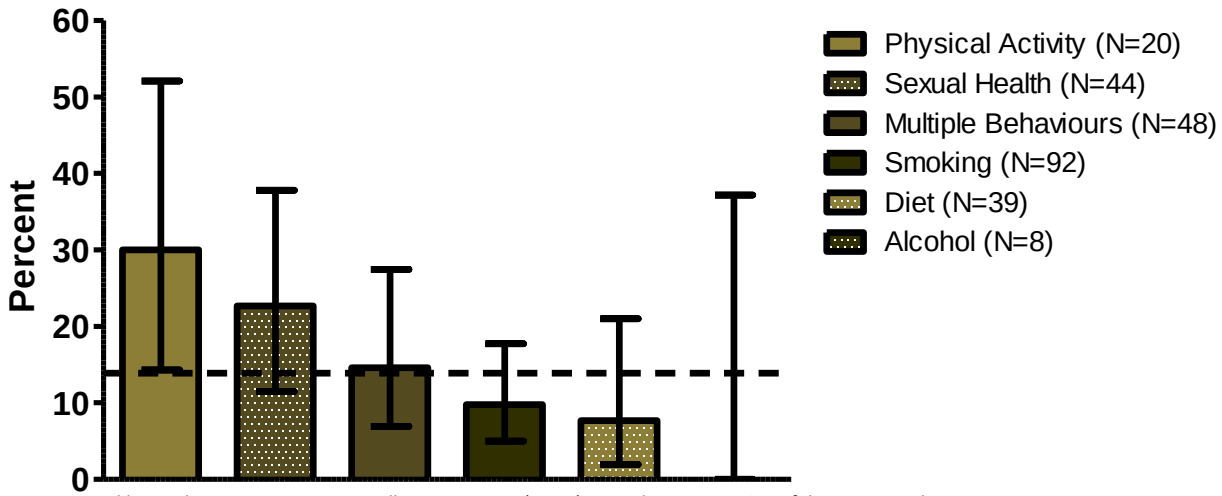


[#]BCTs (N=39) described in at least one multiple behaviour intervention are shown; *See Appendix 11 for details of BCTs

5.1.11 Prevalence of 'choice architecture' in interventions

The use of 'choice architecture' as defined in this report was not particularly common among interventions. Overall, only 13.9% (95%CI 10.2-18.8) out of the 251 interventions (N=35) included a BCT which reflected the use of some environmental tool or element designed to alters people's behaviour "in a predictable way without forbidding any options or significantly changing their economic incentives". As shown in Figure 11, 'choice architecture' was most prevalent in physical activity interventions, being present in around a fifth of these. By contrast, none of the interventions targeting alcohol use included BCTs related to 'choice architecture'. While prevalence differed significantly as a function of the health-related behaviour targeted (Likelihood ratio $\chi^2(5)=11.2$, p=0.047), none of the post-hoc comparisons reached corrected statistical significance levels.

FIGURE 11: PREVALENCE OF CHOICE ARCHITECTURE BY HEALTH-RELATED BEHAVIOUR



Dotted line indicates average across all interventions (N=79); Error bars are 95% confidence intervals

As shown in Table 7, none of the BCTs included in the definition of 'choice architecture' were significantly correlated within interventions. Therefore it was impossible to carry out the sensitivity analysis as planned.

TABLE 7: CORRELATIONS[#] AMONG CHOICE ARCHITECTURE BCTS

BCT	15	16	30	31[$]	32[$]	34
16[$]						
30	-.028	-				
31[$]	-	-	-			
32[$]	-	-	-	-		
34	.113	-	-.021	-	-	
79[$]	-	-	-	-	-	-

[#]Reports Spearman's rho; [$]Not coded in any intervention

5.2 Factors associated with cost-effectiveness

In order to meaningfully interpret data in relation to NICE threshold guidelines (*cf.* footnote 2), only interventions reporting cost-utility analyses were included in the appraisal of cost-effectiveness in this section (N=102). As some of the economic analyses carried out sensitivity analysis, varying cost-effectiveness estimates based on various factors such as user characteristics and time horizons, both lower (most optimistic) and upper (most pessimistic) limits of CUA estimates were recorded where available and cost-effectiveness determined according to NICE guidelines In cases where no such sensitivity analysis was carried out, the single estimate was included as both the lower and upper limit. Of the included interventions, 62% (N=63) used a single CUA estimate and 38% (N=39) provided multiple CUA estimates.

TABLE 8: PREVALENCE OF COST-EFFECTIVE INTERVENTIONS AS A FUNCTION OF NICE THRESHOLD AND LOWER/UPPER COST-EFFECTIVENESS ESTIMATES

	All (N=102)	Smoking (N=37)	Diet (N=20)	Physical Activity (N=3)	Alcohol (N=2)	Sexual health (N=13)	Multiple health targets (N=27)	*P**
				Mean (SEM)				
Lower estimate	**£8,025 (1,528)**	£2,382[a] (648)	£6,098[a,b] (1,265)	£109[a,b] (109)	£4,858[a,b] (572)	£11,012[a,b] (6,360)	£16,864[b] (4,286)	*0.006*
Higher Estimate	**£11,470 (1,898)**	£7,593 (2,769)	£11,812 (3,714)	£4,962 (4,962)	£4,858 (572)	£11,763 (6,540)	£17,601 (4,310)	0.439
				% (N) below £20,000 threshold				
Lower estimate	**91.2 (93)**	100.0 (37)[a]	95.0 (19)[a,b]	100.0 (3)[a,b]	100.0 (2)[a,b]	84.6 (11)[a,b]	77.8 (21)[b]	*0.022*
Higher Estimate	**85.3 (87)**	91.9 (34)	85.0 (17)	100.0 (3)	100.0 (2)	84.6 (11)	74.1 (20)	0.370
				% (N) below £30,000 threshold				
Lower estimate	**95.1 (97)**	100.0 (37)	100.0 (20)	100.0 (3)	100.0 (2)	92.3 (12)	85.2 (23)	0.070
Higher Estimate	**90.2 (92)**	94.6 (35)	95.0 (19)	100.0 (3)	100.0 (2)	84.6 (11)	81.5 (22)	0.429

*Significant overall differences are in italics; [a,b,c] Comparison of interventions targeting different health-related behaviours, different letters indicate significant difference at p<0.05 (Bonferroni-corrected)

As can be seen in Table 8, when looking at the average lower estimates, there was a significant difference between smoking cessation interventions and interventions targeting multiple health-related behaviours ($F(5, 96)=3.47$, $p=0.006$) but there were no significant differences between different health-related behavioural interventions for the higher estimate. This finding was also reflected when comparing cost-effective and cost-ineffective interventions based on the £20,000 threshold – only with the lower estimate was there a significant difference between smoking cessation and multiple health-related behaviour interventions but there were no differences when using other thresholds or estimates.

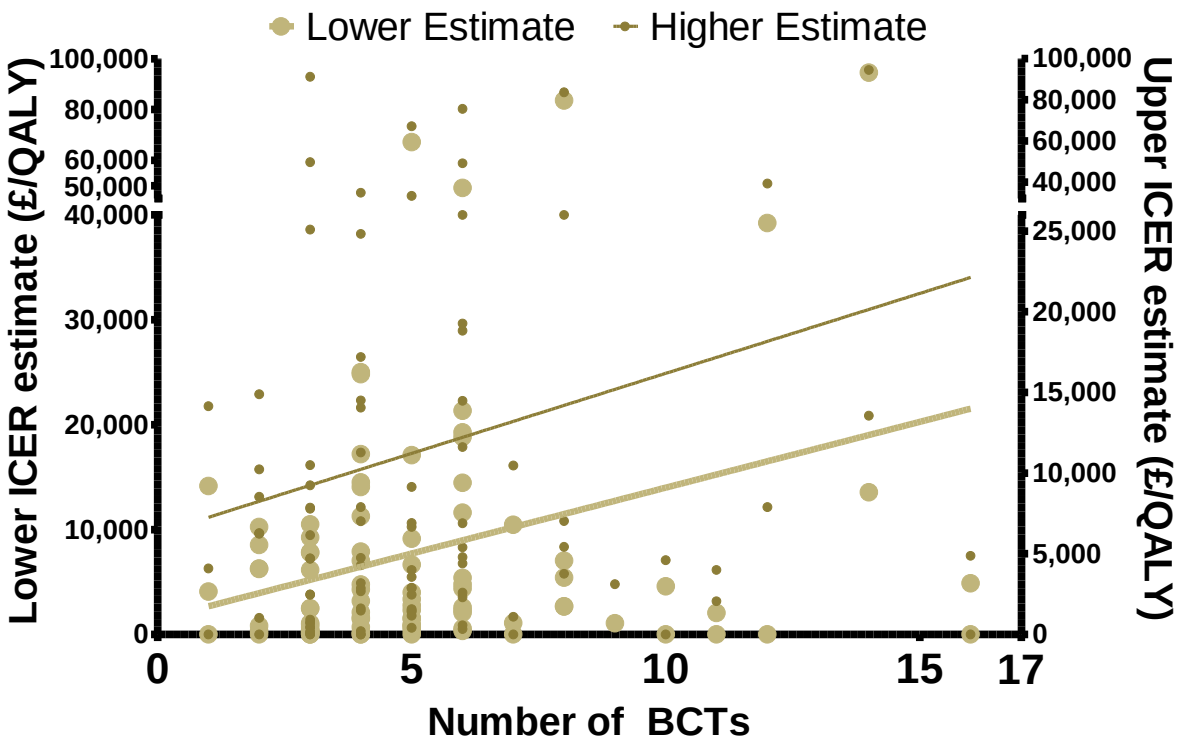
5.2.1 Cost-utility analyses (continuous outcome)

5.2.1.1 All interventions

Given the large number of potential predictor variables and for the sake of simplicity, only those variables that were associated with cost-utility estimates in univariate analysis (detailed below) were included in the multiple regression analysis.

- *Intervention characteristics* (see Table 4): Only the population targeted was associated with cost-effectiveness CUA estimates. Interventions for the general population produced better (lower) CUA values for both lower ($t(100)=3.3$, $p<0.001$) and upper ($t(100)=3.2$, $p=0.002$) estimates than interventions aimed at vulnerable populations.

FIGURE 12: COST-EFFECTIVENESS BY BCT PREVALENCE[#]



[#]Lines are linear regressions

- *Intervention functions* (see Table 5): There was evidence that interventions whose function focused on "persuasion" had better cost-utility estimates than those which did not (for upper estimate only ($t(100)=2.8$, $p=0.006$) and the opposite was true for interventions focusing on "education" (for lower estimate only; $t(100)=3.0$, $p=0.004$)
- *BCTs / BCT clusters* (see Table 6): As shown in Figure 12, there was a positive association between the number of BCTs recorded and cost-utility estimates (this was significant for the lower estimate $r=0.249$, $p=0.012$; indicated by thick regression line). Given large differences in the prevalence of individual BCTs, only

BCT clusters were included in univariate analysis. This revealed that none of the clusters were associated with cost-utility estimates.

- *Choice Architecture* (see Table 7): There was no difference in the cost-utility estimates of interventions that did or did not include BCTs relevant to 'choice architecture'.

Multiple linear regression was conducted using both the lower and upper cost-utility estimates to determine, which, if any, variables were independently associated with these estimates. The linear regression model showed that the target population was the only variable reliably and significantly associated with cost-effectiveness: interventions aimed at vulnerable populations had worse (i.e. higher) cost-utility values (in £/QALY) (for lower estimate: β=0.268, t=2.74, p=0.007; for upper estimate: β=0.313, t=3.34, p=0.001) compared with those aimed at the general population. None of the other intervention features were associated with either the lower or upper cost-utility estimates. However, for the upper cost-utility estimate there was also evidence that interventions focusing on "persuasion" had better cost-utility estimates than those that did not (β=-0.189, t=2.02, p=0.046). As no BCT cluster was associated independently with cost-effectiveness, a second linear two-step regression was carried out to establish whether any important associations may have been missed. In the first step the only variables with known independent association (target population for analysis using the lower estimate and target population and "persuasion" for the analysis with the upper estimate) was entered and in the second step individual BCTs mentioned in at least one percent of interventions (to ensure sufficient variance, see Figure 4) were included in a forward conditional model. This showed that the presence of BCT 5 ("Reduce negative emotions") was associated with worse (higher) cost-utility values for lower (β=0.475, t=6.45, p<0.001) and higher estimates (β=0.349, t=4.16, p<0.001). In addition, BCT 57 ("Non-specific reward") was associated with worse CUA outcomes for lower (β=0.401, t=5.43, p<0.001) and BCT12 ("Monitoring of behaviour by others without feedback") for higher (β=0.284, t=3.39, p=0.001) estimates when controlling for other confounders.

5.2.1.2 Health behaviour

The same approach as above was used to determine the association of relevant factors, if any, with cost-effectiveness but analysed separately for each health-related behaviour targeted. Owing to the small number of eligible papers neither physical activity nor alcohol interventions were analysed. Only independent associations from multiple linear regression analyses are reported.

Smoking cessation interventions: There were no associations with the higher CUA estimate. However, based on the lower estimate, a greater number of BCTs (β=0.409, t=7.31, p<0.001), BCT 15 ("Prompts/cues"), BCT 66 ("Goal setting (behaviour)") and BCT 85 ("Salience of consequences"; β=0.850, t=15.29, p<0.001) were all associated with worse (higher) cost-utility estimates. By contrast, BCTs 14 ("Biofeedback"; β=-377, t=5.54, p<0.001) and 35 ("Body changes"; β=-0.130, t=2.45, p=0.044) predicted better (lower) CUA values.

Diet interventions: Compared with all other intervention categories, medication only interventions were associated with worse CUA values for lower (β=0.798, t=5.94, p<0.001)

and upper (β=1.02, t=15.93, p<0.001) estimates, respectively. In addition, based on lower estimates, BCT 36 ("Instruction on how to perform a behaviour") predicted better (lower) CUA values (β=-0.295, t=2.46, p=0.026). Based on upper estimates, brief interventions (β=0.255, t=2.35, p=0.037), BCT 13 ("Monitoring outcome(s) of behaviour by others without feedback"; β=0.495, t=7.72, p<0.001) and BCT 60 ("Material incentive (behaviour)"; β=0.274, t=3.25, p=0.007) were associated with worse and BCT 88 ("Demonstration of the behaviour"; β=-0.335, t=4.41, p<0.001) with better cost-utility, controlling for other variables.

Sexual health intervention: BCT 5 ("Reduce negative emotions")was associated with worse CUA values for lower (β=0.951, t=10.24, p<0.001) and upper (β=0.916, t=7.55, p<0.001) estimates, respectively. No other factors were associated with cost-utility.

Multiple health-related behaviour intervention: As was the case when looking at all health-related behaviours together, BCT 57 ("Non-specific reward") was associated with worse CUA outcomes for lower (β=0.481, t=2.74, p=0.011) and BCT12 ("Monitoring of behaviour by others without feedback"; β=0.469, t=2.65, p=0.014) for higher estimates. No other factors were associated with cost-utility.

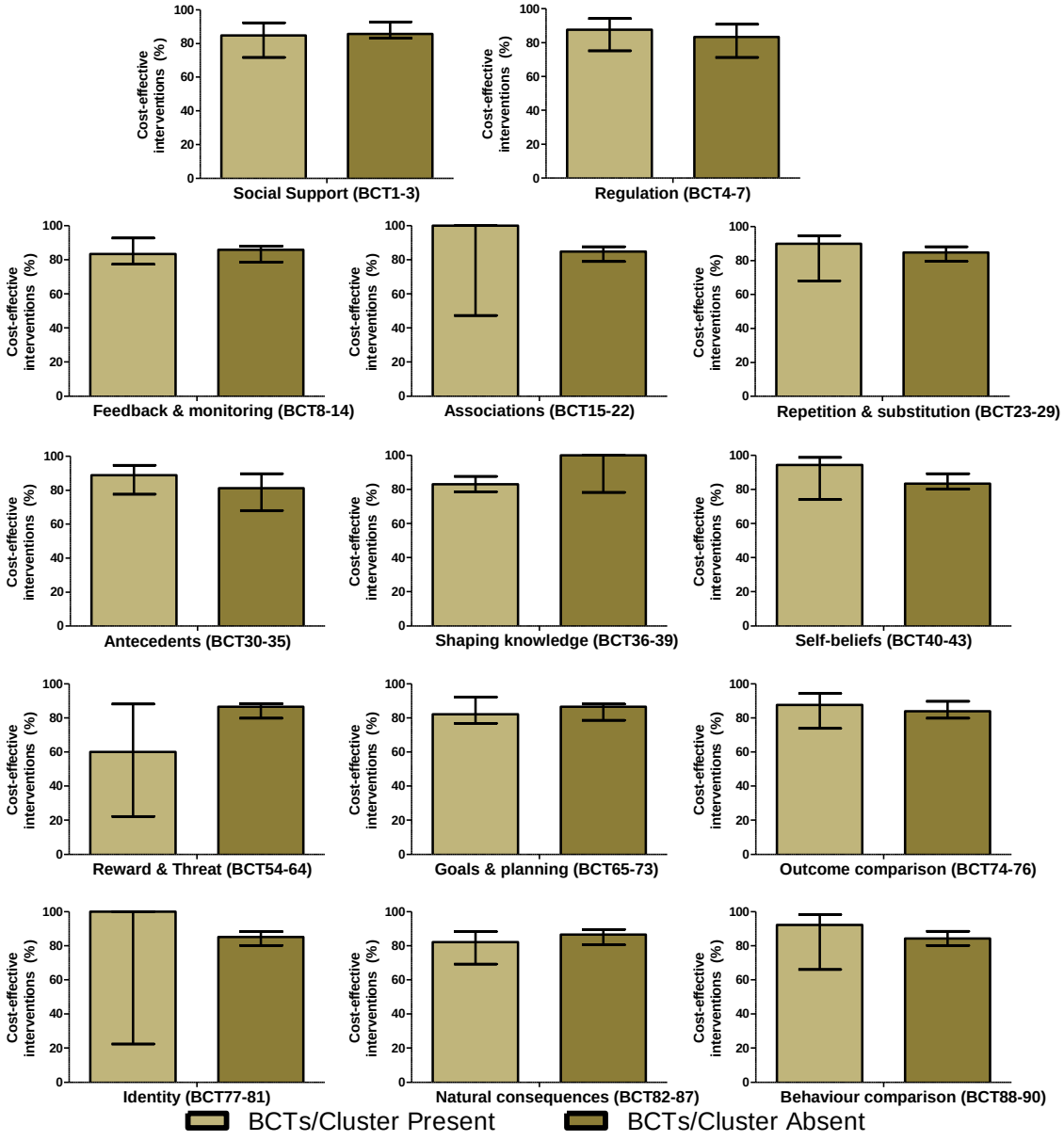
5.2.2 Cost-utility analyses (categorical outcome)

5.2.2.1 All interventions

In this analysis interventions were not classified along a cost-effectiveness continuum but in two mutually exclusive categories: as being cost-effective or cost-ineffective. As before, given the large number of predictor variables and for the sake of simplicity, only those variables that were associated with cost-(in)effectiveness in univariate analysis (detailed below) were included in the multiple regression analysis. Cost-effectiveness was based on upper CUA estimates falling below the £20,000/QALY threshold as this is the most conservative measure and also produced maximal variance (see Table 8)

- *Intervention characteristics* (see Table 4): As for the analysis using a continuous CUA value, interventions targeting the general population were significantly more cost-effective than those targeting vulnerable populations (Fisher exact test, p=0.047).
- *Intervention functions* (see Table 5): There were no significant associations.
- *BCTs / BCT clusters* (see Table 6): Given that there was no association between the number of BCTs recorded and whether an intervention was appraised to be cost-effective and because there were large differences in the prevalence of individual BCTs, only BCT clusters were included in univariate analysis. However, as can be seen in Figure 13, the prevalence of cost-effective interventions was relatively equally spread for all clusters and there were no significant differences.
- *Choice Architecture* (see Table 3): Whether interventions were considered cost-effective was not related to the presence of BCTs relevant to 'choice.

FIGURE 13: PERCENT OF INTERVENTIONS IDENTIFIED AS COST-EFFECTIVE AS A FUNCTION OF PRESENCE AND ABSENCE OF BCT CLUSTERS[#]



[#]No intervention featured BCT clusters 'Scheduled consequences' (BCT44-53) or 'Covert learning' (BCT91-93); Bars are 95% confidence intervals

Multivariate logistic regression was conducted to establish the independent association of significant variables from univariate analysis. However, given that only the target population was associated with cost-effectiveness and as no BCT cluster was associated with cost-effectiveness, a second logistic two-step regression was carried out to establish whether any important associations may have been missed. In the first step the target population was entered and in the second step individual BCTs mentioned in at least one percent of

interventions (to ensure sufficient variance, see Figure 4) were included in a forward conditional model. This revealed that interventions targeting the general population were significantly more likely to be cost-effective (OR 12.0, 95%CI 1.5-96.4) whereas interventions containing BCT 13 ("Monitoring outcome(s) of behaviour by others without feedback") were significantly less likely to be cost-effective (OR 0.01 , 95%CI 0.0-0.3).

5.2.2.2 Health behaviour

Again the association of relevant factors, if any, with cost-effectiveness using a dichotomous outcome was analysed separately for each health-related behaviour targeted, except physical activity and alcohol interventions. Only independent associations from multiple linear regression analyses are reported.

Smoking cessation interventions: The only variable associated with cost-effectiveness was the target population, interventions for the general population were more likely to be cost-effective than those for vulnerable populations (Fisher's exact test, p=0.005).
Diet interventions: The only variable associated with cost-effectiveness was the BCT cluster "Comparison of outcomes" – those interventions with BCTs from this cluster were less likely to be cost-effective (OR 0.30 , 95%CI 0.0-0.7).
Sexual health intervention: No factors were associated with cost-effectiveness.
Multiple health-related behaviour intervention: The only variable associated with cost-effectiveness was the use of supporting material: interventions that used electronic supporting material appeared to be less likely to be cost-effective than those using other or no supporting material (OR 0.02; 95%CI 0.0-0.7).

5.3 Comparison of cost-effective interventions identified in Stage 1 with cost-effective interventions identified in Stage 3

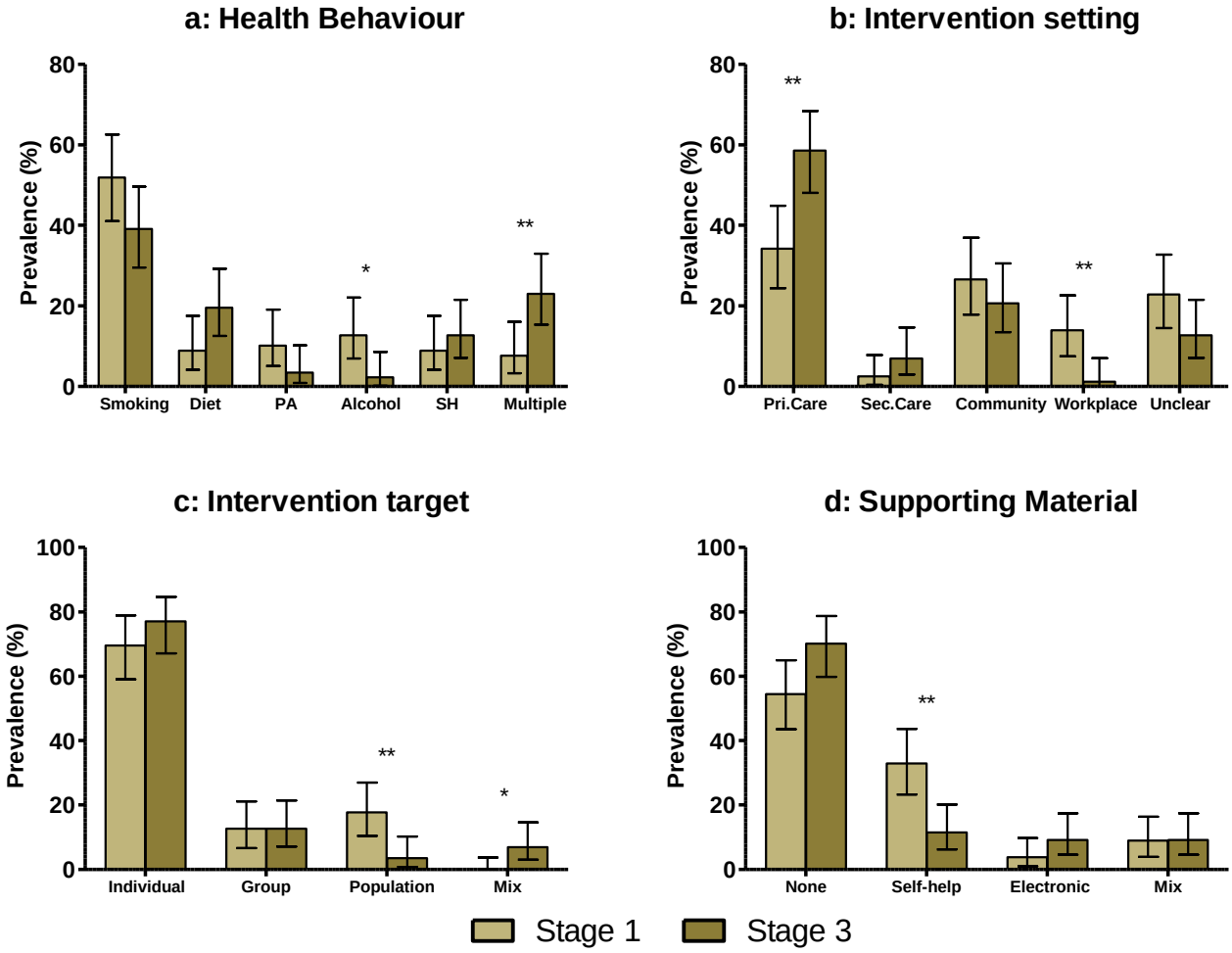
Altogether 79 cost-effective interventions were identified in Stage 1 [1] compared with 87 cost-effective interventions in this report according to the criteria described above (highest CUA estimate lies below £20,000/QALY threshold). However, it should be noted that due to the different approach taken in identifying eligible interventions, many of the interventions included in Stage 1 would not have represented individual interventions but rather a set of interventions that were appraised and grouped together in terms of their cost-effectiveness due to their similarity. By contrast, the current report mostly concentrated on individual interventions appraised for their cost-effectiveness separately since interventions were not identified through NICE reports but in published papers of interventions. Thus the number of individual interventions that contributed to Stage 1 may have been larger. Notwithstanding this, the following attempts to compare interventions appraised as cost-effective in Stage 1 and Stage 3 of the behaviour change update in terms of their general characteristics, main functions, behaviour change technique used as well as choice architecture.

5.3.1 General characteristics of interventions

Perhaps unsurprisingly, there are a number of differences between cost-effective interventions included in both reports. As shown in Figure 14a, while a greater proportion of

interventions in Stage 1 focused on alcohol, more interventions in this report focused on multiple behavioural targets ($\chi^2(5)=21.6$, p=0.001).

FIGURE 14: INTERVENTION CHARACTERISTICS BY STAGE



Bars are 95% confidence intervals; *p<0.05; **p<0.01; *PA – Physical Activity; SH – Sexual Health*

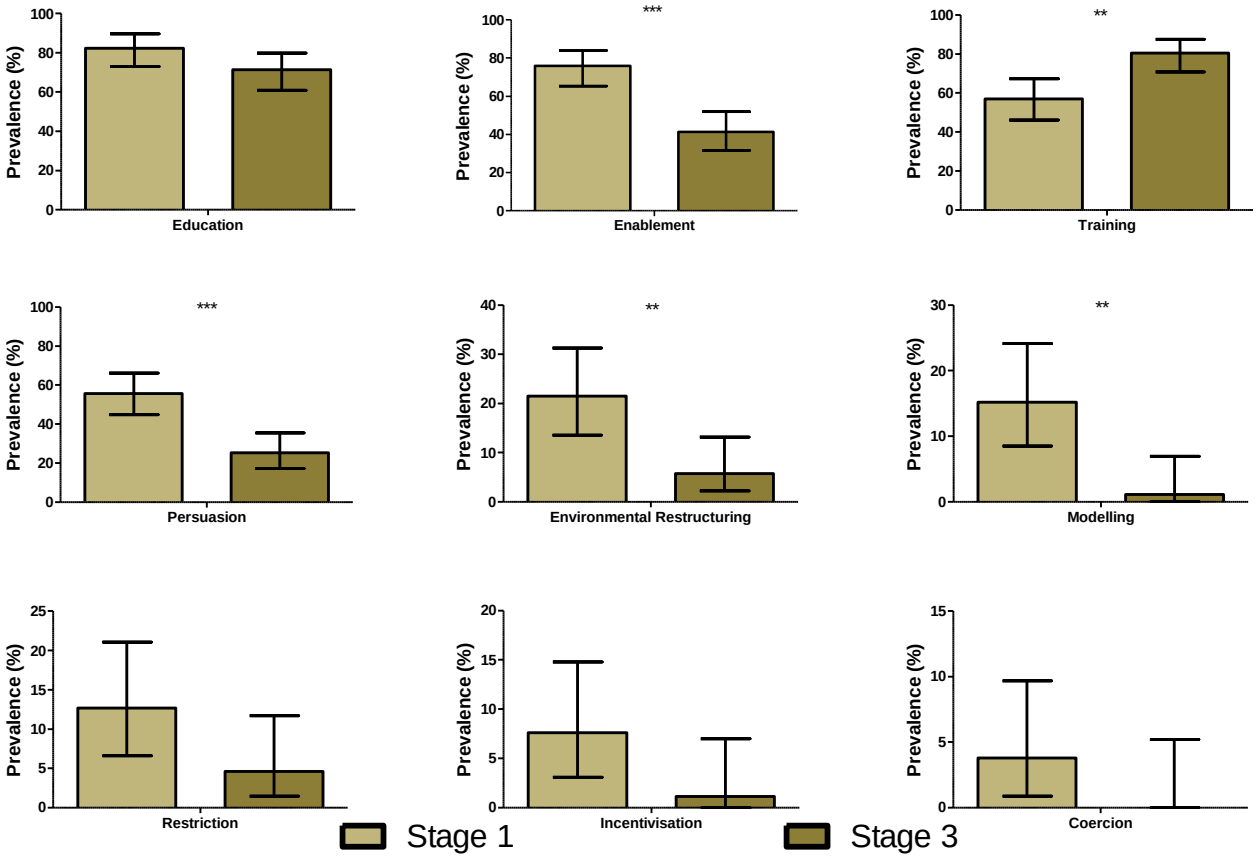
Stage 3 interventions also were more often set in primary care while a much smaller proportion was set in the workplace ($\chi^2(4)=20.9$, p<0.001, Figure 14b). Cost-effective interventions in Stage 1 were more likely to be population-level interventions compared with those included in Stage 3, but more interventions in Stage 3 had a mixed intervention target ($\chi^2(3)=16.9$, p=0.001, Figure 14c), possibly due to the fact that more interventions in this report had multiple behavioural targets. However, a higher proportion of interventions in Stage 3 had no supporting material at all and in particular less self-help material ($\chi^2(3)=12.2$, p=0.007, Figure 14d). In addition, a higher proportion of interventions identified in Stage 1 targeted the general population (Fisher's exact test, p=0.027) and involved the use of incentives (Fisher's exact test, p=0.001). In terms of cost-effectiveness estimates of interventions, while there was a significant difference for the lower estimate (cost-effective

interventions identified in Stage 1 on average cost £2,046/QALY saved compared with £4,209 in Stage 3; t(157)=3.1, p=0.002), the upper estimates were much more similar and did not differ significantly (Stage 1: £5,792/adjusted LY saved; Stage 3: £4,883).

5.3.2 Main functions of interventions

Stage 1 interventions fulfilled more functions than those in Stage 3 (see Figure 15). While the prevalence of interventions focusing on training was greater in Stage 3 than 1, the opposite was observed for enablement, persuasion, environmental restructuring and modeling. The only functions which did not differ were education (highly prevalent in both stages) and restriction, incentivisation and coercion (least prevalent across both stages, see Figure 15).

FIGURE 15: INTERVENTION FUNCTION BY STAGE

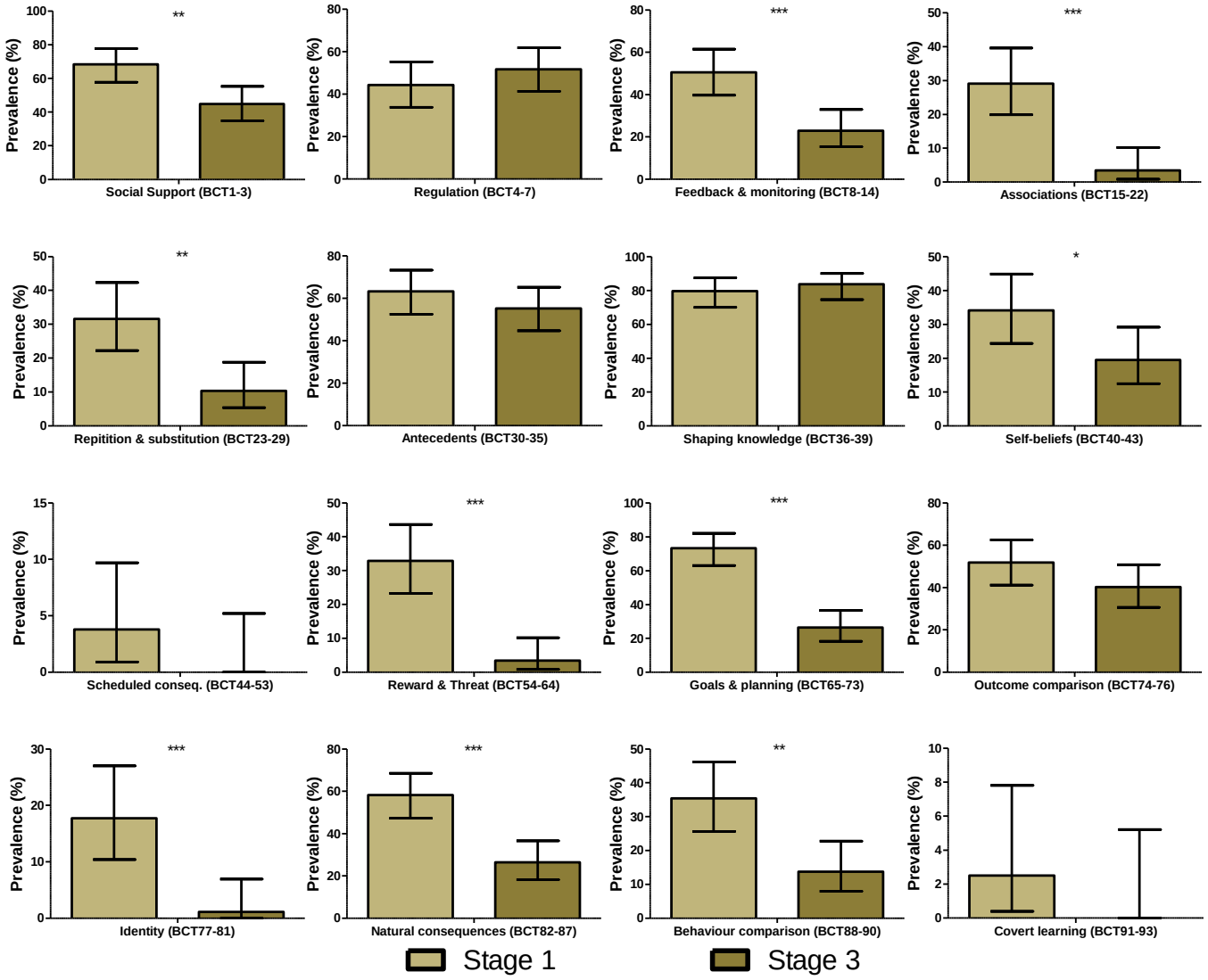


Bars are 95% confidence intervals; **p<0.01; ***p<0.001

5.3.3 BCT clusters in interventions

The average number and range of clusters was significantly higher and wider for interventions included in Stage 1 (6.8; 1-15) than in Stage 3 (4.0; 1-9; t(164)=6.5, p<0.001). Perhaps unsurprising then, the prevalence of most clusters was much higher in cost-effective interventions in Stage 1 than Stage 3 (see Figure 16).

FIGURE 16: BCT CLUSTERS BY STAGE



Bars are 95% confidence intervals; *p<0.05; **p<0.01; ***p<0.001

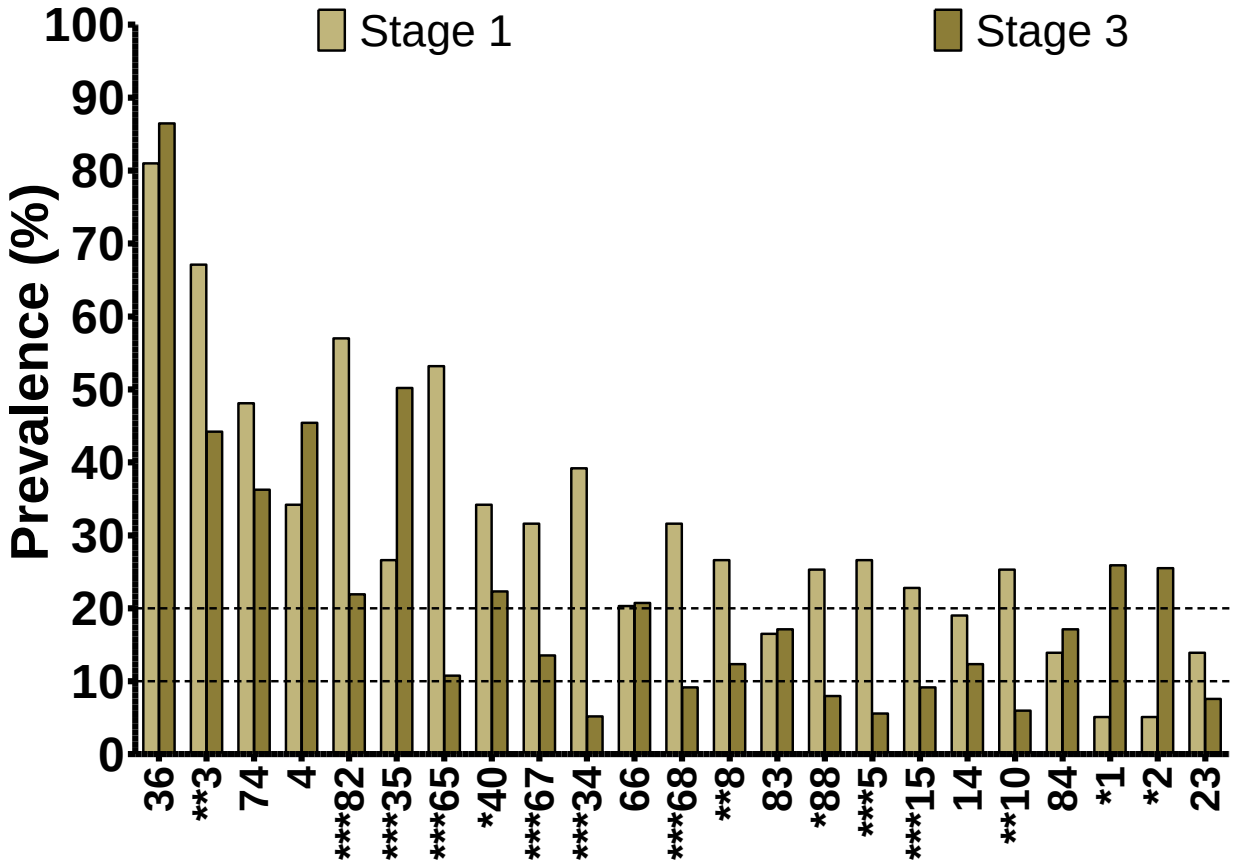
Whilst there was no difference in the clusters most prevalent ("Regulation'; "Shaping knowledge"; "Antecendents"; "Outcome comparison") and least prevalent ("Scheduled consequences"; "Covert Learning") across both stages, all other BCT clusters were significantly more common in cost-effective interventions covered by Stage 1 than those in Stage 3 (see Figure 16). This is consistent with the finding that interventions in Stage 1 were judged to be fulfilling more functions than interventions covered in the current report.

5.3.4 Prevalence of individual BCTs

In keeping with the findings described above, the average cost-effective intervention in Stage 1 included a larger number and wider range of individual BCTs (9.7, 2-39) than those in Stage 3 (5.1, 1-16; t(164)=5.2, p<0.001). Notwithstanding this, there was a fair amount of

overlap for the most prevalent BCTs reported. Some eight BCTs (3, 4, 35, 36, 40, 66, 74, 82) were mentioned in at least a fifth of interventions in both Stage 1 and 3 and a further six BCTs (8, 14, 65, 67, 83, 84) in at least a tenth of interventions (see Figure 17).

FIGURE 17: MOST COMMON BCTS ACROSS STAGE 1 AND 3[#]



[#]Includes interventions which on average across Stage 1 and 3 have been coded in at least ten percent of interventions; Differences by stage: *p<0.05; **p<0.01; ***p<0.001

There were differences in the prevalence of the most commonly reported BCTs across both reports (see Figure 17). Whilst BCTs 3, 5, 8, 10, 15, 34, 40, 65, 67, 68, 82 and 88 were more prevalent in interventions from Stage 1 than 3, the opposite was true for BCTs 1, 2 and 35.

TABLE 9: LEAST COMMON BCTS ACROSS STAGE 1 AND 3

No.	Label	No.	Label	No.	Label
17.	Cue signalling reward	18.	Remove access to the reward	19.	Remove aversive stimulus
20.	Satiation	21.	Exposure	22.	Associative learning
27.	Overcorrection	31.	Restructuring the social environment	33.	Distraction

No.	Label	No.	Label	No.	Label
37.	Information about antecedents	39.	Behavioural experiments	41.	Mental rehearsal of successful performance
42.	Focus on past success	43.	Self-talk	45.	Behaviour cost
46.	Remove reward	47.	Reward approximation	48.	Rewarding completion
49.	Situation-specific reward	50.	Reward incompatible behaviour	51.	Reward alternative behaviour
52.	Reduce reward frequency	53.	Remove punishment	64.	Self-incentive
70.	Review outcome goal(s)	73.	Discrepancy between current behaviour and goal	76.	Comparative imagining of future outcomes
77.	Identification of self as role model	78.	Valued self-identity	87.	Anticipated regret
91.	Imaginary punishment	92.	Imaginary reward	93.	Vicarious consequences

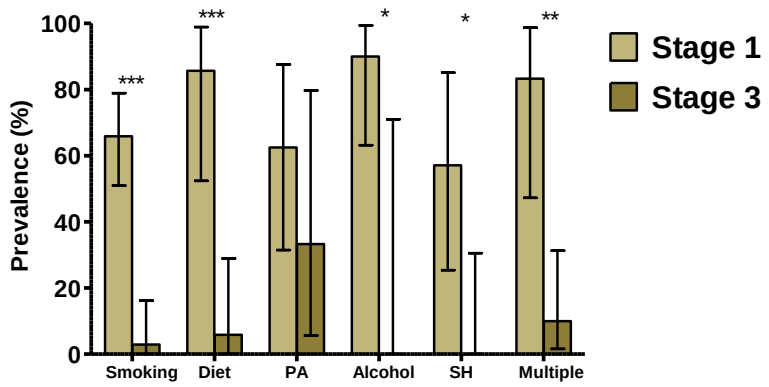
A full list of BCTs and definitions is provided in Appendix 11

By contrast, among the most prevalent behaviour change techniques, BCTs 4, 14, 23, 36, 66, 74, 83 and 84 were equally common. Interestingly, 33 BCTs were not mentioned once, either in Stage 1 or Stage 3 (see Table 9).

5.3.5 Prevalence of 'choice architecture' in interventions

Given the overall differences in BCTs coded for in cost-effective interventions in Stage 1 and Stage 3 and the fact that choice architecture in this report has been operationalized in relation to BCTs, there was consequent difference in the prevalence of 'choice architecture' (CA). CA was significantly more prevalent in interventions included in Stage 1 than in interventions included in Stage 3 (Stage 1: 70.9%; 95%CI 60.0-79.8 vs. Stage 3: 5.8%, 95%CI 2.2-13.2; p<0.001). However, as can be seen in Figure 18, this difference was not significant for physical activity interventions and most pronounced for smoking cessation and diet interventions and interventions targeting multiple health-related behaviours.

FIGURE 18: PREVALENCE OF CA BY INTERVENTION TARGET AND STAGE



Bars are 95% confidence intervals;**p<0.01, ***p<0.001; *PA – Physical Activity; SH – Sexual Health*

6. Summary

Over 250 cost-effective as well as cost-ineffective interventions across six different behaviour targets (smoking cessation, diet, physical activity, alcohol, sexual health and multiple behaviour targets) were identified from a total of 84 papers and reviews. The large majority of interventions (over four fifth) were considered cost-effective based on estimates from cost-utility analysis and other types of cost-effectiveness analyses. However, few studies were tested rigorously against adequate (matched) control conditions.

With regards to interventions characteristics, similar to the Stage 1 report, the majority of cost-effective interventions based on NICE criteria focused on smoking cessation. However, by comparison with Stage 1, fewer interventions in this report focused on alcohol and more on targeting multiple health-related behaviours. Whilst most interventions in this and in the previous report were set in primary care, this proportion was much higher in Stage 3 than in Stage 1 interventions. However, as in the previous report, the majority of interventions were delivered by health professionals to individuals, even if, relatively speaking, fewer interventions in the current report were delivered to the population at large, e.g. by means of mass media and use of legislation. Moreover, compared with interventions in Stage 1, more interventions in this report targeted vulnerable populations while the use of supporting material and incentives in interventions was lower. Nonetheless, cost-utility estimates for cost-effective interventions in Stage 1 and Stage 3 were reasonably similar.

When it comes to differences between different health-related behaviours, as in Stage 1, compared with other interventions, smoking cessation interventions were most likely to involve pharmacological support, but few other differences in intervention characteristics as a function of the health-related behaviour targeted were consistent with the Stage 1 report. This is most likely due to a different composition of interventions in this report, namely the inclusion of cost-ineffective interventions.[12] Compared with other interventions, fewer interventions targeting multiple health-related behaviours were judged to be cost-effective; more specifically, multiple health-related behaviour interventions provided worse (higher) CUA estimates than smoking cessation interventions. This finding may reflect the fact interventions targeting multiple behaviours result in diluted effectiveness and thus cost-effectiveness and, given the high intensity of such interventions, that there is no linear positive relationship between cost-effectiveness and intervention intensity. The latter suggestion is also confirmed by the positive association of the numbers of BCTs included in interventions with higher (i.e. worse) CUA values. As in Stage 1, sexual health and smoking cessation interventions were mainly set in primary care but, unlike Stage 1, so were alcohol interventions. Smoking cessation and alcohol interventions were also most rigorously tested in terms of their control condition and while multiple health-related behaviour interventions were most comprehensive (and thus intensive), physical activity and alcohol interventions

[12] Please note that the analysis of differences between interventions targeting different health-related behaviours reported in section 5.1 includes both cost-effective and cost-ineffective interventions while the direct comparison of Stage 1 and Stage 3 interventions reported in 5.3 only includes cost-effective interventions (as no cost-ineffective interventions were included in the Stage 1 report).

were mostly brief interventions and smoking cessation interventions judged to be least intensive.

As in the Stage 1 report, most interventions in this report focused on imparting knowledge, as indicated by a similar proportion having "Education" as its main function, including the BCT cluster "Shaping knowledge" and, more specifically, focusing on BCT 36 ("Providing instructions on how to perform a behaviour"). There was also some consistency in terms of main functions, BCT clusters and individual BCTs that were uncommon in cost-effective interventions. A similarly low proportion of cost-effective interventions in Stage 1 and 3 had as its main functions "Restriction", "Incentivisation" or "Coercion", focused on BCT clusters "Scheduled consequences", "Covert learning" or included related BCTs such as BCT 18 ("Remove access to reward"); BCT 64 ("Self-incentive) or BCT 91 ("Imaginary punishment"). Lastly, among the more commonly coded individual BCTs, interventions in both this and the previous report commonly featured BCTs relating to verbal persuasion (BCT 74), to providing pharmacological support (BCT 4) or information about emotional (BCT 83), social and environmental consequences (BCT 84) as well as biofeedback (BCT 14) and behavioural practice and rehearsal (BCT 23). Whilst more interventions in this than in the previous report focused on training and included BCTs pertaining to practical and emotional (but not unspecified) social support (BCTs 1, 2) as well as to body changes (BCT 35), this was the exception not the rule. Compared with Stage 1 interventions, cost-effective interventions in this report generally focused on fewer functions, covered fewer BCT clusters (and some not at all) and consequently fewer BCTs were coded. However, it should be noted that a third of available BCTs (N=33) did not feature in any cost-effective interventions either in this or the previous report.

In terms of differences between interventions targeting different health-related behaviours with regards to intervention function, BCT clusters and individual BCTs, there were not many similarities to those reported in Stage 1 for the reasons outlined above. Compared with other interventions, diet interventions were most likely to focus on training, those for multiple health-related behaviours on education, smoking cessation interventions on enablement and alcohol interventions on persuasion. Given their comprehensive nature and greater intensity, interventions targeting multiple health-related behaviours on average covered the greatest number of BCT clusters followed by smoking cessation interventions (in Stage 1, smoking cessation and multiple health-related behaviour interventions also covered most BCT clusters). As was the case for in Stage 1, among the most common clusters, "Shaping knowledge" was least prevalent in alcohol and "Comparison of outcomes" least prevalent in diet interventions, "Regulation" most prevalent in smoking cessation interventions while "Social support" was equally prevalent across interventions. However, unlike Stage 1, "Feedback and monitoring", Goals and planning" and "Natural consequences" were least prevalent, and "Antecedents" most prevalent, in smoking cessation interventions and "Self-beliefs" most prevalent in physical activity interventions.

When considering individual BCTs and in contrast to Stage 1, interventions with multiple behavioural targets, being more comprehensive and intensive, featured the largest number of BCTs on average (around seven) - significantly more than smoking cessation, diet and physical activity interventions - but differences between health-related behaviours were generally small. As in Stage 1 interventions, instructions on how to perform a behaviour (BCT 36) and pharmacological support (BCT 4) were prevalent in smoking cessation interventions, BCT 36 and body changes (BCT 35) prevalent in diet interventions, BCT 36 and non-specific support (BCT 3) prevalent in physical activity interventions, and the latter also prevalent in alcohol interventions, and BCT 36 prevalent in sexual health interventions as well as interventions targeting multiple behaviours. Notable differences to Stage 1 include that BCT 35 was more in common and information about health consequence (BCT 82) less common in smoking cessation interventions in this report. Similarly, adding objects to the environment (BCT 34) was much less common and BCT 4 more common in diet interventions, practical and emotional support (BCT 1 and 2) more prevalent and BCT 82 less prevalent in physical activity interventions, restructuring the physical environment (BCT 30) and inclusion of a persuasive source (BCT 74) much less common and BCTs 1 and 2 much more common in alcohol interventions. Lastly, the use of problem solving techniques (BCT 65) was less prevalent and BCTs 4 and 82 more prevalent in sexual health interventions and providing feedback on behaviour (BCT 8) was less common and BCTs 1 and 2 more common in multiple health-related behaviour interventions.

Though not a focus of this report, perhaps the biggest differences between interventions included in Stage 1 and Stage 3 relates to the occurrence of BCTs related to 'Choice architecture' (CA). CA was much more prevalent in interventions included in Stage 1 than in Stage 3. Less than one in twenty of cost-effective interventions featured BCTs that reflect CA compared with over two thirds of interventions in Stage 1. These differences between Stage 1 and 3 interventions were particularly pronounced for smoking cessation and diet interventions while physical activity were roughly comparable in their use of 'choice architecture' to Stage 1 interventions. Although the prevalence of CA was highest in physical activity interventions (around one in three included BCTs related to CA) and not a single alcohol intervention showed evidence of CA using our definition, there was no overall significant difference in CA as a function of the health-related behaviour targeted in the 251 interventions included in this report.

In contrast to the Stage 1 report, this report included both cost-effective as well as cost-ineffective interventions which allowed for a comparison between these types of interventions based on cost-utility analyses only and using an accepted NICE threshold. The first analysis used cost-utility estimates as a continuous outcome to evaluate associations of various intervention characteristics with better (that is lower) cost-utility estimates expressed in £/QALY gained. These results suggest that smoking cessation interventions tended to produce lower (better) CUA values on average than interventions targeting multiple behaviours related to health. Everything else being equal only two factors were independently associated with both lower and higher CUA estimates: interventions targeting

vulnerable populations and those which included BCT 5 to "reduce negative emotions" were associated with worse (higher) CUA values. In addition, when looking at interventions targeting different health-related behaviours separately, the only consistent finding was that diet interventions which provided medication only had worse CUA outcomes than other types of diet interventions, showing an association with both the lower and higher CUA estimate.

The second analysis dichotomised all interventions into cost-effective and cost-ineffective interventions based on the NICE threshold using reported CUA. As for the previous analysis, smoking cessation interventions tend to be more cost-effective than interventions for multiple health-related behaviours when using the lower CUA estimate to determine cost-effectiveness (see Table 8) or when including studies reporting economic analyses other than cost-utility analyses (Table 4). Controlling for all other factors, the results confirm that interventions which target vulnerable populations tend to be less cost-effective than those targeting the general population. In addition, interventions which included BCT 13 ("Monitoring outcome(s) of behaviour by others without feedback") were significantly less likely to be cost-effective. When looking at interventions for different health-related behaviours separately, the inclusion of BCTs related to "Comparison of outcomes" was associated with being cost-ineffective diet interventions and the use of electronic material with cost-ineffective interventions targeting multiple behaviours related to health.

6.1 Caveats

In addition to the problem of comparing interventions included in Stage 1 and in Stage 3 (see page 35 and Footnote 12), there are some other caveats and limitations that need to be acknowledged when interpreting the findings of this report. First, BCTs were coded from published/available information rather than from intervention protocols. As most papers provide only limited information on intervention content, this is likely to have resulted in some discrepancy between actual intervention content and coded content. This is further confounded by the fact that due to the large number of interventions included from reviews, resource limitations required coding of intervention content second-hand from descriptions obtained in reviews. For this reason only reviews with sufficiently detailed description were included so as to reduce this bias.

Second, the BCT taxonomy approach is conservative: one of the principles of coding for BCTs using the taxonomy is to only code the presence of a technique where there is unequivocal evidence from written material that that technique has been used. Thus, one of the advantages of the taxonomy, its specificity and precision in identifying BCTs, also makes it difficult to extract BCTs, because many intervention reports are poorly specified. So, it may be that other techniques have been used in many of these interventions but were not adequately reported, so we could not detect them. This is a frequent observation among those who use the BCT taxonomy to code intervention reports. Reports need to be better specified to allow for BCT coding.

Third, this report is limited by the quality and time-frame of the papers which provided the evidence-based for interventions included in this BCT analysis. As indicated in Sections 4.1 and 4.2, economic modelling itself is open to a number of limitations, such as uncertainty about temporal discounting, adjustment for quality of life and the use of disparate methodologies (e.g. assumptions) across reports. Whilst care was taken to account for different control conditions and econometric approaches employed, it is still likely that considerable heterogeneity remains as exemplified by the fact that the same intervention is appraised as cost-effective in some but not other analyses (e.g. see Shepherd et al [18]).

Fourth, given the relative vague definition of 'choice architecture' in the literature, it is possible that the analyses in this report either over- or underestimate its prevalence in cost-effective interventions, depending on whether the operationalization of 'choice architecture' in this report is too inclusive or too restrictive. A fact which is underlined by the rather disparate results obtained in this report when using differing ways of estimating the presence of 'choice architecture'. In addition, the same limitations that apply to the association of BCTs with cost-effectiveness (outlined below) apply to 'choice architecture', given that this construct was operationalized based on BCTs. Moreover, as the Bazian searches did not include search terms for choice architecture, it is possible that papers that should have been identified may have been missed.

Fifth, whilst different forms of economic analyses and different thresholds were used to define cost-effectiveness, there remains considerable variability in the methodologies used to derive cost-utility and other types of economic estimates which are likely to have introduced some noise into the analysis of factors associated with cost-effectiveness.

Sixth, and most importantly, it is not possible to infer that, because certain BCTs have been used frequently in (cost-)effective interventions, that these BCTs will always result in behaviour change. Whilst we attempted to address this issue in part by evaluating the association of BCTs with cost-utility estimates and by comparing cost-effective with cost-ineffective interventions, these findings need to be interpreted with caution as they assume independence between study outcome and reporting of intervention content. As indicated above, the accuracy of BCT analysis crucially depends on the quality of the study and intervention description. Without an explicit quality assessment, the possibility cannot be excluded that, for instance, some BCTs are negatively (or positively) associated with cost-effectiveness simply because these findings derive from 'better' studies which also provide a more detailed account of intervention content. Put differently, if study quality is reflected both in outcome and ability to identify BCTs accurately this could result in artefactual or spurious associations. Furthermore, it is not possible to reliably isolate the contribution of each BCT/intervention characteristic to effectiveness because many BCTs are used in conjunction with others, and meta-analysis/meta-regression would be more suitable to discern these effects but this is outside of remit of the current project. Lastly, any conclusions of this report rely on the assumption that the description of BCTs reflects actual implementation of BCTs in interventions. However, since fidelity of intervention delivery was not assessed, this is by no means guaranteed.

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8. Appendices

Appendix 1: Detailed overview of reviewed interventions[13]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Medication	Bupropion	No intervention	£25098 ICER in QALY when benefits last 1 year, dominant when it lasts 10 years	Yes	Coleman 2010 [Review]
		Bupropion	**NRT**	**$702 per QALY gained for men and $521 for women**	**Yes**	**Ruger 2012 [Review]**
		Bupropion	Placebo	Cost per non-smoking employee $270-151	Yes*	Ruger 2012 [Review]
		Bupropion	Standard care	$3852 per life year saved	Yes	Ruger 2012 [Review]
		Bupropion	Usual care	VND $172582000 / DALY	No	Higashi 2012
		Free nicotine patch incentive	Preinitiative program	$2688 per quit, $86 more per life year saved	Yes	Ruger 2012 [Review]
		Full coverage nicotine gum	No coverage of gum	Cost per qutter $716	Yes*	Reda 2012 [Review]

[13] [a]Classification by consensus of authors of report; [b]Data come directly from reports; [c]In order to determine cost-effectiveness (ICER) compared with control condition CUA/CEA data were transferred into £ per QALY/DALY/LY, where necessary, representing costs for average user at time of analysis (see 4.2 Review of economic analyses for more details); in cases where CEA was not expressed in terms of (adjusted) life years saved and another economic analysis was used, authors conclusions (indicated by asterisk*) was used to indicate cost-effectiveness; [d]Indicates whether intervention was found in individual paper or review; full references provided in Appendix 9; Interventions in bold are cost-effective based on the threshold used in this report for section 5.2.2 and 5.3 (higher CUA estimate below £20,000/QALY saved, see Table 8)

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Medication	Full coverage nicotine gum	Partial coverage	Cost per quitter $260	Yes*	Reda 2012 [Review]
		Gum	Usual care	VND $376261000 per DALY	No	Higashi 2012
		NRT	No intervention	£49731 ICER in QALY when benefits last 1 year, dominant when it lasts 10 years	Yes	Coleman 2010 [Review]
		NRT	Standard care	$1867 per life year saved	Yes	Ruger 2012 [Review]
		Patch	Usual care	VND $287684000 per DALY	No	Higashi 2012
		Placebo	Placebo	Cost per non-smoking employee $82	Yes*	Ruger 2012 [Review]
		Varenicline	**Brief counselling**	**Euro 240/QALY**	**Yes**	**Annemans 2009**
		Varenicline	**Brief counselling**	**£172-1192 per QALY**	**Yes**	**Ruger 2012 [Review]**
		Varenicline	**Bupropion**	**Varenicline dominant**	**Yes**	**Annemans 2009**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Medication	**Varenicline**	**Compared with nortriptyline**	**$1472 per QALY**	**Yes**	**Ruger 2012 [Review]**
		Varenicline	No intervention	£322 ICER in QALY when benefits last 10 years; £91189 ICER when benefits last one year	Yes	Coleman 2010 [Review]
		Varenicline	**NRT**	**Varenicline dominant**	**Yes**	**Annemans 2009**
		Varenicline	**NRT**	**Cost effectiveness ratio $3936 per QALY gained**	**Yes**	**Ruger 2012 [Review]**
		Varenicline	NRT	$919 more compared to NRT per additional quitter	Yes*	Ruger 2012 [Review]
		Varenicline	**Placebo**	**QALY $420 for men and $7464 for women**	**Yes**	**Ruger 2012 [Review]**
		Varenicline	Placebo	Cost per non-smoking employee $541	Yes*	Ruger 2012 [Review]
		Varenicline	**Unaided cessation**	**Euro 1656/QALY**	**Yes**	**Annemans 2009**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Medication	**Varenicline**	**Unaided cessation**	**$285 per QALY**	**Yes**	**Ruger 2012 [Review]**
		Varenicline	Usual care	VND $108412000 per DALY - varenicline dominated bupropion and NRT	Yes	Higashi 2012
		Varenicline plus additional 12 months	**Unaided cessation**	**Incremental cost of $972, dominated control**	**Yes**	**Ruger 2012 [Review]**
	Brief intervention	**Brief bed side counselling**	**Usual care**	**Incremental cost per incremental discounted life year saved $1691-7444**	**Yes**	**Ruger 2012 [Review]**
		Brief counselling	Usual care	More costly and less effective	No*	Ruger 2012 [Review]
		Computerised program	**Standard care**	**Incremental cost-effectiveness ratio was $1174 per life year aved ($869 per QALY)**	**Yes**	**Smith 2007**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Brief intervention	Manual	No treatment	$691 incremental cost per quit from society perspective $264 from provider	Yes*	Ruger 2012 [Review]
		Minimal or brief counselling	**Usual care**	**Euro per QALY 16900**	**Yes**	**Hoogendoorn 2010 [Review]**
		Moderate no NRT	Brief counselling	Incremental cost per quit $1912	Yes*	Hollis 2007
		NOT teen smoking cessation	Brief intervention	Incremental cost effectiveness ratio per discounted life year saved $443	Yes	Ruger 2012 [Review]
		Physician brief advice	Usual care	VND $1742000 per DALY	Yes	Higashi 2012
		Recruitment postcard	Standard contact	Total cost £3389.00; only 1.3% enrolled versus 0% control condition	No*	Holtrop 2005
		Recruitment telephone call	Standard contact	Total cost £4766.00; total cost per quit $1191; 20.6% enrolled compared to 0% control condition	Yes*	Holtrop 2005

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Brief intervention	Self-help	No treatment	$1131 incremental cost per quit from society perspective $973 from provider	Yes*	Ruger 2012 [Review]
		Structured community pharmacist	Usual care	Cost savings to health system of $500 and $614 and 0.18 life years gained and 0.24 life years gained men and women, respectively	Yes*	Ruger 2012 [Review]
	Brief intervention and medication	Advice and motivation from pharmacist	Usual advice from pharmacist	Cost per life year saved $337-603 for men and $310-1332 for women	Yes	Ruger 2012 [Review]
		Basic advice and medication	**No intervention**	**The 30 year cost/QALY is $3000 less than the base-case assumpions and less than $10000 under pessimistic assumptions**	**Yes**	**Eddy 2009**
		Brief advice and NRT	Brief GP advice without NRT	$965-1585 average cost per life year saved for me, $1634-2360 for women	Yes	Ruger 2012 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Brief intervention and medication	Brief advice and NRT	Physician advice and counselling	Cost per life year saved $4113-6465 for men and $6880-9473 for women	Yes	Ruger 2012 [Review]
		Brief NRT	Brief counselling	Incremental cost per quit $2467	Yes*	Hollis 2007
		Brief telephone counselling with NRT	Brief counselling and no NRT	$2467 for each additional quit	Yes*	Ruger 2012 [Review]
		Bupropion and NRT and proactive telephone counselling	Pharmacotherapy (bupropion and NRT)	$731 per additional quitter	Yes*	Reda 2012 [Review]
		Full coverage	Partial coverage	Incremental cost effectiveness ratio: financial gain $5316	Yes*	Reda 2012[Review]
		GP advice and NRT	**GP advice only**	**$4390-10943 per QALY men, $4955-6983 women**	**Yes**	**Ruger 2012 [Review]**
		GP brief counselling with NRT	Same intervention with placebo NRT	$568 per life years saved	Yes	Ruger 2012 [Review]
		GP training and NRT	Usual care	$107 per additional quitter	Yes*	Ruger 2012 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Brief intervention and medication	GP training, NRT and remuneration	Usual care	$97 per additional quitter	Yes*	Ruger 2012 [Review]
		Minimal advice and NRT	**Minimal advice without NRT**	**Cost per QALY aved ranged from $1108 to 4542 with more intensive interventions being more cost effective**	**Yes**	**Ruger 2012 [Review]**
		Minimal counselling from GP with NRT	**Current practice**	**Cost per QALY gained in Euros if 1-year implementation 1700, 10 year implementation 1500 and permanent implementation 1400**	**Yes**	**Feenstra 2005**
		Moderate NRT	Brief counselling	Incremental cost per quit $2109	Yes*	Hollis 2007
		Patches and uninsured quitline for 8 weeks	Patches and uninsured quitline for 2 weeks	Average cost per quit $1405 compared to $1156 for 2 weeks	Yes*	McAfee 2008
		Pharmacist directed smoking cessation with bupropion	Self-directed quit attempt	$1150 incremental cost per quit	Yes*	Ruger 2012 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Brief intervention and medication	Pharmacist directed smoking cessation with gum	Self-directed quit attempt	$1232 incremental cost per quit	Yes*	Ruger 2012 [Review]
		Pharmacist directed smoking cessation with patch	Self-directed quit attempt	$936 incremental cost per quit	Yes*	Ruger 2012 [Review]
		Pharmacy	**Self-quit cessation**	**£4400 per QALY**	**Yes**	**Boyd 2009**
		Pharmacy	**Self-quit scenario**	**£2600 per QALY**	**Yes**	**Bauld 2010**
		Reimbursement for counselling and pharmacotherapy	**Usual care**	**$2342/QALY**	**Yes**	**Reda 2012 [Review]**
		Reimbursement for Smoking Cessation Support	**No reimbursement**	**Intervention costs per QALY gained compared to the reference scenario were approximately Euro 1200 extrapolating the trial effects directly and 4200 when combining the trials use of SCS with the cessation rates from the literature**	**Yes**	**Vemer 2010**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Brief intervention and medication	Two telephone call backs to initial call	4 telephone call backs to initial call	Cost per quit was the same for the two groups. Two call backs $442 and 4 call backs $445, no difference in effectiveness either	No*	Carlin-Menter 2011
	Comprehensive intervention	Assisted self-help	Manual only	Incremental cost per quit $922-$1758	Yes*	Akers 2007
		Intensive counselling	**Usual care**	**Euro per QALY 8200**	**Yes**	**Hoogendoorn 2010 [Review]**
		Intensive no NRT	Brief counselling	Incremental cost per quit $2640	Yes*	Hollis 2007
		Motivational interviewing	**Usual care**	**$628 QALY for relapse prevention but dominated by usual care for smoking cessation.**	**Yes**	**Ruger 2008**
		Motivational telephone counselling	No telephone call	Effectiveness to cost ratio of 1:$84	Yes*	Parker 2004

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Comprehensive intervention	Smoking cessation or reduction in pregnancy treatment	No treatment	Cost benefit ratio of $1:$12, cost-saving	Yes*	Windsor 2003 [Review]
		Telephone assistance for smoking cessation	Self-help booklets	Smoking cessation attributable to counselling availability is approximately $1300	Yes*	McAlister 2004
		Telephone based intervention	Usual care	$11408 cost per quitter	Yes*	Smith 2011
		Telephone counselling	**Current practice**	**Cost per QALY gained in Euros if 1-year implementation 1500, 10 year implementation 1200 and permanent implementation 1100**	**Yes**	**Feenstra 2005**
		Usual care plus population based direct to smoker outreach	Usual care	Estimated incremental cost per quit $464	Yes*	Rigotti 2011
	Comprehensive intervention and medication	Counselling and Bupropion	Advice or counselling alone	Incremental cost per life year saved $920-2150	Yes	Ruger 2012 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Comprehensive intervention and medication	Counselling and NRT	Advice or counselling alone	Incremental cost per life year saved $1441-3445	Yes	Ruger 2012 [Review]
		Counselling and NRT and Bupropion	Advice or counselling alone	Incremental cost per life year saved $1282-2836	Yes	Ruger 2012 [Review]
		Genetic testing within the course of usual smoking cessation intervention with NRT and counselling	**Usual smoking cessation intervention with NRT and counselling**	**The discounted incremental cost per QALY was AU$34687 over 35 years.**	**Yes**	**Gordon 2010**
		Group intensive and NRT	**Minimal advice without NRT**	**Cost per QALY saved ranged from $1108 to 4542 with more intensive interventions being more cost effective**	**Yes**	**Ruger 2012 [Review]**
		Group support	**Self-quit cessation**	**£5400 per QALY**	**Yes**	**Boyd 2009**
		Group support	**Self-quit scenario**	**£4800 per QALY**	**Yes**	**Bauld 2010**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Comprehensive intervention and medication	**Individual intensive and NRT**	**Minimal advice without NRT**	**Cost per QALY aved ranged from $1108 to 4542 with more intensive interventions being more cost effective**	**Yes**	**Ruger 2012 [Review]**
		Intensive counselling with NRT	**Minimal counselling without NRT**	**QALY gained $4939**	**Yes**	**Ruger 2012 [Review]**
		Intensive counselling with bupropion	**Current practice**	**Cost per QALY gained in Euros if 1-year implementation 3600, 10 year implementation 3400 and permanent implementation 3400**	**Yes**	**Feenstra 2005**
		Intensive counselling with NRT	**Current practice**	**Cost per QALY gained in Euros if 1-year implementation 5200, 10 year implementation 4900 and permanent implementation 4900**	**Yes**	**Feenstra 2005**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Smoking	Comprehensive intervention and medication	**Intensive counselling with pharmacotherapy**	**Usual care**	**Euro per QALY 2400**	**Yes**	**Hoogendoorn 2010 [Review]**
		Intensive NRT	Brief counselling	Incremental cost per quit $2112	Yes*	Hollis 2007
		Intensive telephone counselling with NRT	Brief counselling and no NRT	$2467 for each additional quit	Yes*	Ruger 2012 [Review]
		Mobile smoking cessation service	Other comprehensive programs	Per self reported quitter $594	Yes*	Abdullah 2008
		Moderate telephone counselling with NRT	Brief counselling and no NRT	$2467 for each additional quit	Yes*	Ruger 2012 [Review]
		Peer delivered smoking cessation counselling	Self help	Cost per participant $300. The incremental cost effectiveness of the intervention was$5371 per additional quit	Yes*	Emmons 2005
		Stepped care	No treatment	$5170 per life-year	Yes	Barnett 2008
		Stepped care and mental health services	No treatment	$9580 per life-year	Yes	Barnett 2008

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Diet	Medication	Acarbose	No treatment	CER AD $37000/DALY	Yes	Bertram 2010
		Metformin	No treatment	CER AD $22000/DALY	Yes	Bertram 2010
		Metformin	Placebo intervention	$34974-$123964/QALY from societal perspective	No	Diabetes research group 2003
		Orlistat	No treatment	CER AD $100000/DALY	No	Bertram 2010
		Orlistat AHT	Diet	£4633 per life years	Yes	Avenell 2004 [Review]
		Orlistat hypercholesterolemia	Diet	£4645 per life years	Yes	Avenell 2004 [Review]
		Orlistat hypercholesterolemia and AHT	Diet	£2171 per life years	Yes	Avenell 2004 [Review]
		Orlistat no complications	Diet	£12522 per life-years	Yes	Avenell 2004 [Review]
	Brief intervention	**Adjustable gastric banding**	**No treatment**	**£8527 per QALY**	**Yes**	**Avenell 2004 [Review]**
		Diet intervention	**No treatment**	**ICER per QALY Euro 8996**	**Yes**	**Hertzman 2005**
		Educational video	**Usual care**	**£14066 per QALY**	**Yes**	**Avenell 2004 [Review]**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Diet	Brief intervention	Gastric bypass surgery - 10% IGT, 90% NGT	No intervention	£5527 per life years	Yes	Avenell 2004 [Review]
		Gastric bypass surgery - IGT	No intervention	£2067 per life years	Yes	Avenell 2004 [Review]
		New York State Expanded Food and Nutrition Education Program	**No intervention**	**$20863 QALY (sensitivity $42935 QALY)**	**Yes**	**Dollahite 2008**
		Roux-en-Y gastric bypass	**No treatment**	**£6289 per QALY**	**Yes**	**Avenell 2004 [Review]**
		Sibutramine	**Placebo**	**£7860 per QALY gained**	**Yes**	**Avenell 2004 [Review]**
		Sibutramine	**Placebo**	**£10500 per QALY gained**	**Yes**	**Avenell 2004 [Review]**
		Vertical banded gastroplasty	**No treatment**	**£10237 per QALY**	**Yes**	**Avenell 2004 [Review]**
		Vertical banded gastroplasty	**No treatment**	**$5865 direct costs of surgery and productivity gained $2765 per year, dominated control**	**Yes**	**Avenell 2004 [Review]**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Diet	Brief intervention	VLCD and individual therapy - IGT and NGT	No intervention	£1168 per life years	Yes	Avenell 2004 [Review]
	Brief intervention and medication	**Orlistat and diet intervention**	**Diet intervention for 12 months and no treatment**	**The ICER per QALY gained versus diet only was estimated to be Euro 13125 for the average patient. When compared with no intervention, the cost effectiveness was improved. Comparing diet only with no diet gave a slightly higher ICER, indicating that Orlistat had extended dominance over the diet only intervention.**	**Yes**	**Hertzman 2005**
	Comprehensive intervention	Diet	No treatment	CER AD $38000/DALY	Yes	Bertram 2010
		Diet	Routine care	Dominated by the exercise, diet and behaviour modification program	No*	Loveman 2011 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Diet	Comprehensive intervention	Food stamp nutrition education program and video	Expanded food and nutrition education program	$4820 compared to $13463 for control	Yes*	Cox 2003
		Gutbusters workplace	**No control group**	**dominates to £7900, average £7900**	**Yes**	**Dalziel 2007 [Review]**
		Intensive life style change to prevent diabetes	General dietary advice at trial start	AU$9500 per percentage point increase in the incremental cost effectiveness ratio	Yes	Dalziel 2007 [Review]
		Lighten up	Current practice	Cost-effectiveness ratio $130000/DALY	No	Cobiac 2010
		Mediterranean diet	**Prudent Western diet**	**dominates to £1400, average £410**	**Yes**	**Dalziel 2007 [Review]**
		Nutritional counselling in GP	Feedback of initial measurements	£2600-26000, average £4200	Yes	Dalziel 2007 [Review]
		Oxcheck nurse checks in GP	Delayed treatment group	£2700-26000, average £5100	Yes	Dalziel 2007 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Diet	Comprehensive intervention	**Reduced fat diet for IGT**	**General dietary advice at trial start**	**dominates to £4000, average £4000**	**Yes**	**Dalziel 2007 [Review]**
		Screening followed by lifestyle intervention for subjects diagnosed with either impaired glucose tolerance or impaired fasting glucose	**No screening**	**Cost-effectiveness ratio of $9511 per QALY**	**Yes**	**Hoerger 2007**
		Screening overweight subjects and giving them the lifestyle intervention included in the diabetes prevention program if diagnosed with impaired glucose tolerance and impaired fasting glucose	**No screening**	**Cost-effectiveness ratio of $8181 per QALY**	**Yes**	**Hoerger 2007**
		Web based intervention MENU tailored	Non-tailored intervention	Cost per average change in fruit and veg $27	Yes*	Sukhanova 2009

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Diet	Comprehensive intervention	Web based intervention MENU tailored and HOBI counselling	Non-tailored intervention	Cost per average change in fruit and veg $61	Yes*	Sukhanova 2009
		Weight watchers	Current practice	Cost-effectiveness ratio $140000/DALY	No	Cobiac 2010
	Comprehensive intervention and medication	Diet and pharmacology	Routine care	Dominated by the exercise, diet and behaviour modification program	No*	Loveman 2011 [Review]
	Mass media	**FFFF media campaign**	**No control group**	**£4 to dominated, average £2300**	**Yes**	**Dalziel 2007 [Review]**
		Multi media 2 fruit 5 veg	**No control group**	**£10 to dominated, average £18**	**Yes**	**Dalziel 2007 [Review]**
Physical activity	Brief intervention	Community campaign	No intervention	Cost effectiveness ratio as $ per MET-hour gained/person 0.009	Yes*	Wu 2007 [Review]
		Creation or enhanced access to places for physical activity	No intervention	Cost effectiveness ratio as $ per MET-hour gained/person 0.40	Yes*	Wu 2007 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Physical activity	Brief intervention	GP prescription	Current practice	$11000 AD/DALY	Yes	Cobiac 2009
		GP referral to exercise physiologist	Current practice	$75000 (37500-150000) AD/DALY	Yes	Cobiac 2009
		Internet	Current practice	$2000 AD/DALY	Yes	Cobiac 2009
		Pedometers	**Current practice**	**Dominant**	**Yes**	**Cobiac 2009**
		Phone intervention	Mailings unrelated to physical activity	$1290-$3967 per participant moved out of sedentary status	Yes*	Sevick 2007
		Point of decision prompts	No intervention	Cost effectiveness ratio as $ per MET-hour gained/person 0.07	Yes*	Wu 2007[Review]
		Print intervention	Mailings unrelated to physical activity	$756-$955 per participant moved out of sedentary status	Yes*	Sevick 2007
		TravelSmart	Current practice	$18000 AD/DALY	Yes	Cobiac 2009

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Physical activity	Comprehensive intervention	Disease register screening	Opportunistic patient recruitment	£53 per patient in controls and £191 in disease sites. The incremental cost of converting one sedentary adult to an active state of 150 minutes of moderate intensity physical activity per week amounts to £886.50 in disease register practices compared to control.	Yes*	Boehler 2011
		Exercise	No treatment	CER AD $30000/DALY	Yes	Bertram 2010
		Green prescription program	**Usual care**	**NZ $2053 per QALY**	**Yes**	**Dalziel 2006**
		High intensity individually adapted behaviour	No intervention	Cost effectiveness ratio as $ per MET-hour gained/person 0.084	Yes*	Wu 2007 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Physical activity	Comprehensive intervention	High intensity social support	No intervention	Cost effectiveness ratio as $ per MET-hour gained/person 1.16	No*	Wu 2007 [Review]
		Intervention group	Intervention offered once	Incremental cost effectiveness ratio over the first 6 months Euro 142 per score point on the McMaster Toronto Arthritis Patient Preference Disability Questionnaire	Yes*	Bulthuis 2008
		LIFE-P exercise intervention	Aging intervention: educational meetings	Cost/disability avoided $28206	Yes*	Groessl 2009
		Low intensity individually adapted behaviour	No intervention	Cost effectiveness ratio as $ per MET-hour gained/person 0.10	Yes*	Wu 2007 [Review]
		Low intenstiy social support	No intervention	Cost effectiveness ratio as $ per MET-hour gained/person 0.47	Yes*	Wu 2007 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Physical activity	Mass media	**Mass media-based campaign**	**Current practice**	**Dominant**	**Yes**	**Cobiac 2009**
Alcohol	Brief intervention	Brief intervention	No treatment	Net cost savings per participant $89. Potential net savings of $1.82 billion annually.	Yes*	Gentilello 2005
		Brief relationship therapy	Individual based treatment	Higher cost effectiveness ratio than control	Yes*	Fals-Stewart 2005
		Brief relationship therapy	Psychosocial educational attention control treatment	Higher cost effectiveness ratio than control	Yes*	Fals-Stewart 2005
		Brief relationship therapy	Standard behavioural couples therapy	Higher cost effectiveness ratio than control	Yes*	Fals-Stewart 2005
		Screening and brief intervention	**Normal care**	**Cost-effectiveness ratio of Euro 5,400 per QALY gained.**	**Yes**	**Tariq 2009**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Alcohol	Brief intervention	Screening and referral to alcohol health worker	Information only control	65% probability that more cost effective then the information only control	Yes*	Barrett 2005
	Comprehensive intervention	**Motivational interviewing**	**Standard care**	**per QALY $8795**	**Yes**	**Neighbors 2010**
		Stepped care intervention	Minimal intervention	Cost-saving of £9000 per participant, 98% confidence that stepped care more cost-effective than control	Yes*	Drummond 2009
Sexual health	Medication	STI treatment	No intervention	$739 to $767/DALY averted	Yes	Aldridge 2009
	Brief intervention	Condoms	No intervention	$500 to $503/DALY averted	Yes	Aldridge 2009
		Incentive	Standard treatment	Incremental cost effectiveness ratio $1,104 per treated infection	Yes*	Gift 2005

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Sexual health	Brief intervention	Peer education for sex workers	No treatment	Average cost effectiveness ratio per DALY averted Afr-E $4 and Sear-D $3	Yes	Hogan 2013 [Review]
		Reminder	Standard treatment	Incremental cost effectiveness ratio $345 per treated infection	Yes*	Gift 2005
		Tailored print communication	**No intervention**	**ICER QALY EURO 2867**	**Yes**	**van Keulen 2010**
		Usual care and behavioural internet treatment	Usual care	$25.92 per kilogram of weight loss and $28.96 per centimeter of waist-circumference loss; cost per each additional point gained on the efficacy lifestyle questionnaire $37.88	Yes*	Rasu 2010
		Voluntary counselling and testing	No intervention	$116 to $118/DALY averted	Yes	Aldridge 2009

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Sexual health	Brief intervention and medication	Antiretroviral - intensive monitoring, first and second line drugs	No treatment	Average cost effectiveness ratio per DALY averted Afr-E $1977 and Sear-D $1280	Yes	Hogan 2013 [Review]
		Antiretroviral - intensive monitoring, first line drugs only	No treatment	Average cost effectiveness ratio per DALY averted Afr-E $596 and Sear-D $570	Yes	Hogan 2013 [Review]
		Antiretroviral - no intensive monitoring, first and second line drugs	No treatment	Average cost effectiveness ratio per DALY averted Afr-E $2010 and Sear-D $1319	Yes	Hogan 2013 [Review]
		Antiretroviral - no intensive monitoring, first line drugs only	No treatment	Average cost effectiveness ratio per DALY averted Afr-E $556 and Sear-D $542	Yes	Hogan 2013 [Review]
		HAART basic	No intervention	$2403/DALY averted	Yes	Aldridge 2009
		HAART comprehensive	No intervention	$1995/DALY averted	Yes	Aldridge 2009
		HAART intermediate	No intervention	$2297/DALY averted	Yes	Aldridge 2009

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Sexual health	Brief intervention and medication	Treatment of sexually transmitted infections	No treatment	Average cost effectiveness ratio per DALY averted Afr-E $32 and Sear-D $20	Yes	Hogan 2013 [Review]
	Comprehensive intervention	**Community - peer opinion leaders (1)**	**Two comparison cities**	**Cost per QALY saved $0**	**Yes**	**Herbst 2007 [Review]**
		Community - peer opinion leaders	**Two comparison cities**	**Cost per QALY saved $0**	**Yes**	**Herbst 2007 [Review]**
		Group intervention - safe sex training	**60-90 minute safer sex lecture**	**$9757 per discounted QALY saved**	**Yes**	**Herbst 2007 [Review]**
		Group intervention - small group	**Wait-list group**	**$0 per discounted QALY saved**	**Yes**	**Herbst 2007 [Review]**
		HIV harm reduction intervention	No intervention	$359 per HIV infection averted	Yes*	Kumaranayake 2003
		HIV prevention	No intervention	Cost-effectiveness ratio of US$530 per DALY averted	Yes	Shepard 2010 [Review]
		HIV prevention intervention	**No intervention**	**$6180 per QALY saved**	**Yes**	**Shepard 2010 [Review]**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Sexual health	Comprehensive intervention	**Intervention group - annually**	**Intervention offered only once**	**$1075 per QALY**	**Yes**	**Burgos 2010**
		Intervention group - once	**No intervention**	**$183 per QALY**	**Yes**	**Burgos 2010**
		Motivation counselling and reminder	Standard treatment	Dominated by control	No*	Gift 2005
		Motivational counselling	Standard treatment	Dominated by control	No*	Gift 2005
		Mpowerment project	Santa Barbara	Pre-steady to steady state $41993-49580 per HIV infection prevented (year 1, societal perspective), $7373-10578 (year 20 societal perspective);	Yes*	Herbst 2007 [Review]
		Obesity management	Standard dietetic therapy	Cost per KG weight loss $AU31 - $100 per patient per year	Yes*	Osland 2006

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Sexual health	Comprehensive intervention	One-day CB HIV risk reduction	No intervention	$57000 per QALY saved when training costs included and $41000 per QALY saved when they were excluded	No	Shepard 2010 [Review]
		Safer choices intervention	No intervention	$2.65 saved for every dollar spent on the programme	Yes*	Shepard 2010 [Review]
		School based education	No intervention	Cost per person $305 and cost per HIV case averted $39M	No*	Shepard 2010 [Review]
		Self-help cardiac rehabilitation	Usual care control	$40463/QALY	Yes	Lee 2007 [Review]
		SHARE project	**No intervention**	**£11,622/QALY gained**	**Yes**	**Shepard 2010 [Review]**
		Time matched session	Small group CB skills	$136,295 per QALY when restricted to women not cost effective for men	No	Johnson-Masotti 2003 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Sexual health	Comprehensive intervention	Voluntary counselling and testing	No treatment	Average cost effectiveness ratio per DALY averted Afr-E $82 and Sear-D $40	Yes	Hogan 2013 [Review]
	Comprehensive intervention and medication	**Intervention group plus HAART**	**Intervention offered annually**	**Cost per QALY of $2436**	**Yes**	**Burgos 2010**
		Intervention group plus HAART	**Intervention offered once**	**Cost per QALY of $14136**	**Yes**	**Burgos 2010**
		Peer counselling and treatment of STIs for female sex workers	No intervention	$55/DALY averted	Yes	Aldridge 2009
		Peer counselling and treatment of STIs for men who have sex with men	No intervention	$1317 to $1336/DALY averted	Yes	Aldridge 2009
		Peer education and treatment of sexually transmitted infections for sex workers	No treatment	Average ICER per DALY averted Afr-E $4 and Sear-D $3	Yes	Hogan 2013 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Sexual health	Comprehensive intervention and medication	Prevention of mother and child transmission	No intervention	$5928/DALY averted	Yes	Aldridge 2009
		Prevention of mother to child transmission	No treatment	Average ICER per DALY averted Afr-E $34 and Sear-D $310	Yes	Hogan 2013 [Review]
	Mass media	Mass media campaign	No intervention	$246/DALY averted	Yes	Aldridge 2009
		Mass media campaign	No treatment	Average cost effectiveness ratio per DALY averted Afr-E $3 and Sear-D $18	Yes	Hogan 2013 [Review]
Multiple behaviours	Medication	**Metformin intervention**	**Placebo metformin**	**Cost per QALY $31300**	**Yes**	**Herman 2005**
	Brief intervention	Behavioural intervention	Non-behavioural intervention	Ranged from $42457/LY saved for normal weight women to $87300 for men.	No	Datta 2010
		Community intervention	**Usual care**	**€3100-3900 per QALY**	**Yes**	**Jacobs-van-der-Bruggen 2007**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Multiple behaviours	Brief intervention	Internet intervention	Usual care	£39248 per QALY	No	McConnon 2007
		Mail	Invited for measurements	Cost per participant per month £38.22	Yes*	Dzator 2004
		Screening	**No screening**	**£14150/QALY (discounted 3.5% a year)**	**Yes**	**Gillies 2008**
		Telephone	**Real control**	**$29375 QALY**	**Yes**	**Graves 2009**
		Usual care	**Real control**	**$12153 QALY**	**Yes**	**Graves 2009**
		Video plus self-help	Routine care	AU$11 million	No*	Avenell 2004 [Review]
		Weight-wise	Wait-listed control	The incremental cost per life year gained (discounted) from a decrease in obesity was $1862	Yes	Gustafson 2009

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Multiple behaviours	Brief intervention and medication	**Nurse led clinics to promote of secondary prevention**	**Usual care**	**per QALY £1097**	**Yes**	**Raftery 2004**
		Screening and pharmacological intervention	**No screening**	**QALY (discounted 3.5% a year for both costs and benefits) £7023**	**Yes**	**Gillies 2008**
	Comprehensive intervention	**Cardiac rehabilitation**	**Usual care**	**$9200 per QALY**	**Yes**	**Lee 2007 [Review]**
		Cardiac rehabilitation	Traditional protocol	No difference in clinical measures, cost $738 less than control treatment.	No*	Lee 2007 [Review]
		Cardiac rehabilitation	Traditional protocol	No difference in clinical measures, cost $738 less than control treatment.	No*	Lee 2007 [Review]
		Chronic care diabetes	Usual care	ICER £94511 per QALY	No	Carr 2011 [Review]
		Chronic care diabetes	Usual care	Was dominated	No*	Carr 2011 [Review]
		Chronic care diabetes	**Usual care**	**ICER £13565 per QALY**	**Yes**	**Carr 2011 [Review]**
		Counterweight program	**No treatment**	**£473 per QALY**	**Yes**	**Loveman 2011 [Review]**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Multiple behaviours	Comprehensive intervention	Diet and exercise	Routine care	Dominated by the exercise, diet and behaviour modification program	No*	Loveman 2011 [Review]
		Diet and exercise therapy	**Control education about diabetes**	**$10870 per well life year**	**Yes**	**Avenell 2004 [Review]**
		Diet, exercise and behaviour modification	**Routine care**	**$12640 per QALY**	**Yes**	**Loveman 2011 [Review]**
		Dietary intervention	Combination	Dominated by Dietary intervention+Exercise	No	Barton 2009
		Strengthening exercise	Leaflet	Subject to extended dominance	No	Barton 2009
		Dietary intervention plus strengthening exercise	**Leaflet provision**	**Incremental cost per QALY £10469.44**	**Yes**	**Barton 2009**
		Exercise and diet intervention	Usual care	ICER of £67184 per QALY	No	Irvine 2011
		Finnish Diabetes Prevention study	**Usual care**	**Cost-effectiveness ratio was Euro 2363 per QALY**	**Yes**	**Lindgren 2007**

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Multiple behaviours	Comprehensive intervention	Group phone based obesity treatment for rural women	Individual phone based obesity treatment for rural women	$714 for group counselling and $1029 for individual counselling per participant	Yes*	Befort 2010
		Health care intervention	**Usual care**	**€3100-3900 per QALY**	**Yes**	**Jacobs-van-der-Bruggen 2007**
		Improving control with activity and nutrition	Usual care	$3586 lower than control	Yes*	Wolf 2007
		In person group behaviour weight loss intervention	Internet group behavioural weight loss intervention	Incremental cost-effectiveness ratio was $7177 per (discounted) LYG	Yes	Krukowski 2011
		Internet group behaviour weight loss intervention	No intervention	Incremental cost-effectiveness ratio was $2160 per (discounted) LYG	Yes	Krukowski 2011

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Multiple behaviours	Comprehensive intervention	**LHT intervention**	**Diet intervention control**	**ICER was £14480 per QALY, yet there was a 61% chance of making the wrong decision at a £20000/QALY threshold**	**Yes**	**Barton 2012**
		Life-style intervention	**Placebo metformin**	**Cost per QALY $1100. Life style intervention dominanted the metformin intervention**	**Yes**	**Herman 2005**
		Lifestyle intervention	Placebo intervention	$28053-$54613/QALY from societal perspective	Yes	Diabetes research group 2003
		Lifestyle intervention with standard care	**Standard care alone**	**$1668-4813 per QALY**	**Yes**	**Eriksson 2010**
		Mail and interactive group sessions	Invited for measurements	Cost per participant per month £38.37	Yes*	Dzator 2004
		PREVENT intervention	Usual care	$379 per risk factor dropped. $228 cost effectiveness estimate per unit change in multiple risk factor score	Yes*	Emmons 2005

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Multiple behaviours	Comprehensive intervention	**Screening and lifestyle intervention**	**No screening**	**QALY (discounted 3.5% a year for both costs and benefits) £6242**	**Yes**	**Gillies 2008**
		Cardiac rehabilitation	Usual care	SEK 43000 for the control group and SEK 36030 for intervention group. 52% of treatment group participants were employed compared to 27% of controls. Saves 70610 on sick leave. Total benefit-cost ratio of 51.1	Yes*	Lee 2007 [Review]
		Home based cardiac rehabilitation	No cardiac rehabilitation	Improved work capacity. Cost per patient $1898	No*	Lee 2007 [Review]
		Hospital based cardiac rehabilitation	No cardiac rehabilitation	Improved work capacity. Cost per patient $10170	No*	Lee 2007 [Review]
		Video cardiac rehabilitation	Usual care control	$40463/QALY	Yes	Lee 2007 [Review]

Health-related Behaviour	Intervention type[a]	Intervention name	Control condition	Economic analysis data[b]	Cost-effective[c]	Source[d]
Multiple behaviours	Comprehensive intervention	Cardiac rehabilitation	Usual care	$2688 per patient treated. Program entrants were less likely to be rehospitalised and pre-admission charges when hospitalised significantly less.	Yes*	Lee 2007 [Review]
	Comprehensive intervention and medication	Diet plus exercise	No treatment	CER AD $23000/DALY	Yes	Bertram 2010
		Israeli Blood Pressure Control Program	**No treatment**	**$931000 for 1000 QALYs**	**Yes**	**Yosefy 2003**
		Metformin+diet plus exercise	No treatment	CER AD $81000/DALY	No	Bertram 2010
		Wisewomen intervention	No treatment	$4400 per discounted life-year gained	Yes	Finkelstein 2006

Appendix 2: Behaviour change techniques classified in interventions for Smoking Cessation[14]

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Social support							
1	Social support (practical)		X[36]	X[40,53,59]	X[64,67-69,72,73]	X[88,90,92]	
2	Social support (emotional)		X[36]	X[40,53,59]	X[64,67-69,72,73]	X[88,90,92]	
3	Social support (unspecified)		X[29,30,31-33,36]	X[40,41,43,45,46,47,48,53,55,56,59,60]	X[64,65,67-69,72,73]	X[75,77-79,81-88,90,92]	
Regulation							
4	Pharmacological support	X[1-27]		X[40-63]	X[65, 67,69,70,72,73]	X[74-92]	
5	Reduce negative		X[36]	X[51,53,54,57-59]	X[73]	X[88,89,91]	

[14] See Appendix 8 for details of references indicated by numbers in Table

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	emotions						
6	Conserving mental resources						
7	Paradoxical instructions						
Feedback and monitoring							
8	Feedback on behaviour				X[68,69]	X[76,80,88,92]	
9	Feedback on outcome(s) of behaviour						
10	Self-monitoring						

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	of behaviour						
11	Self-monitoring of outcome(s) of behaviour						
12	Monitoring of behaviour by others without feedback					X[92]	
13	Monitoring outcome(s) of behaviour by others without feedback						
14	Biofeedback				X[66]	X[74,82]	
Associations							

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
15	Prompts/cues		X[30]	X[40,59]	X[67-69,73]	X[90]	
16	Reduce prompts/cues						
17	Cue signalling reward						
18	Remove access to the reward						
19	Remove aversive stimulus						
20	Satiation						
21	Exposure						
22	Associative						

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	learning						
Repetition and substitution							
23	Behavioural practice/rehearsal						
24	Habit formation						
25	Behaviour substitution						
26	Habit reversal						
27	Overcorrection						
28	Generalisation of a target						

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	behaviour						
29	Graded tasks						
Antecedents							
30	Restructuring the physical environment			X[53]			
31	Restructuring the social environment						
32	Avoidance/reducing exposure to cues for the behaviour						
33	Distraction						

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
34	Adding objects to the environment						
35	Body changes	X[1-27]	X[29,37]	X[40-63]	X[73]	X[74-92]	
Shaping knowledge							
36	Instruction on how to perform a behaviour	X[1-27]	X[28,29,34,35,36-39]	X[40-63]	X[64,66-73]	X[74-92]	
37	Information about antecedents						
38	Re-attribution						
39	Behavioural experiments						

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Self-beliefs							
40	Verbal persuasion about capability		X[28-31,36,37]	X[40,42,44,45, 49-51,53,59]	X[64,66,68-73]	X[88,92]	
41	Mental rehearsal of successful performance						
42	Focus on past success						
43	Self-talk						
Scheduled consequences							
44	Punishment						

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
45	Behaviour cost						
46	Remove reward						
47	Reward approximation						
48	Rewarding completion						
49	Situation-specific reward						
50	Reward incompatible behaviour						
51	Reward alternative behaviour						

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
52	Reduce reward frequency						
53	Remove punishment						
Reward and threat							
54	Material reward (behaviour)						
55	Material reward (outcome)						
56	Social reward						
57	Non-specific reward						
58	Self-reward			X[60]			

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
59	Future punishment			X[46]			
60	Material incentive (behaviour)	X[23,24]		X[56]			
61	Material incentive (outcome)			X[58]			
62	Social incentive						
63	Non-specific incentive						
64	Self-incentive						
Goals and planning							

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
65	Problem solving			X[53,59]	X[68,70,71]	X[82,88,92]	
66	Goal setting (behaviour)			X[42,44,53]	X[66,68-70]	X[75,88,92]	
67	Goal setting (outcome)			X[40]	X[68-70]	X[77,88,92]	
68	Action planning			X[53]	X[68-70]	X[88]	
69	Review behaviour goal(s)			X[53]			
70	Review outcome goal(s)						
71	Behavioural contract				X[70]		

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
72	Commitment						
73	Discrepancy between current behaviour and goal						
74	Persuasive source	X[1-4,7,13,19,20]	X[30,32]	X[41-45,47-52,54-58,61-63]	X[65,66,70]	X[74-78,80,81,89,91]	
75	Pros and cons						
76	Comparative imaging of future outcomes						
Identity							

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
77	Identification of self as role model						
78	Valued self-identity						
79	Framing/reframing						
80	Incompatible beliefs					X[74]	
81	Identity associated with changed behaviour						
Natural consequences							

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
82	Information about health consequences				X[64,66, 67,69,70]	X[74,82,92]	
83	Information about emotional consequences				X[64,67,69,70]	X[82,92]	
84	Information about social and environmental consequences				X[64,67,69,70]	X[82,92]	
85	Salience of consequences				X[70]	X[82,92]	
86	Monitoring of emotional consequences						

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
87	Anticipated regret						
Comparison of behaviour							
88	Demonstration of behaviour						
89	Social comparison					X[74]	
90	Information about others' approval						
Covert learning							
91	Imaginary punishment						

SMOKING CESSSATION		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
92	Imaginary reward						
93	Vicarious consequences						

Appendix 3: Behaviour change techniques classified in interventions for diet[15]

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Social support							
1	Social support (practical)				X[116,117,120-125,128]	X[129]	
2	Social support (emotional)				X[116,117,120-125,128]	X[129]	
3	Social support (unspecified)		X[111]		X[116,117-125,128]	X[129]	
Regulation							
4	Pharmacological support	X[93-100]	X[103,106,108]	X[113]		X[129]	
5	Reduce negative emotions				X[115]		

[15] See Appendix 8 for details of references indicated by numbers in Table

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
6	Conserving mental resources						
7	Paradoxical instructions						
Feedback and monitoring							
8	Feedback on behaviour				X[118,120,123,125]		
9	Feedback on outcome(s) of behaviour						
10	Self-monitoring of behaviour				X[123-164]		X[130]
11	Self-monitoring of outcome(s)						

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	of behaviour						
12	Monitoring of behaviour by others without feedback				X[122]		
13	Monitoring outcome(s) of behaviour by others without feedback				X[119-121]		
14	Biofeedback	X[93,95,97]			X[117]		
Associations							
15	Prompts/cues				X[126,128]		X[131]
16	Reduce						

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	prompts/cues						
17	Cue signalling reward						
18	Remove access to the reward						
19	Remove aversive stimulus						
20	Satiation						
21	Exposure						
22	Associative learning						
Repetition and							

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
substitution							
23	Behavioural practice/rehearsal				X[120,126]		
24	Habit formation						
25	Behaviour substitution				X[123]		
26	Habit reversal						
27	Overcorrection						
28	Generalisation of a target behaviour						
29	Graded tasks						

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Antecedents							
30	Restructuring the physical environment						
31	Restructuring the social environment						
32	Avoidance/reducing exposure to cues for the behaviour						
33	Distraction						
34	Adding objects to the environment		X[101,103-112]				

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
35	Body changes	X[93-100]	X[102-112]	X[113]	X[118]	X[129]	
Shaping knowledge							
36	Instruction on how to perform a behaviour	X[93-100]		X[113]	X[114-116,120-128]	X[129]	X[130,131]
37	Information about antecedents						
38	Re-attribution						
39	Behavioural experiments						
Self-beliefs							

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
40	Verbal persuasion about capability						X[131]
41	Mental rehearsal of successful performance						
42	Focus on past success						
43	Self-talk						
Scheduled consequences							
44	Punishment						
45	Behaviour cost						

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
46	Remove reward						
47	Reward approximation						
48	Rewarding completion						
49	Situation-specific reward						
50	Reward incompatible behaviour						
51	Reward alternative behaviour						
52	Reduce reward frequency						

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
53	Remove punishment						
Reward and threat							
54	Material reward (behaviour)						
55	Material reward (outcome)						
56	Social reward						
57	Non-specific reward						
58	Self-reward						
59	Future punishment						

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
60	Material incentive (behaviour)						X[130]
61	Material incentive (outcome)						
62	Social incentive						
63	Non-specific incentive						
64	Self-incentive						
Goals and planning							
65	Problem solving				X[115]		

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
66	Goal setting (behaviour)				X[114,115,120,121,124,128]		X[130]
67	Goal setting (outcome)				X[118,120,121,124,128]		X[130]
68	Action planning				X[120,128]		
69	Review behaviour goal(s)						
70	Review outcome goal(s)						
71	Behavioural contract						
72	Commitment						

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
73	Discrepancy between current behaviour and goal						
74	Persuasive source	X[93-95,97]			X[115,117,121,124]		
75	Pros and cons	X[94]					
76	Comparative imaging of future outcomes						
Identity							
77	Identification of self as role model						

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
78	Valued self-identity						
79	Framing/reframing						
80	Incompatible beliefs						
81	Identity associated with changed behaviour						
Natural consequences							
82	Information about health consequences	X[94]	X[101,102]		X[120,123,124,127,128]	X[130]	
83	Information about		X[101,102]		X[123,124,126-128]		

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	emotional consequences						
84	Information about social and environmental consequences		X[101,102]		X[123,124,126-128]		
85	Salience of consequences				X[126-128]		
86	Monitoring of emotional consequences						
87	Anticipated regret						
Comparison of behaviour							

DIET		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
88	Demonstration of behaviour				X[123,126]		X[130]
89	Social comparison						
90	Information about others' approval						
Covert learning							
91	Imaginary punishment						
92	Imaginary reward						
93	Vicarious consequences						

Appendix 4: Behaviour change techniques classified in interventions for physical activity[16]

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Social support							
1	Social support (practical)		X[132,135]		X[142,144,148,153]		
2	Social support (emotional)		X[132,135]		X[142,144,148,153]		
3	Social support (unspecified)		X[132,135,137]		X[142,144,146,148,149,152,153]		
Regulation							
4	Pharmacological support						
5	Reduce negative emotions						

[16] See Appendix 8 for details of references indicated by numbers in Table

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
6	Conserving mental resources						
7	Paradoxical instructions						
Feedback and monitoring							
8	Feedback on behaviour		X[139,141]				
9	Feedback on outcome(s) of behaviour						
10	Self-monitoring of behaviour		X[139,141]				
11	Self-monitoring of outcome(s)						

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	of behaviour						
12	Monitoring of behaviour by others without feedback						
13	Monitoring outcome(s) of behaviour by others without feedback				X[148]		
14	Biofeedback				X[144]		
Associations							
15	Prompts/cues		X[140]		X[148,151]		
16	Reduce						

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	prompts/cues						
17	Cue signalling reward						
18	Remove access to the reward						
19	Remove aversive stimulus						
20	Satiation						
21	Exposure						
22	Associative learning						
Repetition and							

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
substitution							
23	Behavioural practice/rehearsal				X[150,151]		
24	Habit formation						
25	Behaviour substitution						
26	Habit reversal						
27	Overcorrection						
28	Generalisation of a target behaviour				X[151]		
29	Graded tasks				X[151]		

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Antecedents							
30	Restructuring the physical environment		X[138]				
31	Restructuring the social environment						
32	Avoidance/reducing exposure to cues for the behaviour						
33	Distraction						
34	Adding objects to the environment		X[133,136]		X[151]		

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
35	Body changes		X[139-141]		X[150]		
Shaping knowledge							
36	Instruction on how to perform a behaviour		X[133,134,137]		X[142,146,148,149,150-153]		
37	Information about antecedents						
38	Re-attribution						
39	Behavioural experiments						
Self-beliefs							

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
40	Verbal persuasion about capability		X[139,141]		X[142,148,149,152,153]		X[154]
41	Mental rehearsal of successful performance						
42	Focus on past success						
43	Self-talk						
Scheduled consequences							
44	Punishment						
45	Behaviour cost						

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
46	Remove reward						
47	Reward approximation						
48	Rewarding completion						
49	Situation-specific reward						
50	Reward incompatible behaviour						
51	Reward alternative behaviour						
52	Reduce reward frequency						

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
53	Remove punishment						
Reward and threat							
54	Material reward (behaviour)		X[133]				
55	Material reward (outcome)		X[133]				
56	Social reward						
57	Non-specific reward						
58	Self-reward						

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
59	Future punishment						
60	Material incentive (behaviour)		X[139,141]		X[151]		
61	Material incentive (outcome)						
62	Social incentive						
63	Non-specific incentive						
64	Self-incentive						
Goals and planning							

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
65	Problem solving						
66	Goal setting (behaviour)		X[135,139-141]		X[148,150,151]		
67	Goal setting (outcome)		X[135,139-141]		X[148]		
68	Action planning				X[148,149]		
69	Review behaviour goal(s)				X[148,151]		
70	Review outcome goal(s)						

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
71	Behavioural contract						
72	Commitment						
73	Discrepancy between current behaviour and goal						
74	Persuasive source		X[132,135]		X[144,150,151]		
75	Pros and cons						
76	Comparative imaging of future outcomes						

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Identity							
77	Identification of self as role model						
78	Valued self-identity						
79	Framing/reframing						
80	Incompatible beliefs						
81	Identity associated with changed behaviour						
Natural consequences							

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
82	Information about health consequences		X[134]		X[148]		X[154]
83	Information about emotional consequences		X[134]		X[148]		X[154]
84	Information about social and environmental consequences		X[134]		X[148]		X[154]
85	Salience of consequences						
86	Monitoring of emotional consequences						
87	Anticipated						

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	regret						
Comparison of behaviour							
88	Demonstration of behaviour						
89	Social comparison						
90	Information about others' approval						
Covert learning							
91	Imaginary punishment						

PHYSICAL ACTIVITY		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
92	Imaginary reward						
93	Vicarious consequences						

Appendix 5: Behaviour change techniques classified in interventions for alcohol[17]

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Social support							
1	Social support (practical)		X[157-160]		X[161,162]		
2	Social support (emotional)		X[157-160]		X[161,162]		
3	Social support (unspecified)		X[155, 157-160]		X[161,162]		
Regulation							
4	Pharmacological support						
5	Reduce negative emotions						

[17] See Appendix 8 for details of references indicated by numbers in Table

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
6	Conserving mental resources						
7	Paradoxical instructions						
Feedback and monitoring							
8	Feedback on behaviour		X[155,160]				
9	Feedback on outcome(s) of behaviour						
10	Self-monitoring of behaviour						
11	Self-monitoring of outcome(s) of						

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	behaviour						
12	Monitoring of behaviour by others without feedback						
13	Monitoring outcome(s) of behaviour by others without feedback						
14	Biofeedback		X[155-160]				
Associations							
15	Prompts/cues						
16	Reduce						

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	prompts/cues						
17	Cue signalling reward						
18	Remove access to the reward						
19	Remove aversive stimulus						
20	Satiation						
21	Exposure						
22	Associative learning						
Repetition and							

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
substitution							
23	Behavioural practice/rehearsal						
24	Habit formation						
25	Behaviour substitution						
26	Habit reversal						
27	Overcorrection						
28	Generalisation of a target behaviour						
29	Graded tasks						

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Antecedents							
30	Restructuring the physical environment						
31	Restructuring the social environment						
32	Avoidance/reducing exposure to cues for the behaviour						
33	Distraction						
34	Adding objects to the environment						

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
35	Body changes						
Shaping knowledge							
36	Instruction on how to perform a behaviour		X[156-159]				
37	Information about antecedents						
38	Re-attribution						
39	Behavioural experiments						
Self-beliefs							

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
40	Verbal persuasion about capability		X[156]		X[161,162]		
41	Mental rehearsal of successful performance						
42	Focus on past success						
43	Self-talk						
Scheduled consequences							
44	Punishment						
45	Behaviour cost						

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
46	Remove reward						
47	Reward approximation						
48	Rewarding completion						
49	Situation-specific reward						
50	Reward incompatible behaviour						
51	Reward alternative behaviour						
52	Reduce reward frequency						

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
53	Remove punishment						
Reward and threat							
54	Material reward (behaviour)						
55	Material reward (outcome)						
56	Social reward						
57	Non-specific reward						
58	Self-reward						
59	Future punishment						

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
60	Material incentive (behaviour)						
61	Material incentive (outcome)						
62	Social incentive						
63	Non-specific incentive						
64	Self-incentive						
Goals and planning							
65	Problem solving		X[157-159]		X[162]		

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
66	Goal setting (behaviour)						
67	Goal setting (outcome)						
68	Action planning						
69	Review behaviour goal(s)						
70	Review outcome goal(s)						
71	Behavioural contract		X[157-159]				
72	Commitment						

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
73	Discrepancy between current behaviour and goal						
74	Persuasive source		X[155]		X[161]		
75	Pros and cons						
76	Comparative imaging of future outcomes						
Identity							
77	Identification of self as role model						

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
78	Valued self-identity						
79	Framing/reframing						
80	Incompatible beliefs						
81	Identity associated with changed behaviour						
Natural consequences							
82	Information about health consequences				X[161,162]		
83	Information about				X[161,162]		

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	emotional consequences						
84	Information about social and environmental consequences				X[161,162]		
85	Salience of consequences						
86	Monitoring of emotional consequences						
87	Anticipated regret						
Comparison of behaviour							

ALCOHOL		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
88	Demonstration of behaviour						
89	Social comparison						
90	Information about others' approval						
Covert learning							
91	Imaginary punishment						
92	Imaginary reward						
93	Vicarious consequences						

Appendix 6: Behaviour change techniques classified in interventions for sexual health[18]

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Social support							
1	Social support (practical)				X[179, 195,196,200,201]	X[205,206,209]	
2	Social support (emotional)				X[179,195,196,200,201]	X[205,206,209]	
3	Social support (unspecified)			X[178]	X[179,185,186,188, 190,194,196,199-201]	X[205-209]	
Regulation							
4	Pharmacological support	X[163]	X[165]	X[171-178]	X[189,195-197,200]	X[203-209]	
5	Reduce negative				X[179]		

[18] See Appendix 8 for details of references indicated by numbers in Table

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	emotions						
6	Conserving mental resources						
7	Paradoxical instructions						
Feedback and monitoring							
8	Feedback on behaviour		X[164-166,170]		X[201]		
9	Feedback on outcome(s) of behaviour						
10	Self-monitoring of behaviour		X[170]		X[189,197]		

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
11	Self-monitoring of outcome(s) of behaviour						
12	Monitoring of behaviour by others without feedback			X[171-173]			
13	Monitoring outcome(s) of behaviour by others without feedback						
14	Biofeedback		X[165,166,170]	X[171-173]	X[189,194,197]		
Associations							
15	Prompts/cues		X[169,170]		X[185,189]		
16	Reduce						

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	prompts/cues						
17	Cue signalling reward						
18	Remove access to the reward						
19	Remove aversive stimulus						
20	Satiation						
21	Exposure						
22	Associative learning						
Repetition and substitution							

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
23	Behavioural practice/rehearsal				X[189,197]		
24	Habit formation						
25	Behaviour substitution						
26	Habit reversal						
27	Overcorrection						
28	Generalisation of a target behaviour						
29	Graded tasks						
Antecedents							

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
30	Restructuring the physical environment						
31	Restructuring the social environment						
32	Avoidance/reducing exposure to cues for the behaviour						
33	Distraction						
34	Adding objects to the environment		X[165,167]	X[178]	X[199]	X[206,208,209]	
35	Body changes	X[163]	X[165]	X[171-178]	X[179,180,185,186,187-193,195-197,199-202]	X[203-209]	
Shaping knowledge							

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
36	Instruction on how to perform a behaviour	X[163]	X[164,165,167-170]	X[171-178]		X[203-209]	X[210,211]
37	Information about antecedents						
38	Re-attribution				X[189,197]		
39	Behavioural experiments				X[185,186,191,193,201]		
Self-beliefs							
40	Verbal persuasion about capability		X[168-170]			X[203,204]	X[210,211]
41	Mental rehearsal of successful performance						

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
42	Focus on past success						
43	Self-talk						
Scheduled consequences							
44	Punishment						
45	Behaviour cost						
46	Remove reward						
47	Reward approximation						
48	Rewarding completion						

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
49	Situation-specific reward						
50	Reward incompatible behaviour						
51	Reward alternative behaviour						
52	Reduce reward frequency						
53	Remove punishment						
Reward and threat							
54	Material reward (behaviour)						

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
55	Material reward (outcome)						
56	Social reward						
57	Non-specific reward						
58	Self-reward						
59	Future punishment						
60	Material incentive (behaviour)		X[168]				
61	Material incentive (outcome)						
62	Social incentive						

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
63	Non-specific incentive						
64	Self-incentive						
Goals and planning							
65	Problem solving				X[188,189,197,201]		
66	Goal setting (behaviour)		X[170]		X[189,191,193,197,201]	X[203,204]	
67	Goal setting (outcome)		X[170]		X[189,197,201]		
68	Action planning		X[170]		X[189,197,201]		
69	Review behaviour goal(s)				X[201]		

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
70	Review outcome goal(s)						
71	Behavioural contract						
72	Commitment						
73	Discrepancy between current behaviour and goal						
74	Persuasive source	X[163]	X[164-166]			X[205,206,209]	
75	Pros and cons						
76	Comparative imaging of future outcomes						

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Identity							
77	Identification of self as role model						
78	Valued self-identity						
79	Framing/reframing						
80	Incompatible beliefs						
81	Identity associated with changed behaviour						
Natural consequences							
82	Information about health		X[167]	X[178]	X[179,180,187,188-190,192,194-	X[207,208]	X[210]

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	consequences				197,199-202		
83	Information about emotional consequences				X[179,180,187,188-190,195-197,199-202]	X[207]	
84	Information about social and environmental consequences				X[179,180,187,188-190,195-197,199-202]	X[207]	
85	Salience of consequences				X[201]		
86	Monitoring of emotional consequences						
87	Anticipated regret						

SEXUAL HEALTH		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Comparison of behaviour							
88	Demonstration of behaviour				X[189,197,201]		
89	Social comparison				X[189,195-197,200]		
90	Information about others' approval						
Covert learning							
91	Imaginary punishment						
92	Imaginary reward						
93	Vicarious consequences						

Appendix 7: Behaviour change techniques classified in interventions for multiple behaviours [19]

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
Social support							
1	Social support (practical)		X[215,220]		X[143,145,181-184,224,225,227, 228, 231,233,236,237,239 ,242, 245,247	X[248,249]	
2	Social support (emotional)				X[143,145,181-184,224,225,227, 228,231,233,236,237,239 ,242, 245,247	X[248,249]	
3	Social support (unspecified)	X[212]		X[222,223]	X[143,145,181-184,224,225,227, 228,231,233,234,236,237,239,240, 242,245,247	X[248-251]	
Regulation							

[19] See Appendix 8 for details of references indicated by numbers in Table

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
4	Pharmacological support				X[224,227,231]	X[248,250,251]	
5	Reduce negative emotions				X[198]		
6	Conserving mental resources				X[198]		
7	Paradoxical instructions						
Feedback and monitoring							
8	Feedback on behaviour		X[213,218]		X[184,224,227,231,245,247]	X[250]	
9	Feedback on outcome(s) of		X[213]	X[223]			

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	behaviour						
10	Self-monitoring of behaviour		X[216,220]		X[230,236,239, 244,247]		
11	Self-monitoring of outcome(s) of behaviour				X[236,239]		
12	Monitoring of behaviour by others without feedback				X[224,227,231]		
13	Monitoring outcome(s) of behaviour by others without feedback						

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
14	Biofeedback		X[215,217]	X[222]	X[183,235,345]	X[248,249]	
Associations							
15	Prompts/cues		X[215,216,221]		X[245,246]		
16	Reduce prompts/cues						
17	Cue signalling reward						
18	Remove access to the reward						
19	Remove aversive stimulus						

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
20	Satiation						
21	Exposure						
22	Associative learning						
Repetition and substitution							
23	Behavioural practice/rehearsal		X[217]		X[143,145,147,183,184,198,226, 232,235,238, 240,243]		
24	Habit formation		X[221]		X[236,239,246,247]		
25	Behaviour substitution						

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
26	Habit reversal						
27	Overcorrection						
28	Generalisation of a target behaviour				X[147,183,198]		
29	Graded tasks				X[234]		
Antecedents							
30	Restructuring the physical environment						
31	Restructuring the social environment						

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
32	Avoidance/reducing exposure to cues for the behaviour						
33	Distraction						
34	Adding objects to the environment				X[184,232]		
35	Body changes	X[212]	X[216]	X[222,223]	X[181-184,198,224,226,227,231,232,234,243]	X[248,250,251]	
Shaping knowledge							
36	Instruction on how to perform a behaviour	X[212]	X[213,214,215,218-220,221]	X[222,223]	X[143,145,147,181-184,189,224-229,231-234,237,238,240-244,245,246]	X[248,250,251]	

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
37	Information about antecedents						
38	Re-attribution						
39	Behavioural experiments						
Self-beliefs							
40	Verbal persuasion about capability		X[213,220]		X[230,238,244,247]		
41	Mental rehearsal of successful performance						

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
42	Focus on past success						
43	Self-talk						
Scheduled consequences							
44	Punishment						
45	Behaviour cost						
46	Remove reward						
47	Reward approximation						
48	Rewarding						

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	completion						
49	Situation-specific reward						
50	Reward incompatible behaviour						
51	Reward alternative behaviour						
52	Reduce reward frequency						
53	Remove punishment						
Reward and threat							

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
54	Material reward (behaviour)		X[220]				
55	Material reward (outcome)		X[220]				
56	Social reward						
57	Non-specific reward				X[224,227,231]		
58	Self-reward						
59	Future punishment						
60	Material incentive (behaviour)		X[220]				

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
61	Material incentive (outcome)		X[220]				
62	Social incentive						
63	Non-specific incentive						
64	Self-incentive						
Goals and planning							
65	Problem solving		X[220,221]		X[145,230,240,244,245-247]	X[251]	
66	Goal setting (behaviour)		X[213,220]		X[183,184,198,224,226,227,229-232,236,239,240,242-247]		

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
67	Goal setting (outcome)		X[213,220]		X[147,184,229,236,239,240,242, 244,245-247]		
68	Action planning		X[213,220]		X[147,184,226,229,232,236,239, 240,242,243]		
69	Review behaviour goal(s)				X[245,246]		
70	Review outcome goal(s)						
71	Behavioural contract						
72	Commitment						

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
73	Discrepancy between current behaviour and goal						
74	Persuasive source	X[212]	X[215,216,218,220,221]	X[223]	X[143,145,147, 183,184,198,224, 225,227,229,231,237,239,241,246]	X[248,250,251]	
75	Pros and cons				X[230,240]		
76	Comparative imaging of future outcomes						
Identity							

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
77	Identification of self as role model						
78	Valued self-identity						
79	Framing/reframing						
80	Incompatible beliefs						
81	Identity associated with changed behaviour				X[198]		
Natural consequences							

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
82	Information about health consequences		X[213,213,219,221]	X[223]	X[143, 183,184,224,227,230,231, 237,241,246]		
83	Information about emotional consequences		X[213,215,219,221]		X[145,224,227,231,237,241,246]		
84	Information about social and environmental consequences		X[213,215,219,221]		X[145,224,227,231,237,241,246]		
85	Salience of consequences		X[213]	X[223]			
86	Monitoring of emotional consequences						

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
87	Anticipated regret						
Comparison of behaviour							
88	Demonstration of behaviour		X[212,213,219,221]		X[143,145,147, 183,184,198, 226,232,234,238, 240,243,246]		
89	Social comparison						
90	Information about others' approval						
Covert learning							
91	Imaginary						

MULTIPLE BEHAVIOURS		Intervention type					
BCT category code and BCT		Medication	Brief Intervention	Brief intervention and medication	Comprehensive intervention	Comprehensive intervention and medication	Mass media
	punishment						
92	Imaginary reward						
93	Vicarious consequences						

Appendix 8: Legend for Appendices 2-7

Study number	Primary Study	Year	Secondary study(ies)	Intervention
1	Higashi	2012		Gum
2	Higashi	2012		Patch
3	Higashi	2012		Bupropion
4	Higashi	2012		Varenicline
5	Ruger [Review]	2012	Bolin	Varenicline
6	Ruger [Review]	2012	Antonanzas	Bupropion
7	Annemans	2009		Varenicline
8	Ruger [Review]	2012	Antonanzas	NRT
9	Ruger [Review]	2012	Hoogendoorn	Varenicline
10	Ruger [Review]	2012	Bolin	Bupropion
11	Coleman [Review]	2010	Gonzales, Jorenby, Nakamura, Oncken, Williams	Varenicline
12	Ruger [Review]	2012	Bolin	Varenicline
13	Annemans	2009		Varenicline
14	Ruger [Review]	2012	Hoogendoorn	Varenicline
15	Ruger [Review]	2012	Annemans	Varenicline
16	Ruger [Review]	2012	Fellows	Free nicotine patch incentive
17	Coleman [Review]	2010	Blondal, Hurt, Jarvis, Jorenby, Schneider, Shiffman, Piper	NRT
18	Coleman [Review]	2010	Gonzales, Hurt, Jorenby, Piper	Bupropion
19	Annemans	2009		Varenicline
20	Annemans	2009		Varenicline
21	Ruger [Review]	2012	Knight	Varenicline plus additional 12 months
22	Ruger [Review]	2012	Jackson	Bupropion
23	Reda [Review]	2012	Hughes	Full coverage nicotine gum
24	Reda [Review]	2012	Hughes	Full coverage nicotine gum
25	Ruger [Review]	2012	Jackson	Placebo

Study number	Primary Study	Year	Secondary study(ies)	Intervention
26	Ruger [Review]	2012	Hoogendoorn	Varenicline
27	Ruger [Review]	2012	Jackson	Varenicline
28	Ruger [Review]	2012	Ruger	Brief couselling
29	Holtrop	2005		Recruitment postcard
30	Hoogendoorn [Review]	2010	Kotz, Wilson, Hiberink	Minimal or brief counselling
31	Ruger [Review]	2012	Meenan	Brief bed side counselling
32	Smith	2007		Computerised program
33	Higashi	2012		Physician brief advice
34	Ruger [Review]	2012	Dino	NOT teen smoking cessation
35	Ruger [Review]	2012	Akers	Manual
36	Hollis	2007		Moderate no NRT
37	Holtrop	2005		Recruitment telephone call
38	Ruger [Review]	2012	Akers	Self-help
39	Ruger [Review]	2012	Thavorn	Structured community pharmacist
40	Carlin-Menter	2011		Two telephone call backs to initial call
41	Boyd	2009		Pharmacy
42	Ruger [Review]	2012	Fiscella	GP advice and NRT
43	Bauld	2010		Pharmacy
44	Ruger [Review]	2012	Oster	Brief advice and NRT
45	Eddy	2009		Basic advice and medication
46	Reda [Review]	2012	Kaper	Reinbursement for counselling and pharmacotherpy
47	Feenstra	2005		Minimal couselling from GP with NRT
48	Vemer	2010		Reinbursement for Smking Cessation Support
49	Ruger [Review]	2012	Cromwell	Minimal advice and NRT
50	Ruger [Review]	2012	Wasley	Brief advice and NRT
51	Ruger [Review]	2012	Stapleton	GP brief couselling with NRT
52	Ruger [Review]	2012	Crealey	Advice and motivation from pharmacist
53	Hollis	2007		Brief NRT
54	Ruger [Review]	2012	Hollis	Brief telephone couselling with NRT
55	Reda [Review]	2012	Halpin	Bupropion and NRT and proactive telephone couselling

Study number	Primary Study	Year	Secondary study(ies)	Intervention
56	Reda [Review]	2012	Curry	Full coverage
57	Ruger [Review]	2012	Salize	GP training and NRT
58	Ruger [Review]	2012	Salize	GP training, NRT and remuneration
59	Hollis	2007		Moderate NRT
60	McAfee	2008		Patches and uninsured quitline for 8 weeks
61	Ruger [Review]	2012	Tran	Pharmacist directed smoking cessation with bupropion
62	Ruger [Review]	2012	Tran	Pharmacist directed smoking cessation with gum
63	Ruger [Review]	2012	Tran	Pharmacist directed smoking cessation with patch
64	Hoogendoorn [Review]	2010	Wilson, Christenhusz, Tonnesen, Wagena, Tashkin, Brandt	Intensive couselling
65	Feenstra	2005		Telephone couselling
66	Ruger	2008		Motivational interviewing
67	Akers	2007		Assisted self-help
68	Hollis	2007		Intenstive no NRT
69	Parker	2004		Motivational telephone counselling
70	Windsor [Review]	2003	n/a	Smoking cessation or reduction in pregnancy treatment
71	McAlister	2004		Telephone assistance for smoking cessation
72	Smith	2011		Telephone based intervention
73	Rigotti	2011		Usual care plus population based direct to smoker outreach
74	Gordon	2010		Genetic testing within the course of usual smoking cessation intervention with NRT and counselling
75	Boyd	2009		Group support
76	Barnett	2008		Stepped care and mental health services
77	Bauld	2010		Group support
78	Feenstra	2005		Intensive couselling with NRT
79	Ruger [Review]	2012	Feenstra	Intensive counselling with NRT
80	Barnett	2008		Stepped care
81	Feenstra	2005		Intensive couselling with bupropion
82	Hoogendoorn [Review]	2010	Kotz, Wilson, Christenhusz, Tonnesen, Wagena, Tashkin, Anthonisen	Intensive couselling with pharmacotherapy

Study number	Primary Study	Year	Secondary study(ies)	Intervention
83	Ruger [Review]	2012	Song	Counselling and NRT
84	Ruger [Review]	2012	Song	Couselling and NRT and Bupropion
85	Ruger [Review]	2012	Cromwell	Group intensive and NRT
86	Ruger [Review]	2012	Cromwell	Individual intensive and NRT
87	Ruger [Review]	2012	Song	Counselling and Bupropion
88	Hollis	2007		Intensive NRT
89	Ruger [Review]	2012	Hollis	Intensive telephone couselling with NRT
90	Abdullah	2008		Mobile smoking cessation service
91	Ruger [Review]	2012	Hollis	Moderate telephone couselling with NRT
92	Emmons	2005		Peer delivered smoking cessation couselling
93	Bertram	2010		Orlistat
94	Diabetes research group	2003		Metformin
95	Bertram	2010		Acarbose
96	Avenell [Review]	2004	Lamotte	Orlistat no complications
97	Bertram	2010		Metformin
98	Avenell [Review]	2004	Lamotte	Orlistat hypercholesterolemia
99	Avenell [Review]	2004	Lamotte	Orlistat AHT
100	Avenell [Review]	2004	Lamotte	Orlistat hypercholesterolemia and AHT
101	Avenell [Review]	2004	Salkeld	Educational video
102	Dollahite	2008		New York State Expanded Food and Nutrition Education Program
103	Avenell [Review]	2004	O'Meara	Sibutramine
104	Avenell [Review]	2004	Clegg	Vertical banded gastroplasty
105	Avenell [Review]	2004	Clegg	Adjustable gastric banding
106	Avenell [Review]	2004	BASF	Sibutramine
107	Avenell [Review]	2004	Clegg	Roux-en-Y gastric bypass
108	Hertzman	2005		Diet intervention
109	Avenell [Review]	2004	Segal	Gastric bypass surgery - 10% IGT, 90% NGT
110	Avenell [Review]	2004	Segal	Gastric bypass surgery - IGT
111	Avenell [Review]	2004	Segal	VLCD and individual therapy - IGT and NGT

Study number	Primary Study	Year	Secondary study(ies)	Intervention
112	Avenell [Review]	2004	van Gemert	Vertical banded gastroplasty
113	Hertzman	2005		Orlistat and diet intervention
114	Cobiac	2010		Weight watchers
115	Cobiac	2010		Lighten up
116	Loveman [Review]	2011	Roux	Diet
117	Bertram	2010		Diet
118	Hoerger	2007		Screening followed by lifestyle intervention for subjects diagnosed with either impaired glucose tolerance or impaired fasting glucose
119	Hoerger	2007		Screening overweight subjects and giving them the lifestyle intervention included in the diabetes prevention program if diagnosed with impaired glucose tolerane and impaired fasting glucose
120	Dalziel [Review]	2007	Eriksson	Intensive life style change to prevent diabetes
121	Dalziel [Review]	2007	ICRF	Oxcheck nurse checks in GP
122	Dalziel [Review]	2007	Pritchard	Nutritional counselling in GP
123	Dalziel [Review]	2007	Egger	Gutbusters workplace
124	Dalziel [Review]	2007	Swinburn	Reduced fat diet for IGT
125	Dalziel [Review]	2007	Lorgeril	Mediteranen diet
126	Cox	2003		Food stamp nutrition education program and video
127	Sukhanova	2009		Web based intervention MENU tailored
128	Sukhanova	2009		Web based intervention MENU tailored and HOBI counselling
129	Loveman [Review]	2011	Roux	Diet and pharmacology
130	Dalziel [Review]	2007	Wardle	FFFF media campaign
131	Dalziel [Review]	2007	Dixon	Multi media 2 fruit 5 veg
132	Cobiac	2009		GP referral to exercuse physiologist
133	Cobiac	2009		TravelSmart
134	Cobiac	2009		Internet
135	Cobiac	2009		GP prescription
136	Cobiac	2009		Pedmeters
137	Wu [Review]	2007	Community campaign	Community campaign

Study number	Primary Study	Year	Secondary study(ies)	Intervention
138	Wu [Review]	2007	Creation or enhanced access to places for physical activity	Creation or enhanced access to places for physical activity
139	Sevick	2007		Phone intervention
140	Wu [Review]	2007	Point of decision prompts	Point of decision prompts
141	Sevick	2007		Print intervention
142	Wu [Review]	2007	High intensity social support	High intensity social support
143	Lee [Review]	2007	Marchionni	Hospital based cardiac rehabilitation
144	Bertram	2010		Exercise
145	Lee [Review]	2007	Oldridge	Cardiac rehabilitation
146	Dalziel	2006		Green prescription program
147	Lee [Review]	2007	Levin	Cardiac rehabilitation
148	Boehler	2011		Disease register screening
149	Wu [Review]	2007	High intensity individually adapted behaviour	High intensity individually adapted behaviour
150	Bulthuis	2008		Intervention group
151	Groessl	2009		LIFE-P exercise intervention
152	Wu [Review]	2007	Low intensity individually adapted behaviour	Low intensity individually adapted behaviour
153	Wu [Review]	2007	Low intenstiy social support	Low intenstiy social support
154	Cobiac	2009		Mass media-based campaign
155	Tariq	2009		Screening and brief intervention
156	Gentilello	2005		Brief intervention
157	Fals-Stewart	2005		Brief relationship therapy
158	Fals-Stewart	2005		Brief relationship therapy
159	Fals-Stewart	2005		Brief relationship therapy
160	Barrett	2005		Screening and referral to alcohol health worker
161	Neighbors	2010		Motivational interviewing
162	Drummond	2009		Stepped care intervention
163	Aldridge	2009		STI treatment
164	van Keulen	2010		Tailored print communication
165	Aldridge	2009		Condoms
166	Aldridge	2009		Voluntary couselling and testing
167	Hogan [Review]	2013	n/a	Peer education for sex workers

Study number	Primary Study	Year	Secondary study(ies)	Intervention
168	Gift	2005		Incentive
169	Gift	2005		Reminder
170	Rasu	2010		Usual care and behavioural internet treatment
171	Aldridge	2009		HAART basic
172	Aldridge	2009		HAART intermediate
173	Aldridge	2009		HAART comprehensive
174	Hogan [Review]	2013	n/a	Antiretrovial - no intensive monitoring, first and second line drugs
175	Hogan [Review]	2013	n/a	Antiretrovial - intensive monitoring, first and second line drugs
176	Hogan [Review]	2013	n/a	Antiretrovial - intensive monitoring, first line drugs only
177	Hogan [Review]	2013	n/a	Antiretrovial - no intensive monitoring, first line drugs only
178	Hogan [Review]	2013	n/a	Treatment of sexually transmitted infections
179	Johnson-Masotti [Review]	2003	Pinkerton/Otto-Salaj	Time matched session
180	Shepard [Review]	2010	Pinkerton	One-day CB HIV risk reduction
181	Lee [Review]	2007	Salkeld	Self-help cardiac rehabilitation
182	Lee [Review]	2007	Salkeld	Video cardiac rehabiliation
183	Lee [Review]	2007	Carlson	Cardiac rehabilitation
184	Lee [Review]	2007	Marchionni	Home based cardiac rehabilitation
185	Gift	2005		Motivation counselling and reminder
186	Gift	2005		Motivational counselling
187	Shepard [Review]	2010	Cohen	School based education
188	Shepard [Review]	2010	Wright	SHARE project
189	Herbst [Review]	2007	Pinkerton	Group level intervention - safe sex training
190	Shepard [Review]	2010	Tao	HIV prevention intervention
191	Burgos	2010		Intervention group - annually
192	Shepard [Review]	2010	Hogan	HIV prevention

Study number	Primary Study	Year	Secondary study(ies)	Intervention
193	Burgos	2010		Intervention group - once
194	Hogan [Review]	2013	n/a	Voluntary counselling and testing
195	Herbst [Review]	2007	Kahn	Community - peer opinion leaders
196	Herbst [Review]	2007	Pinkerton	Community - peer opinion leaders
197	Herbst [Review]	2007	Holtgrave	Group level intervention - small group
198	Lee [Review]	2007	Ades	Cardiac rehabilitation
199	Kumaranayake	2003		HIV harm reduction intervention
200	Herbst [Review]	2007	Kahn	Mpowerment project
201	Osland	2006		Obesity management
202	Shepard [Review]	2010	Wang	Safer choices intervention
203	Burgos	2010		Intervention group plus HAART
204	Burgos	2010		Intervention group plus HAART
205	Aldridge	2009		Prevention of mother and child transmission
206	Aldridge	2009		Peer couselling and treatment of STIs for men who have sex with men
207	Hogan [Review]	2013	n/a	Prevention of mother to child transmission
208	Hogan [Review]	2013	n/a	Peer education and treatment of sexually transmitted infections for sex workers
209	Aldridge	2009		Peer couselling and treatment of STIs for female sex workers
210	Aldridge	2009		Mass media
211	Hogan [Review]	2013	n/a	Mass media
212	Herman	2005		Metformin intervention
213	McConnon	2007		Internet intervention
214	Avenell [Review]	2004	Salkeld	Video plus self-help
215	Datta	2010		Behavioural intervention
216	Graves	2009		Telephone
217	Gillies	2008		Screening
218	Graves	2009		Usual care
219	Jacobs-van-der-Bruggen	2007		Community intervention
220	Gustafson	2009		weight-wise
221	Dzator	2004		Mail

Study number	Primary Study	Year	Secondary study(ies)	Intervention
222	Gillies	2008		Screening and pharmacological intervention
223	Raftery	2004		Nurse led clinics to promote medical and lifestycomponents of secondary prevention
224	Carr [Review]	2011	Lujan	Chronic care diabetes
225	Irvine	2011		Exercise and diet intervention
226	Barton	2009		Dietary intervention plus strengthening exercise
227	Carr [Review]	2011	Gary	Chronic care diabetes
228	Loveman [Review]	2011	Roux	Diet and exercise
229	Diabetes research group	2003		Lifestyle intervention
230	Barton	2012		LHT intervention
231	Carr [Review]	2011	Young	Chronic care diabetes
232	Barton	2009		Dietary intervention plus strengthening exercise
233	Loveman [Review]	2011	Roux	Diet, exercise and behaviour modification
234	Avenell [Review]	2004	Kaplan	Diet and exercise therapy
235	Gillies	2008		Screening and lifestyle intervention
236	Krukowski	2011		In person group behaviour weight loss intervention
237	Jacobs-van-der-Bruggen	2007		Health care intervention
238	Lindgren	2007		Finnish Diabetes Prevention study
239	Krukowski	2011		Internet group behaviour weight loss intervention
240	Eriksson	2010		Lifestyle intervention with standard care
241	Herman	2005		Life-style intervention
242	Loveman [Review]	2011	Counterweight program	Counterweight program
243	Barton	2009		Dietary intervention plus strengthening exercise
244	Befort	2010		Group phone based obesity treatment for rural women
245	Wolf	2007		Improving control with activity and nutrition
246	Dzator	2004		Mail and interactive group sessions
247	Emmons	2005		PREVENT intervention

Study number	Primary Study	Year	Secondary study(ies)	Intervention
248	Bertram	2010		Metformin+diet plus exercise
249	Bertram	2010		Diet plus exercise
250	Finkelstein	2006		Wisewomen intervention
251	Yosefy	2003		Israeli Blood Pressure Control Program

Appendix 9: Studies/Reviews included in BCT analysis

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Appendix 10: Studies/Reviews Excluded From BCT analysis

9.1 Wrong design

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9.3 No economic analysis

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9.4 Conference abstract

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13. Smith M, Fu S, Nugent S, Nelson D, Joseph A, An L. A cost-effective telehealth intervention for smoking cessation. *Journal of General Internal Medicine Conference: 33rd Annual Meeting of the Society of General Internal Medicine Minneapolis, MN United States Conference Start: 20100428 Conference End: 20100501 Conference Publication: 25 (pp S208),* 2010.

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9.5 Not found

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9.6 Wrong target

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brief interventions for smokeless tobacco cessation. *Preventive Medicine* 2006; **43(6)** :482-487.

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9.7 Review with insufficient description

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12. Johnson NW. The role of the dental team in tobacco cessation. [Review] [39 refs]. *European Journal of Dental Education* 2004; **8**:Suppl-24.

13. Li R, Zhang P, Barker LE, Chowdhury FM, Zhang X. Cost-effectiveness of interventions to prevent and control diabetes mellitus: A systematic review. *Diabetes Care* 2010; **33(8)**:1872-1894.

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Appendix 11: BCT codes, clusters and definitions

No.	Label	Definition	Examples
Social support			
1.	***Social support (practical)***	Advise on, arrange, or provide practical help (beyond adding objects to the environment) for performance of the behaviour *Note: if emotional, code **2, Social support (emotional)**; if general or unspecified, code **3, Social support (unspecified)** If only restructuring the physical environment or adding objects to the environment, code **30, Restructuring the physical environment** or **34, Adding objects to the environment***	Ask the partner of the patient to put their tablet on the breakfast tray so that the patient remembers to take it
2.	***Social support (emotional)***	Advise on, arrange, or provide emotional social support for performance of the behaviour *Note: if practical, code **1, Social support (practical)**; if unspecified, code **3, Social support (unspecified)***	Ask the patient to take a partner or friend with them to their colonoscopy appointment
3.	***Social support (unspecified)***	Advise on, arrange or provide social support *(e.g. friends, relatives, colleagues,' buddies' or staff)* or non-contingent praise or reward for performance of the behaviour. It includes encouragement and counselling, but only when it is directed at the **behaviour** *Note: attending a group class does not necessarily apply this BCT, support must be explicitly mentioned; if practical, code **1, Social support (practical)**; if emotional, code **2, Social support (emotional)***	Advise the person to call a 'buddy' when they experience an urge to smoke Arrange for a housemate to encourage continuation with the behaviour change programme Give information about a self-help group that offers support for the

No.	Label	Definition	Examples
			behaviour
Regulation			
4.	***Pharmacological support***	Provide, or encourage the use of or adherence to, drugs to facilitate behaviour change	Suggest the patient asks the family physician for nicotine replacement therapy to facilitate smoking cessation
5.	***Reduce negative emotions***	Advise on ways of reducing negative emotions to facilitate performance of the behaviour (includes '***Stress Management***')	Advise on the use of stress management skills, e.g. to reduce anxiety about joining Alcoholics Anonymous
6.	***Conserving mental resources***	Advise on ways of minimising demands on mental resources to facilitate behaviour change	Advise smokers on how to minimise work-related stress during the first weeks of quitting
7.	***Paradoxical instructions***	Advise to engage in some form of the unwanted behaviour with the aim of reducing motivation to engage in that behaviour	Advise a smoker to smoke twice as many cigarettes a day as they usually do Tell the person to stay awake as long as

No.	Label	Definition	Examples
			possible in order to reduce insomnia
Feedback and monitoring			
8.	***Feedback on behaviour***	Monitor and provide feedback on performance of the behaviour *(e.g. form, frequency, duration, intensity)* *Note: if Biofeedback, code only **14, Biofeedback** and not **8, Feedback on behaviour**; if feedback is on **outcome(s)** of behaviour, code **9, Feedback on outcome(s) of behaviour**; if there is no clear evidence that feedback was given, code **12, Monitoring of behaviour by others without feedback***	Inform the person of how many steps they walked each day (as recorded on a pedometer) or how many calories they ate each day (based on a food consumption questionnaire)
9.	***Feedback on outcome(s) of behaviour***	Monitor and provide feedback on the outcome of performance of the behaviour *Note: if Biofeedback, code only **14, Biofeedback** and not **9, Feedback on outcome(s) of behaviour**; if feedback is on **behaviour** code **8, Feedback on behaviour**; if there is no clear evidence that feedback was given code **13, Monitoring outcome(s) of behaviour by others without feedback***	Inform the person of how much weight they have lost following the implementation of a new exercise regime
10.	***Self-monitoring of behaviour***	Establish a method for the person to monitor and record their behaviour(s) as part of a behaviour change strategy Note: if monitoring is part of a data collection procedure rather than a strategy aimed at changing behaviour, do not code; if monitoring of outcome of behaviour, code 11, Self-monitoring of outcome(s) of behaviour; if	Ask the person to record daily, in a diary, whether they have brushed their teeth for at least two minutes before going to bed

No.	Label	Definition	Examples
		monitoring is by someone else (without feedback), code 12, Monitoring of behaviour by others without feedback	Give patient a pedometer and a form for recording daily total number of steps
11.	***Self-monitoring of outcome(s) of behaviour***	Establish a method for the person to monitor and record the outcome(s) of their behaviour as part of a behaviour change strategy Note: Only code if monitoring is aimed at changing behaviour rather than part of data ; if monitoring behaviour, code 10, Self-monitoring of behaviour; if monitoring is by someone else (without feedback), code 13, Monitoring outcome(s) of behaviour by others without feedback	Ask the person to weigh themselves at the end of each day, over a two week period, and record their daily weight on a graph to increase exercise behaviours
12.	***Monitoring of behaviour by others without feedback***	Observe or record behaviour with the person's knowledge as part of a behaviour change strategy Note: if monitoring is part of a data collection procedure rather than a strategy aimed at changing behaviour, do not code; if feedback given, code only 8, Feedback on behaviour, and not 12, Monitoring of behaviour by others without feedback; if monitoring outcome(s) code 13, Monitoring outcome(s) of behaviour by others without feedback; if self-monitoring behaviour, code 10, Self-monitoring of behaviour	Watch hand washing behaviours among health care staff and make notes on context, frequency and technique used
13.	***Monitoring outcome(s) of behaviour by others without***	Observe or record outcomes of behaviour with the person's knowledge as part of a behaviour change strategy Note: if monitoring is part of a data collection procedure rather than a strategy aimed at	Record blood pressure, blood glucose, weight loss, or physical fitness

No.	Label	Definition	Examples
	feedback	changing behaviour, do not code; if feedback given, code only 9, Feedback on outcome(s) of behaviour; if monitoring behaviour code 12, Monitoring of behaviour by others without feedback; if self-monitoring outcome(s), code 11, Self-monitoring of outcome(s) of behaviour	
14.	***Biofeedback***	Provide feedback about the body (e.g. physiological or biochemical state) using an external monitoring device as part of a behaviour change strategy Note: if Biofeedback, code only 14, Biofeedback and not 8, Feedback on behaviour or 9, Feedback on outcome(s) of behaviour	Inform the person of their blood pressure reading to improve adoption of health behaviours
Associations			
15.	***Prompts/cues***	Introduce or define environmental or social stimulus with the purpose of prompting or cueing the behaviour. The prompt or cue would normally occur at the time or place of performance *Note: when a stimulus is linked to a specific action in an if-then plan, code also **64, Action planning**,*	Put a sticker on the bathroom mirror to remind people to brush their teeth
16.	***Reduce prompts/cues***	Withdraw gradually prompts to perform the behaviour (includes ***'Fading'***)	Reduce gradually the number of reminders used to take medication
17.	***Cue signalling reward***	Identify an environmental stimulus that reliably predicts that reward will follow the behaviour (includes ***'Discriminative cue'***)	Advise that a fee will be paid to dentists for a particular dental treatment of 6-8 year

No.	Label	Definition	Examples
			old children to encourage delivery of that treatment (the 6-8 year old children are the environmental stimulus)
18.	***Remove access to the reward***	Advise or arrange for the person to be separated from situations in which unwanted behaviour can be rewarded in order to reduce the behaviour (includes ***'Time out'***)	Arrange for cupboard containing high calorie snacks to be locked for a specified period to reduce the consumption of sugary foods in between meals
19.	***Remove aversive stimulus***	Advise or arrange for the removal of an aversive stimulus to facilitate behaviour change (includes ***'Escape learning'***)	Arrange for a gym-buddy to stop nagging the person to do more exercise in order to increase the desired exercise behaviour
20.	***Satiation***	Advise or arrange repeated exposure to a stimulus that reduces or extinguishes a drive for the unwanted behaviour	Arrange for the person to eat large quantities of chocolate, in order to reduce the person's appetite for sweet foods
21.	***Exposure***	Provide systematic confrontation with a feared stimulus to reduce the response to a later encounter	Agree a schedule by which the person will e.g. make a telephone call to their boss, spend an evening without

No.	Label	Definition	Examples
			snacking
22.	***Associative learning***	Present a neutral stimulus jointly with a stimulus that already elicits the behaviour repeatedly until the neutral stimulus elicits that behaviour (includes 'Classical/Pavlovian Conditioning') Note: when a BCT involves reward or punishment, do not code 22, Associative learning	Present repeatedly fatty foods with a disliked flavoured sauce to discourage the consumption of fatty foods
Repetition and substitution			
23.	***Behavioural practice/ rehearsal***	Prompt practice or rehearsal of the performance of the behaviour one or more times in a context or at a time when the performance may not be necessary, in order to increase habit and skill *Note: if aiming to associate performance with the context, also code **24, Habit formation***	Prompt asthma patients to measure their peak flow regularly
24.	***Habit formation***	Prompt rehearsal and repetition of the behaviour in the same context repeatedly so that the context elicits the behaviour *Note: also code **23, Behavioural practice/rehearsal***	Prompt patients to always take their statin tablet before brushing their teeth in the evening
25.	***Behaviour substitution***	Prompt substitution of the unwanted behaviour with a wanted or neutral behaviour *Note: if this occurs regularly, also code **26, Habit reversal***	Suggest that the person carries a piece of fruit to eat instead of biscuits or cake if they are offered them

No.	Label	Definition	Examples
26.	***Habit reversal***	Prompt rehearsal and repetition of an alternative behaviour to **replace** an unwanted habitual behaviour *Note: also code **25, Behaviour substitution***	Ask the person to walk up stairs every time they consider taking a lift or escalator
27.	***Overcorrection***	Ask to repeat the wanted behaviour in an exaggerated way following an unwanted behaviour	Ask to eat only fruit and vegetables the day after a poor diet
28.	***Generalisation of a target behaviour***	Advise to perform the wanted behaviour already performed in a particular situation, in another situation	Advise to repeat toning exercises learned in the gym when at home
29.	***Graded tasks***	Set easy-to-perform tasks, making them increasingly difficult, but achievable, until behaviour is performed	Ask the person to walk for 100 yards a day for the first week, then half a mile a day after they have successfully achieved 100 yards, then two miles a day after they have successfully achieved one mile
Antecedents			
30.	***Restructuring the physical environment***	Change, or advise to change the environment in order to facilitate performance of the wanted behaviour or create barriers to the unwanted behaviour (other than prompts/cues, rewards and punishments) *Note: this may also involve **32, Avoidance/reducing exposure to cues for the***	Advise to keep biscuits and snacks in a cupboard that is inconvenient to get to Arrange to move vending machine out of

No.	Label	Definition	Examples
		behaviour**; if restructuring of the social environment code **31, Restructuring the social environment *if only adding objects to the environment, code **34, Adding objects to the environment***	the school
31.	***Restructuring the social environment***	Change, or advise to change the social environment in order to facilitate performance of the wanted behaviour or create barriers to the unwanted behaviour (other than prompts/cues, rewards and punishments) *Note: this may also involve **32, Avoidance/reducing exposure to cues for the behaviour**; if restructuring of the physical environment code **30, Restructuring the physical environment***	Advise to minimise time spent with friends who drink heavily to reduce alcohol consumption
32.	***Avoidance/reducing exposure to cues for the behaviour***	Advise on how to avoid exposure to specific social and contextual/physical cues for the behaviour, including changing daily or weekly routines *Note: this may also involve **30, Restructuring the physical environment*** and/or ***31, Restructuring the social environment***; if the BCT includes analysing the behavioural problem, only code ***61, Problem solving***	Suggest to a person who wants to quit smoking that their social life focus on activities other than pubs and bars which have been associated with smoking
33.	***Distraction***	Advise or arrange to use an alternative focus for attention to avoid triggers for unwanted behaviour	Suggest to a person who is trying to avoid between-meal snacking to focus on a topic they enjoy (e.g. holiday plans) instead of focusing on food when

No.	Label	Definition	Examples
			they are feeling hungry
34.	***Adding objects to the environment***	Add objects to the environment in order to facilitate performance of the behaviour *Note: if this is accompanied by social support, also code* ***1, Social support (practical)****; if the environment is changed beyond the addition of objects, also code* ***30, Restructuring the physical environment***	Provide free condoms to facilitate safe sex Provide attractive toothbrush to improve tooth brushing technique
35.	***Body changes***	Alter body structure, functioning or support directly to facilitate behaviour change	Prompt strength training, relaxation training or provide assistive aids
Shaping knowledge			
36.	***Instruction on how to perform a behaviour***	Advise or agree on how to perform the behaviour (includes '***Skills training***') *Note: when the person attends classes such as exercise or cookery, code* ***36, Instruction on how to perform the behaviour, 23, Behavioural practice/rehearsal*** *and* ***84, Demonstration of the behaviour***	Advise the person how to put a condom on a model of a penis correctly
37.	***Information about antecedents***	Provide information about antecedents (*e.g. social and environmental situations and events, emotions, cognitions)* that reliably predict performance of the behaviour	Advise to keep a record of snacking and of situations or events occurring prior to snacking

No.	Label	Definition	Examples
38.	***Re-attribution***	Elicit perceived causes of behaviour and suggest alternative explanations *(e.g. external or internal and stable or unstable)*	If the person attributes their over-eating to the frequent presence of delicious food, suggest that the 'real' cause may be the person's inattention to bodily signals of hunger and satiety
39.	***Behavioural experiments***	Advise on how to identify and test hypotheses about the behaviour, its causes and consequences, by collecting and interpreting data	Ask a family physician to give evidence-based advice rather than prescribe antibiotics and to note whether the patient is grateful or annoyed
Self-belief			
40.	***Verbal persuasion about capability***	Tell the person that they can successfully perform the wanted behaviour, arguing against self-doubts and asserting that they can and will succeed *Note: distinction between **89, Vicarious consequences,** and **40, Verbal persuasion about capability**, i.e. 40 is not about the consequences of performing the behaviour*	Tell the person that they can successfully increase their frequency of physical activity, arguing against self-doubts and asserting that they can and will succeed
41.	***Mental rehearsal of successful performance***	Advise to practise imagining performing the behaviour successfully in relevant contexts	Advise to imagine eating a salad in a work canteen

No.	Label	Definition	Examples
42.	***Focus on past success***	Advise to think about or list previous successes in performing the behaviour (or parts of it)	Advise to describe or list the occasions on which a doctor advised a patient with acute low back pain to stay active to manage this condition
43.	***Self-talk***	Prompt positive self-talk (aloud or silently) before and during the behaviour	Prompt the person to tell themselves that a walk will be energising
Scheduled consequences			
44.	***Punishment***	Identify and provide aversive consequence contingent on the performance of the unwanted behaviour	Arrange for the person to wear unattractive clothes following consumption of fatty foods
45.	***Behaviour cost***	Withdraw something valued (not a contingent reward) if and only if an unwanted behaviour is performed (includes '***Response cost'***)	Subtract money from a prepaid refundable deposit when a cigarette is smoked
46.	***Remove reward***	Discontinue contingent reward for performing the unwanted behaviour (includes ***'Extinction'***)	Arrange for the other people in the household to ignore the person every time they eat chocolate (rather than attending to them by criticising or persuading)

No.	Label	Definition	Examples
47.	***Reward approximation***	Reward any approximation to the target behaviour, gradually rewarding only performance closer to the wanted behaviour (includes ***'Shaping'***) *Note: also code one of 54-57*	Arrange for or reward the person for any reduction in daily calories, gradually requiring the daily calorie count to become closer to the planned calorie intake
48.	***Rewarding completion***	Build up behaviour by rewarding final component of the behaviour; gradually add the components of the behaviour that occur earlier in the behavioural sequence (includes ***'Backward chaining'***) *Note: also code one of 54-57*	Reward eating a supplied low calorie meal; then make reward contingent on cooking and eating the meal; then make reward contingent on purchasing, cooking and eating the meal
49.	***Situation-specific reward***	Reward the behaviour in one situation but not in another. *Note: also code one of* ***54-57*** **(**includes ***'Discrimination training'***)	Arrange for or reward eating sweet foods at mealtimes but not between meals
50.	***Reward incompatible behaviour***	Reward for responding to a stimulus in a manner that is incompatible with a previous response to that stimulus (includes ***'Counter-conditioning'***) *Note: also code one of 54-57*	Arrange for or reward the person for ordering a soft drink at the bar rather than an alcoholic beverage
51.	***Reward alternative behaviour***	Arrange reward for performance of an alternative to the unwanted behaviour (includes ***'Differential reinforcement'***) *Note: also code one of* ***54-57;*** *consider also coding*	Reward for consumption of low fat foods but not consumption of high fat

No.	Label	Definition	Examples
		61, Problem solving	foods
52.	***Reduce reward frequency***	Arrange for rewards to be made contingent on increasing duration or frequency of the behaviour (includes 'Thinning') Note: also code one of 54-57	Arrange for or reward for each day without smoking, then each week, then each month, then every 2 months and so on
53.	***Remove punishment***	Arrange for removal of an unpleasant consequence contingent on performance of the wanted behaviour (includes 'Negative reinforcement')	Arrange for someone else to do housecleaning only if the person has adhered to the medication regimen for a week
Reward and threat			
54.	***Material reward (behaviour)***	Arrange for the delivery of money, vouchers or other valued objects if and only if there has been effort and/or progress made towards performing the behaviour (includes '***Positive reinforcement***') *Note: if reward is social, code **56, Social reward**, if unspecified code **57, Non-specific reward**, and not **54, Material reward (behaviour)**; if reward is for **outcome**, code **55, Material reward (outcome)***	Arrange for the person to receive money that would have been spent on cigarettes if and only if the smoker has not smoked for one month
55.	***Material reward (outcome)***	Arrange for the delivery of a reward if and only if there has been effort and/or progress made towards achieving the behavioural **outcome** (includes '***Positive reinforcement***') *Note: this includes social, material, self- and non-*	Arrange for the person to receive money if and only if a certain amount of weight is lost

No.	Label	Definition	Examples
		specific rewards for outcome; if reward is for the ***behaviour*** *code* ***56,Social reward****,* ***54 Material reward (behaviour)****,* ***57 Non-specific reward*** *or* ***58, Self-reward*** *and not* ***55, Material reward (outcome)***	
56.	***Social reward***	Arrange verbal or non-verbal reward if and only if there has been effort and/or progress made towards performing the behaviour (includes '***Positive reinforcement***') *Note: if reward is material, code* ***54, Material reward (behaviour)****, if unspecified code* ***57, Non-specific reward****, and not* ***56, Social reward****; if reward is for* ***outcome*** *code* ***55, Material reward (outcome)***	Congratulate the person for each day they eat a reduced fat diet
57.	***Non-specific reward***	Arrange delivery of a reward if and only if there has been effort and/or progress made towards performing the behaviour (includes 'Positive reinforcement') Note: if reward is material, code 54, Material reward (behaviour), if social, code 56, Social reward, and not 57, Non-specific reward; if reward is for outcome code 55, Material reward (outcome)	Identify something (e.g. an activity such as a visit to the cinema) that the person values and arrange for this to be delivered if and only if they attend for health screening
58.	***Self-reward***	Prompt self-praise or self-reward if and only if there has been effort and/or progress made towards the behaviour Note: if self-reward is material, also code 54, Material reward (behaviour), if social, also code 56, Social reward, if unspecified, also code 57, Non-specific reward; if reward is for outcome	Encourage to reward self with material (e.g., new clothes) or other valued objects if and only if they have adhered to a healthy diet

No.	Label	Definition	Examples
		code 55, Material reward (outcome)	
59.	***Future punishment***	Inform that future punishment or removal of reward will be a consequence of performance of an unwanted behaviour (may include fear arousal) (includes 'Threat')	Inform that continuing to consume 30 units of alcohol per day is likely to result in liver disease and early death
60.	***Material incentive (behaviour)***	Inform that money, vouchers or other valued objects will be delivered if and only if there has been effort and/or progress made towards performing the behaviour (includes 'Positive reinforcement') Note: if incentive is social, code 62, Social incentive if unspecified code 63, Non-specific incentive, and not 60, Material incentive (behaviour); if incentive is for outcome, code 61, Material incentive (outcome)	Inform that a financial payment will be made each month in pregnancy that the woman has not smoked
61.	***Material incentive (outcome)***	Inform that a reward will be delivered if and only if there has been effort and/or progress made towards achieving the behavioural outcome (includes 'Positive reinforcement') Note: this includes social, material, self- and non-specific incentives for outcome; if incentive is for the behaviour code 62,Social incentive, 60 Material incentive (behaviour), 63 Non-specific incentive or 64, Self-incentive and not 61, Material incentive (outcome)	Inform the person that they will receive money if and only if a certain amount of weight is lost

No.	Label	Definition	Examples
62.	***Social incentive***	Inform that a verbal or non-verbal reward will be delivered if and only if there has been effort and/or progress made towards performing the behaviour (includes 'Positive reinforcement') Note: if incentive is material, code 60, Material incentive (behaviour), if unspecified code 63, Non-specific incentive, and not 62, Social incentive; if incentive is for outcome code 61, Material incentive (outcome)	Inform that they will be congratulated for each day they eat a reduced fat diet
63.	***Non-specific incentive***	Inform that a reward will be delivered if and only if there has been effort and/or progress made towards performing the behaviour (includes 'Positive reinforcement') Note: if reward is material, code 54, Material reward (behaviour), if social, code 56, Social reward, and not 57, Non-specific reward; if reward is for outcome code 55, Material reward (outcome)	Identify something (e.g. an activity such as a visit to the cinema) that the person values and inform them that this will be delivered if and only if they attend for health screening
64.	***Self-incentive***	Prompt self-incentive if and only if there has been effort and/or progress made towards the behaviour Note: if self-reward is material, also code 60, Material incentive (behaviour), if social, also code 62, Social incentive, if unspecified, also code 63, Non-specific incentive; if incentive is for outcome code 61, Material incentive (outcome)	Encourage to provide self with material (e.g., new clothes) or other valued objects if and only if they have adhered to a healthy diet
Goals and planning			

No.	Label	Definition	Examples
65.	***Problem solving***	Analyse factors influencing the behaviour and generate or select strategies that include overcoming barriers and/or increasing facilitators (includes '***Relapse Prevention***' *and* '***Coping Planning***') *Note: barrier identification without solutions is not sufficient. If the BCT does not include analysing the behavioural problem, consider* ***32, Avoidance/changing exposure to cues for the behaviour, 30, Restructuring the physical environment, 31, Restructuring the social environment,*** *or* ***5, Reduce negative emotions***	Identify specific triggers (e.g. being in a pub, feeling anxious) that generate the urge/want/need to drink and develop strategies for avoiding environmental triggers or for managing negative emotions, such as anxiety, that motivate drinking
66.	***Goal setting (behaviour)***	Set or agree a goal defined in terms of the behaviour to be achieved Note: only code goal-setting if there is sufficient evidence that goal set as part of intervention; if goal unspecified or a behavioural outcome, code 63, Goal setting (outcome); if the goal defines a specific context, frequency, duration or intensity for the behaviour, also code 64, Action planning	Invite the person to propose a daily walking goal (e.g. to walk for at least 30 minutes every day) and reach agreement about the goal Set the goal of eating 5 pieces of fruit per day as specified in public health guidelines
67.	***Goal setting (outcome)***	Set or agree a goal defined in terms of a positive outcome of wanted behaviour Note: only code guidelines if set as a goal in an intervention context; if goal is a behaviour, code 62, Goal setting (behaviour); if goal unspecified code 63, Goal setting (outcome)	Invite the person to set a weight loss goal (e.g. 0.5 kilogram over one week) as an outcome of changed eating patterns

No.	Label	Definition	Examples
68.	***Action planning***	Prompt detailed planning of performance of the behaviour (must include at least one of context, frequency, duration and intensity). Context may be environmental (physical or social) or internal (physical, emotional or cognitive) (includes 'Implementation Intentions') Note: evidence of action planning does not necessarily imply goal setting, only code latter if sufficient evidence	Encourage a plan to carry condoms when going out socially at weekends Prompt planning the performance of a particular physical activity (e.g. running) at a particular time (e.g. before work) on certain days of the week
69.	***Review behaviour goal(s)***	Review behaviour goal(s) jointly with the person and consider modifying goal(s) or behaviour change strategy in light of achievement. This may lead to re-setting the same goal, a small change in that goal or setting a new goal instead of, or in addition to, the first Note: if goal specified in terms of behaviour, code 65, Review behaviour goal(s), if goal unspecified, code 66, Review outcome goal(s); if discrepancy created consider also 69, Discrepancy between current behaviour and goal	Examine how well a person's performance corresponds to agreed goals e.g. whether they consumed less than one unit of alcohol per day, and consider modifying future behavioural goals accordingly e.g. by increasing or decreasing alcohol target or changing type of alcohol consumed
70.	***Review outcome goal(s)***	Review outcome goal(s) jointly with the person and modify goal(s) or behaviour change strategy in light of achievement. This may lead to re-setting the same goal, a small change in that goal or setting a new goal instead of, or in addition to the first Note: if goal specified in terms of behaviour, code	Examine how much weight has been lost and consider modifying outcome goal(s) accordingly e.g., by increasing or decreasing subsequent

No.	Label	Definition	Examples
		65, Review behaviour goal(s), if goal unspecified, code 66, Review outcome goal(s); if discrepancy created consider also 69, Discrepancy between current behaviour and goal	weight loss targets
71.	***Behavioural contract***	Create a written specification of the behaviour to be performed, agreed by the person, and witnessed by another Note: also code 62, Goal setting (behaviour)	Sign a contract with the person e.g. specifying that they will not drink alcohol for one week
72.	***Commitment***	Ask the person to make statements indicating strong commitment to change the behaviour Note: if defined in terms of the behaviour to be achieved also code 62, Goal setting (behaviour)	Ask the person to use an "I will" statement to affirm or reaffirm a strong commitment (i.e. using the words 'strongly', 'committed' or 'high priority') to start, continue or restart the attempt to reduce alcohol use
73.	***Discrepancy between current behaviour and goal***	Draw attention to discrepancies between a person's current behaviour (in terms of the form, frequency, duration, or intensity of that behaviour) and the person's previously set outcome goals, behavioural goals or action plans (goes beyond self-monitoring of behaviour) Note: if discomfort is created only code 76, Incompatible beliefs and not 69, Discrepancy between current behaviour and goal; if goals are	Point out that the recorded exercise fell short of the goal set

No.	Label	Definition	Examples
		modified, also code 65, Review behaviour goal(s) and/or 66, Review outcome goal(s); if feedback is provided, also code 8, Feedback on behaviour	
Comparison of outcomes			
74.	***Persuasive source***	Present verbal or visual communication from a **credible source** in favour of or against the behaviour *Note: code this BCT if source generally agreed on as credible e.g., health professionals, celebrities or words used to indicate expertise or leader in field; if information about health consequences, also code **78, Information about health consequences**, if about emotional consequences, also code **79, Information about emotional consequences**; if about social, environmental or unspecified consequences also code **80, Information about social and environmental consequences***	Present a speech given by a high status professional to emphasise the importance of not exposing patients to unnecessary radiation by ordering x-rays for back pain
75.	***Pros and cons***	Advise the person to identify and compare reasons for wanting (pros) and not wanting to (cons) change the behaviour (includes '***Decisional balance'***) *Note: if information about health consequences, also code **78, Information about health consequences**; if about emotional consequences, also code **79, Information about emotional consequences**; if about social, environmental or unspecified consequences also code **80,***	Advise the person to list and compare the advantages and disadvantages of prescribing antibiotics for upper respiratory tract infections

No.	Label	Definition	Examples
		Information about social and environmental consequences	
76.	***Comparative imagining of future outcomes***	Prompt or advise the imagining and comparing of future outcomes of changed versus unchanged behaviour	Prompt the person to imagine and compare likely or possible outcomes following attending versus not attending a screening appointment
Identity			
77.	***Identification of self as role model***	Inform that one's own behaviour may be an example to others	Inform the person that healthy eating may be a good example for their children
78.	***Valued self-identity***	Advise the person to write or complete rating scales about a cherished value or personal strength as a means of affirming the person's identity as part of a behaviour change strategy (includes ***'Self-affirmation'***)	Advise the person to write about their personal strengths before they receive a message advocating the behaviour change
79.	***Framing/reframing***	Suggest the deliberate adoption of a perspective or new perspective on behaviour (e.g. its purpose) in order to change cognitions or emotions about performing the behaviour (includes 'Cognitive	Suggest that the person might think of the tasks as reducing sedentary behaviour (rather than

No.	Label	Definition	Examples
		structuring')	increasing activity)
80.	***Incompatible beliefs***	Draw attention to discrepancies between current or past behaviour and self-image, in order to create discomfort (includes 'Cognitive dissonance')	Draw attention to a critical care consultant's liberal use of blood transfusion and their self-identification as a proponent of evidence-based medical practice
81.	***Identity associated with changed behaviour***	Advise the person to construct a new self-identity as someone who 'used to engage with the unwanted behaviour'	Ask the person to articulate their new identity as an 'ex-smoker'
Natural consequences			
82.	***Information about health consequences***	Provide information about health consequences of performing the behaviour *Note: consequences can be for any target, not just the recipient(s) of the intervention; if information about emotional consequences, code* ***79, Information about emotional consequences****; if about social, environmental or unspecified consequences code* ***80, Information about social and environmental consequences***	Explain that not finishing a course of antibiotics can increase susceptibility to future infection Present the likelihood of contracting a sexually transmitted infection following unprotected sexual behaviour

No.	Label	Definition	Examples
83.	***Information about emotional consequences***	Provide information about emotional consequences of performing the behaviour *Note: not including **83, Anticipated regret**; consequences can be for any target, not just the recipient(s) of the intervention; if information about health consequences code **78, Information about health consequences**; if about social, environmental or unspecified code **80, Information about social and environmental consequences***	Explain that quitting smoking increases happiness and life satisfaction
84.	***Information about social and environmental consequences***	Provide information about social and environmental consequences of performing the behaviour Note: consequences can be for any target, not just the recipient(s) of the intervention; if information about health or consequences, code 78, Information about health consequences; if about emotional consequences, code 79, Information about emotional consequences; if unspecified, code 80, Information about social and environmental consequences	Tell family physician about financial remuneration for conducting health screening
85.	***Salience of consequences***	Use methods to emphasise (make more memorable) the consequences of changing the behaviour (goes beyond informing about consequences)	Produce cigarette packets showing pictures of health consequences e.g. diseased lungs

No.	Label	Definition	Examples
86.	***Monitoring of emotional consequences***	Prompt assessment of feelings after attempts at performing the behaviour	Agree that the person will record how they feel after e.g., taking their daily walk
87.	***Anticipated regret***	Induce expectations of future regret about performance of the unwanted behaviour Note: not including 79, Information about emotional consequences	Ask the person to assess the degree of regret they will feel if they do not quit smoking (e.g. on a 5 point scale)
Comparison of behaviour			
88.	***Demonstra-tion of the behaviour***	Provide an example of the behaviour being performed for the person to aspire to or imitate (includes '***Modelling***')	Demonstrate to nurses how to raise the issue of excessive drinking with patients via a role-play exercise
89.	***Social comparison***	Draw attention to others' performance to explicitly elicit comparisons *Note: being in a group setting does not necessarily mean that social comparison is actually taking place*	Show the general practitioner the proportion of patients who were prescribed antibiotics for a common cold by themselves and by their colleagues
90.	***Information about others' approval***	Provide information about what other people think about the behaviour. The information clarifies whether others will like, approve or disapprove of what the person is doing or will do	Tell the staff at the hospital ward that staff at all other wards approve of washing their hands according

No.	Label	Definition	Examples
			to the guidelines
Covert learning			
91.	***Imaginary punishment***	Advise to imagine performing the **unwanted** behaviour in a real-life situation followed by imagining an unpleasant consequence (includes ***'Covert sensitisation'***)	Advise to imagine overeating and then vomiting
92.	***Imaginary reward***	Advise to imagine performing the **wanted** behaviour in a real-life situation followed by imagining a pleasant consequence (includes ***'Covert conditioning'***)	Advise the health professional to imagine giving dietary advice followed by the patient losing weight and no longer being diabetic
93.	***Vicarious consequences***	Prompt observation of the consequences (including rewards and punishments) for others when they perform the behaviour Note: if observation of health consequences, also code 78, Information about health consequences; if of emotional consequences, also code 79, Information about emotional consequences, if of social, environmental or unspecified consequences, also code 80, Information about social and environmental consequences	Draw attention to the positive comments other staff get when they disinfect their hands regularly