**Development of a behavior change communication tool for medical students: The ‘Tent Pegs’ booklet**

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**Abstract**

**Objective**

To describe the development and validation of a behavior change communication tool for medical students.

**Methods**

Behavior change techniques (BCTs) were identified within the literature and used to inform a communication tool to support medical students in discussing health-related behavior change with patients. BCTs were organized into an accessible format for medical students (the ‘Tent Pegs’ booklet) and validated using discriminant content validity methods with 11 expert judges.

**Results**

One-sample t-tests showed that judges reliably mapped BCTs onto six of the seven Tent Pegs domains (confidence rating means ranged from 4.0 to 5.1 out of 10, all p ≤ 0.002). Only BCTs within the ‘empowering people to change’ domain were not significantly different from the value zero (mean confidence rating = 1.2, p > 0.05); these BCTs were most frequently allocated to the ‘addressing thoughts and emotions’ domain instead.

**Conclusion**

BCTs within the Tent Pegs booklet are reliably allocated to corresponding behavior change domains with the exception of those within the ‘empowering people to change’ domain.

**Practice implications**

The existing evidence-base on BCTs can be used to directly inform development of a communication tool to support medical students facilitate health behavior change with patients.

**1. Introduction**

Leading causes of premature death are accounted for by lifestyle-related illnesses such as heart disease, cerebrovascular diseases and cancers [1, 2]. Because these illnesses are largely governed by behaviors including smoking, alcohol consumption and diet and physical activity, behavioral modification can result in disease reduction and improved health [2-4]. Thus, researchers have aimed to identify effective methods to support individuals in making changes to these behaviors. At the forefront of this work is the development of a standardized vocabulary of behavior change techniques (BCTs) [5, 6], many of which are congruent with established theoretical frameworks [7, 8]. One example is motivational interviewing, which is a communication approach for exploring and resolving ambivalence about behavior change, and is based upon the core principles of the transtheoretical stages of change model [9, 10]. The clarification of these BCTs has been important because intervention reports have often described techniques differently (e.g. describing different approaches to goal setting, and varied delivery of motivational interviewing), and lacked transparency (e.g. vague reports that ‘behavioral counseling’ was delivered). These issues have in turn prevented replication or comparative evaluations of behavior change interventions [7]. With standardized definitions of BCTs however, these issues can be resolved and identification of active components within behavior change interventions improved [6].

An emerging evidence-base has indicated BCTs which may be more or less effective within different contexts and for different health behaviors. For example, self-monitoring techniques which involve the individual recording their own behavioral performance have been identified as particularly effective in eliciting changes in healthy eating and physical activity [11]. There is also evidence that training in motivational interviewing (MI) improves the behavior change communication skills of health professionals [12], and that using MI within clinical interactions can encourage patient behavior change particularly in alcohol consumption [13] and substance abuse [14]. However, further evidence for the efficacy of motivational interviewing is constrained by lack of robust methodology and transparent reports of intervention protocols [15]. This developing evidence-base provides early indications of which techniques may be most useful in facilitating change in various health behaviors. In addition, some evidence suggests that behavior change interventions that are explicitly based upon theory are more effective than atheoretical interventions, most likely because they target salient behavioral determinants [16-18]. It is therefore unsurprising that less effective techniques have been shown to include more generic approaches such as offering financial incentives [19-21] and using scare tactics [22]. This evidence highlights the importance of tailoring behavior change interventions and encouraging individuals who design and deliver behavior change interventions (e.g. psychologists / health professionals) to select techniques which target salient behavioral determinants for individuals whose health would benefit from making lifestyle changes such as losing weight, reducing alcohol consumption or stopping smoking.

Health professionals have a key role in facilitating health behavior change with patients; hence many interventions have been implemented within clinical settings. For example, goal setting techniques are frequently included within primary care interventions [23], and recent work has encouraged doctors to capitalize upon ‘teachable moments’ which refer to time periods in which patients may be particularly susceptible to health behavior change counseling (e.g. following a myocardial infarction) [24, 25]. Furthermore, medical professionals are expected to deliver tailored behavior change interventions to patients within routine practice [26]. Despite this, doctors often miss opportunities to discuss behavior change with patients [27-29]. Doctors also report low confidence in this area and a need for education to provide them with behavior change facilitation skills [30].

The UK’s General Medical Council (GMC) has recommended that doctors learn how to communicate with patients about obesity and behavior change during medical school [31]. Medical school may be a particularly opportune time to deliver such education as this is when core skills for practice are initially introduced and it may impact upon the quality of care provided to patients in the future [32]. Education at this stage may also prevent the development of attitudes that behavior change is a low priority, low relevance topic, which evidence suggests can be conveyed within the hidden curriculum for topics within the behavioral and social sciences [33]. Thus early education for medical students about behavior change facilitation may help to address an educational need for future doctors, and address issues with confidence and attitudes around engaging in behavior change talk with patients.

However, recent evidence shows that educational interventions of this kind are lacking, specifically in relation to obesity management education [34]. Other research has highlighted that behavior change education is inadequate as it is infrequently delivered within medical schools and often presented to students as isolated from clinical contexts [35]. Furthermore, it is unknown to what extent standardized BCTs such as those in the CALO-RE taxonomy [6], and Health Behavior Change Competency (HBCC) framework [5], have been applied to medical education. In order to contribute to this research area, we argue that behavior change education for medical students that is based upon the existing evidence-base needs to be designed and validated. This would firstly enable medical education curricula to incorporate teaching and learning materials that are appropriate for *medical students*. Secondly, evaluations of this education could be conducted to investigate whether or not the behavior change literature can be successfully translated to effective medical education. We therefore aimed to address the first stage of this process, and to create and validate a communication tool applying the available evidence on BCTs to medical education, in an accessible and usable tool for medical students.

**2. Methods**

2.1 Communication tool design procedure

The authors used two known taxonomies of BCTs to form the basis of the communication tool. The CALO-RE taxonomy [6] has been developed in response to a need for a standardized vocabulary of BCTs used within interventions, and many of its techniques have been linked with established theories of health behavior [7, 8]. The HBCC [5] initially outlines behavior change competencies for health professionals who deliver behavior change interventions, and then describes BCTs for use within interventions. As with the CALO-RE taxonomy, HBCC authors note that these BCTs are congruent with numerous motivation-, action-, and prompt/cue-focused health behavior models. These two taxonomies identify 126 BCTs in total. We initially organized these BCTs into 12 overarching categories. Table 1 displays these 12 categories and illustrates the process by which BCTs were grouped and subsequently excluded or included into the final communication tool framework.

**[Table 1 to be placed about here]**

In order to select BCTs that were relevant to the study’s context (i.e. a practical communication tool for use by medical students), a number of criteria were applied. Firstly, BCTs had to be suitable for use within doctor-patient interactions. Thus they needed to be deliverable via *communication* within health care settings. Secondly, it was required that BCTs were associated with sufficient evidence supporting their efficacy. A narrative rather than a systematic review of the literature on health behavior change facilitation was conducted to inform judgments about this because 1. accumulating evidence for the effectiveness of individual BCTs is not yet conclusive [17], and 2. it was beyond the scope of the present study to conduct and report full systematic reviews with meta-analyses indicating BCT efficacy [e.g. 36]. Literature reviews, seminal papers and robust empirical studies were identified across a number of research databases (EMBASE, Ovid Medline, and PsycInfo) in order to base judgments upon highest quality evidence. Searches were organized using key words targeting the 12 broad behavior change categories identified above (e.g. *‘Information giving’, ‘reinforcement (positive/negative)’, ‘cognitions’, ‘emotions’, ‘social’*) and types of behaviors relevant to this study (e.g. *‘smoking’, ‘alcohol’, ‘diet’, ‘physical activity’, ‘lifestyle’*). This allowed us to formulate an overview of the evidence for and against different groups of BCTs to guide judgments regarding which would most useful to include.

Thirdly, duplicates of BCTs between the two taxonomies were removed and overlapping BCTs combined. Reducing the number of BCTs in this way ensured the communication tool could be explained to medical students during a single education session. Basic psychological principles suggest that memory and information processing is optimal when learners are presented with seven (± two) information chunks [37-39]. We therefore included a maximum of seven broad behavior change domains within the communication tool framework and up to seven BCTs within each domain. Although these criteria restricted the specificity within the communication tool, it importantly allowed for the design of a succinct and comprehendible tool, tailored for medical students.

One author (AC) conducted this process and of the initial 126 BCTs, 23 (18.3%) were excluded as they contained shared elements of definitions, or were exact duplicates of other BCTs. For example, both definitions of ‘imagery’ and ‘mental rehearsal’ focus centrally upon imagining behavioral performance. Fourteen (11.1%) BCTs were also included within definitions of others (e.g. ‘anger control training’ could be one method of ‘stress management’). It was judged that 25 (19.8%) BCTs could not be feasibly used within doctor-patient interactions (e.g. modeling behaviors to patients, or offering threats). Thirty three (26.2%) BCTs were also judged to be unsupported by sufficient evidence of efficacy. One illustration is the conflicting evidence that although fear arousal is a proposed as a motivating factor, it can also reduce individuals’ motivation to change by encouraging removal of the fear source (e.g. health professional’s message) rather than the risk (e.g. smoking) [22, 40]. Although many BCTs have conflicting evidence of their efficacy especially in various contexts, our judgments were primarily guided by literature review findings relating to behavior change interventions by medical professionals specifically. For example, research indicates that medical professionals may rely on information provision and awareness raising to motivate patients to change, which has been criticized as a generic and potentially ineffective approach [39, 40]. Therefore, for this tool, set within the context of supporting clinical communication, fear-inducing and information-giving BCTs were excluded.

Thirty-one BCTs (24.6%) met the inclusion criteria and were selected for inclusion into the communication tool. For parsimony within domains, setting and reviewing goals were combined to form one BCT, as were ‘stress management’ and ‘emotion control management’. Thus the final communication tool comprised 29 BCTs and seven broad behavior change domains. To further enhance memory and assist information processing, domains were organized into a memorable order by applying a familiar acronym [43]: *Tent Pegs* (T = Taking down barriers; EN = Changing the ENvironment; Th = Addressing Thoughts and emotions; P = Perform and practice; E = Empowering people to change; G = Achieving Goals; S = Social support). Each domain comprised three to six individual BCTs (see Figure 1).

[Figure 1 to be placed about here]

The Tent Pegs framework was then formatted within a booklet clearly displaying one domain with its associated BCTs per page. Examples of BCTs being used ‘in action’ were also included on each page, through written examples of doctor-patient dialogue illustrating how patient cues can guide doctors in selecting salient BCTs for individual patients. For example, a patient may mention that smoking relieves stress at work, and the doctor responds by initiating discussion about stress management (one BCT within the ‘addressing thoughts and emotions’ domain). This illustrates that although the Tent Pegs framework does not present exhaustively the BCTs identified within the broader behavior change literature, it does identify key areas of potential intervention for health care professionals. In line with clinical recommendations [26], it also supports health care professionals to tailor health advice to patients by selecting salient BCTs to use within clinical communication, based primarily upon what the patient expresses within those interactions. In this way, behavior change discussions remain patient-centered, which further aligns with the recommended approach to current clinical communication [44, 45].

2.2. Communication tool validation

Due to the complexity involved in reducing and translating the behavior change literature into a usable tool for medical students, we wanted to validate the Tent Pegs booklet’s organization of BCTs into the seven behavior change domains. One approach to doing this is assessing its discriminant content validity (DCV). This has been used previously to test the validity of concepts proposed to be measured within questionnaires [46, 47], and recently to validate the content of a behavior change intervention framework [48]. In the present context, DCV methods were used to investigate the structure of the communication tool specifically by assessing how well BCTs fitted within the domains they were proposed to correspond with in the Tent Pegs framework.

*Participants and procedure*

Individuals with expertise in psychology and/or behavior change were sought to participate in the DCV task. Postgraduate psychology students and health psychologists within a North West UK University were identified using university staff and student databases and invited to participate via email. The task was sent with instructions to willing participants via email. It involved reading through definitions of eight behavior change domains (seven Tent Pegs domains plus one dummy domain), as well as 29 individual BCTs presented in a randomly generated order. Following this, participants allocated each BCT to at least one of the eight domains and rated their confidence with selected allocations on a 10-point scale (1=not at all confident; 10=extremely confident). Techniques within the seven Tent Pegs domains are displayed in Figure 1. Dummy BCTs comprised four techniques that exist within the behavior change literature but that did not fit within any of the Tent Pegs domain definitions. They were direct instruction, financial incentives, provision of information, and explanation of health consequences. This domain was included to prevent participants making forced judgments about BCTs fitting into the Tent Pegs domains when they may instead have believed that BCTs didn’t map onto any of the Tent Pegs domains. This also allowed exploration of participants’ ability to identify BCTs that would not fit within the Tent Pegs framework, thereby testing the parameters of the Tent Pegs framework more broadly.

Psychologists rather than clinicians were invited to assist with validation of the tool because participants were being asked to judge the underlying theoretical concepts of the tool (e.g. the descriptions and organization of BCTs in relation to various psychological approaches to behavior change) rather than how applicable the tool was for use in practice with patients. A previous similar DVC study also used participants with expertise in behavior change theory [48]. Additionally, our pilot work showed that individuals with less psychology training (e.g. undergraduate psychology trainees rather than postgraduate and qualified psychologists) reported finding the task more difficult to complete, suggesting that theoretical knowledge is required for this validation task. It was also deemed more important and appropriate to involve clinicians in subsequent evaluation stages in which the tool’s utility within healthcare practice and acceptability to clinicians is assessed.

*Analysis*

Judges’ confidence ratings for BCTs within each domain were summed and assigned positive scores for allocations matching the Tent Pegs framework, and negative scores for those that didn’t. Summed scores were divided by the number of BCTs in each domain to account for variations in domain size. Thus standardized mean confidence ratings for each domain could be compared to the value zero using one-sample t-tests. Intraclass correlations [ICC] (using a 2-way mixed model to assess consistency) were also conducted to assess judges’ agreement regarding their BCT-domain allocations. ICC values were interpreted to indicate that agreement was poor (<0.21), fair (0.21 to 0.40), moderate (0.41 to 0.60), or good-excellent (≥0.61) [49].

**3. Results**

Eleven judges completed the DCV task (six postgraduate psychologists and five health psychologists). Of these nine (82%) were female, nine (82%) were British and two Chinese (18%). Participants’ mean age was 36 years (range = 23 – 55 years). Tests of normality including Shapiro-Wilks tests, exploration of skewness, kurtosis and Q-Q plots revealed that with the exception of one outlying data point (subsequently removed from the dataset) data for each domain were normally distributed. Thus one-sample t-tests were conducted to investigate the DCV of the Tent Pegs communication tool. Table 2 shows that for six of the seven domains, judges’ confidence ratings were significantly greater than value zero (which would indicate no confidence). These six domains were ‘taking down barriers’, ‘changing the environment’, ‘addressing thoughts and emotions’, ‘perform and practice’, ‘achieving goals’, and ‘social support’. This demonstrates that participants made BCTs-domain allocations consistent with the Tent Pegs booklet for most domains. Mean confidence ratings for these BCT-domain allocations ranged from 4.0 to 5.1 (out of 10) and ICC values showed good to excellent agreement between judges for five of these six domains, but poor agreement for the ‘addressing thoughts and emotions’ domain (see Table 2).

For BCT allocations within the dummy domain, confidence ratings were not significantly different from zero and ICCs show high disagreement between judges. Further, for one of the seven Tent Pegs domains (‘empowering people to change’) confidence ratings were also not significantly different from zero and ICCs show fair agreement between judges (Table 2).

[Table 2 to be placed about here]

To further investigate the non-significant result regarding the ‘empowering people to change’ domain, the distribution of judges’ allocations was calculated (Figure 2). This showed that judges placed these BCTs most frequently within the corresponding Tent Pegs domain (‘empowering people to change’). However, disagreement between judges was accounted for by these BCTs being allocated to five discordant domains as well (‘addressing thoughts and emotions’, ‘perform and practice’, ‘social support’, ‘goal setting’ and ‘other’). Of these, the BCTs were most often mapped onto ‘addressing thoughts and emotions’. Within this, ‘imagery’ was the only BCT to be mapped onto ‘addressing thoughts and emotions’ more often than the ‘empowering people to change’ domain.

[Figure 2 to be placed about here]

**4. Discussion and conclusion**

* 1. Discussion

To our knowledge, this is the first study to demonstrate how the evidence-base on BCTs can inform the development of a communication tool for medical students (i.e. the Tent Pegs booklet). As there is growing recognition that medical school programmes should include more consistent behavior change education [31, 34, 35], it is likely that evidence-based educational tools such as this will benefit medical student learning and preparation for practice. This may ultimately support practicing clinicians to facilitate behavior change with their patients through providing them with the communication skills they may currently be lacking, and improving their confidence in discussing this topic within doctor-patient interactions [30]. Empirical evaluations however, are required both in terms of assessing the validity of novel educational tools themselves, and also subsequently evaluating their efficacy in facilitating medical student learning and improving patient outcomes.

The present study assessed the validity of the Tent Pegs booklet, and found that judges made BCT-domain allocations that were consistent with six of the seven Tent Pegs domains. Thus it can be argued that overall the communication tool has good discriminant content validity. This analysis ultimately indicates that the 29 BCTs identified from the literature are accurately represented by the Tent Pegs domains. This meaningful organization of BCTs is important in the present context as it may serve to enhance student learning by highlighting groups of targetable behavior change determinants that could be addressed with patients, rather than expecting students to make sense of and apply the entire behavior change literature to their interactions with future patients.

It is important to note however, that although judges mapped BCTs onto corresponding domains, general confidence in doing this was low (mean confidence was 50% or lower across all domains). This finding suggests that although judges agreed with the Tent Pegs framework, they did not show high levels of confidence in their ratings. This is however, not entirely surprising given that the theories underlying these BCTs share overlapping concepts [see, 50] and suggests that although BCTs within the Tent Pegs framework may seem similar, they remain distinguishable despite this.

Although most BCT-domain allocations were consistent with the Tent Pegs categorizations, participants were not confident in mapping BCTs onto one domain: ‘empowering people to change’. Mean confidence scores for this domain were not significantly different from the value zero (representing no confidence). Additionally, although judges demonstrated confidence in allocating BCTs to the ‘addressing thoughts and emotions’ domain overall, their level of agreement within this was poor (0.11). These findings may be accounted for by participants allocating ‘empowering people to change’ BCTs within a number of other domains instead. They most frequently matched the BCT ‘imagery’ to the ‘addressing thoughts and emotions’ domain. One possibility is that judges identified ‘imagery’ with attempting to change individuals’ cognitions (i.e. addressing thoughts) rather than drawing focus onto previous successes (which aligns more closely with the ‘empowering people to change’ definition). Taking into account judges’ allocations, it may therefore be more appropriate to include the BCT ‘imagery’ within the ‘addressing thoughts and emotions’ domain. As the results suggest this single BCT may account for the non-significant result and disagreement associated with the ‘empowering people to change domain’, we propose that this domain as a whole is retained but that further work is conducted to replicate the present study with this minor structural revision made.

Participants were also not confident and showed a high level of disagreement when allocating BCTs to the dummy domain. This domain included BCTs that didn’t fit with any of the Tent Pegs domains and was primarily included to allow participants to identify BCTs that they believed did not map onto the Tent Pegs domains. Because findings showed that on the whole participants chose not to allocate BCTs associated with the Tent Pegs framework to the dummy domain, it can be argued that participants generally believed that BCTs fitted within definitions of the seven Tent Pegs domains rather than the dummy domain. However, this does not explain why participants failed to correctly identify the four corresponding dummy BCTs. One possible explanation for the lack of a significant result regarding the dummy domain is that participants were exerting substantial cognitive effort to identify possible BCT-domain allocations, and were therefore more likely to place a BCT within a Tent Pegs domain than the dummy domain. This suggestion is also in line with anecdotal reports from participants that they found it difficult to make allocation decisions during the task and spent longer on the task than estimated during piloting (approx 20 minutes). Although this may indicate that judges were unable to identify BCTs that did not fit within the Tent Pegs domain, the findings as a whole suggest that participants agreed with the basic structure of the Tent Pegs communication tool.

A key strength of this study is the use of DCV methods to test the communication tool’s validity. This allows judgments to be made regarding its structural organization without relying upon subjective cut-off values, which is more likely to lead to bias and is not therefore a desirable approach to take [46]. Furthermore, to enhance learning and the preparation of future doctors to facilitate behavior change with patients, the Tent Pegs communication tool itself is designed to be succinct and easy to understand. This goal was facilitated by the process by which BCTs were selected from the available evidence-base. Thus far, other research has underused this evidence to inform educational interventions in this area [34]. This study therefore demonstrates a novel approach to applying behavior change science to medical education. This application of science to education practice may enable an important advancement in medical education by allowing medical educators to access the available evidence-base on behavior change facilitation and therefore begin to deliver evidence-based education in this area; something which has not yet been achieved within undergraduate medical education [34].

Furthermore, the Tent Pegs framework is supportive of a model of tailored health advice because it encourages medical students to follow patients’ prompts to select the most suitable approaches to lifestyle change. This is congruent with clinical guidance that recommends that health professionals shape behavior change interventions to coincide with individual patients’ contexts [26]. However, it is important to note that our results do not provide full validation of this communication tool, and that minor revisions may improve the coherence of its structure (i.e. repositioning of the BCT ‘imagery’). As previously acknowledged, the Tent Pegs tool is not comprehensive as it doesn’t include all existing BCTs defined within the literature [5, 6]. Additionally, studies used to inform judgments about the efficacy of BCTs were selected by only one author. Although supporting and contradictory evidence were actively sought during searches, using a single author may have introduced opportunities for selection bias which could have influenced the studies included in the narrative review, and subsequent interpretations of the literature as a whole. Thus, there may be other BCTs worthy of inclusion within a communication tool of this kind, and further research is needed to provide a rationale for which BCTs should be included. Finally, the Tent Pegs framework has not yet been tested as an educational tool within the context of the medical education learning environment and hence future research should pursue this in order to determine its efficacy as an educational intervention. The limitations described above should be taken into account and explicitly acknowledged when using this tool within medical education settings.

4.2 Conclusion

This study provides evidence that, on the whole, supports the basic structure of a communication tool to assist medical students discuss health-related behavior change with patients. Findings also indicate that it is possible to use the existing evidence-base on BCTs to inform the development of valid materials for medical education in this area.

* 1. Practice implications

By drawing upon the available evidence-base on behavior change, researchers and educators could improve current education for medical students and better prepare them for medical practice. This would contribute to meeting recommendations that medical students graduate with competence to discuss psychological and sociological aspects of behavior change with future patients [31]. By meeting this educational need, future doctors may be more prepared to discuss behavior change with future patients, thereby enhancing opportunities for successful behavior change facilitation within medical settings.

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|  |
| --- |
| **tenttentTent Pegs** |
| **Taking down barriers**Identify barriers and problem solveCoping planningTime management**Addressing Thoughts and emotions**Stress/emotion managementRelaxationDecision makingReframingDistraction**Empowering people to change**Self-talkImageryPast successMotivational interviewingReassurance | **Changing the Environment**AvoidanceEnvironmental changeTime out**C:\Documents and Settings\mbrx5ac2\Local Settings\Temporary Internet Files\Content.IE5\NED2U972\MP900431173[1].jpgPerform and practice practice**PracticeGeneralise behaviourHabit formationFadingSelf-monitorFeedback**Achieving Goals**Graded tasksSet and review goals (behaviour & outcome)Action planningAgree contract |
| **Social support**Social supportSocial comparisonIdentification as role model/position advocate |

**Figure 1.** ‘Tent Pegs’ behaviour change technique framework used within an educational intervention for medical students**.**



Figure 2. **Distribution of BCT-domain allocations in relation to ‘empowering people to change’ BCTs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Initial BCT group label****Table 1.** Illustration of the development procedure for the Tent Pegs behaviour change communication tool  | **Taxonomy A BCTs:****CALO-RE (40 BCTs)** | **Taxonomy B BCTs:****HBCC framework (86 BCTs)** | **Illustrative summary of evidence for/against including BCTs in the Tent Pegs communication framework**  |
| Provide patient with **information** | A1. Info on consequences of behaviour in general  | B2. General info | **Evidence overview:** * Traditional interventions by health professionals have commonly aimed to elicit behaviour change through increasing patient knowledge (e.g. providing health/behavioural information). This assumes that a lack of knowledge underlies unhealthy behaviours and can often result in interventions focused upon generic health outcomes [41].
* Just telling people to change and providing risk information is unlikely to elicit behaviour change and may even reduce motivation to change (e.g. it may weaken individuals’ beliefs in their ability to change) [42].
* Review on transport choice suggests personalised/tailored behaviour change programmes are more effective than raising awareness alone (e.g. public health campaigns which provide general information about behaviour) [51].
* Risk perception alone is a poor predictor of behaviour thus only informing patients of the consequences/risks of their behaviours may not be useful in facilitating change – however in combination with other factors such as outcome expectancies and self-efficacy, risk perception may also play an important role. Further, risk perception may be important in early stages of behaviour change i.e. stimulating motivation/intentions to change rather than later stages of behaviour change i.e. transferring intentions to actions [52].
* Providing information alone which is not tailored to individuals’ behavioural determinants may be ineffective, however research suggests that in some settings information can raise awareness of a behavioural problem and prompt behaviour change (e.g. brief information-based alcohol interventions) [53, 54].

**Decision – Exclude:** Some evidence suggests that information provision can encourage behavioural change but evidence suggests this needs to be in addition to using other techniques. Also, the literature suggests it would be helpful to move away from encouraging health care professionals to provide generic information and discuss behavioural consequences with patients.  |
| A2. Info on consequences of behaviour to the individual | B4. Info about the behaviour  |
| A3. Info about others’ approval | B12. Comparison  |
| A4. Normative info about others’ behaviour  | B15. Discrepancy assessment  |
| A20. Info on where and when to perform behaviour  |  |
| **Goal pursuit** | A5. Goal setting (behaviour) (B23) | B11. Contract (ED) | **Evidence overview:** * Evidence supports the use of implementation intentions (which aid implementing goal intentions and thus achieving goals) [55].
* Specific goals are also known to increase likelihood of behaviour change – SMART (Specific, Measurable, Attainable, Realistic and Timely) goal setting [see, 7].
* Action planning is supported within the literature [e.g. 56].
* Evidence supports that action planning and goal setting approaches are appropriate and feasible within health care settings [23, 57].

**Decision – Include:** Supportive evidence for this group of BCTs as a whole in terms of efficacy and suitability for use within healthcare settings  |
| A6. Goal setting (outcome) (B23) | B23. Goal setting  |
| A7. Action planning | B26. Action planning (ED) |
| A9. Set graded tasks | B27. Goal review  |
| A10. Prompt review of behavioural goals (B27)  | B28. Standard (B23) |
| A11. Prompt review of outcome goals (B27) | B36. Graded tasks (ED) |
| A25. Agree a behavioural contract |  |
| **Overcoming barriers** | A8. Barrier identification/problem solve | B20. Coping strategies (B25) | **Evidence overview:** * Coping planning facilitates long term lifestyle behaviour change (note however that action planning and coping planning combined may be more effective than either alone [56, 58].
* Addressing environmental barriers can aid the success of physical activity interventions [59].
* Recommendations from research that health practitioners address patient barriers to improve adherence to medical advice [60]. Guidelines for practitioners also recommend that health practitioners address patient barriers to facilitate behaviour change [26, 61]. This includes guidance on obesity management which recommends tailoring health advice to patient barriers to behaviour change (they note here that barriers may include a variety of factors e.g. significant others’ views, cost, time, availability) [61]. Other guidance on behaviour change management also recommends addressing barriers (e.g. lack of information, opportunities, resources) [26].

**Decision – Include:** Encourages tailored health advice which coincides with health care guidelines and is supported in the literature. It is also feasible to implement within clinical interactions.  |
| A35. Relapse prevention/coping planning (S – A8) | B25. Coping planning  |
| A39. Time management | B32. Time management (ED) |
|  | B34. General problem solving (S – A8) |
|  | B40. Relapse prevention (S – A8) |
| **Behavioural reinforcement** (positive or negative) | A12. Provide rewards contingent on effort/progress towards behaviour  | B50. Contingent reward  | **Evidence overview:** * Evidence on fear arousal suggests that it is the perception of the fear which elicits change not the fear itself – thus one might attempt to remove the source of fear (e.g. health professional’s message) rather than the risk (e.g. smoking) [see 22, 40].
* Evidence against using financial incentives exists [e.g. 19-21]. Financial incentives can undermine internal motivation and focus upon external motivation instead [62]. Thus when incentives are removed, the behaviour change often ceases. It may also be that because this approach doesn’t take into account individuals’ behavioural drivers, it is likely to be unsuccessful in generating motivation to change which is salient to individuals.
* Behvaiour change thoeries link with positive and negative reinforcement techniques [63]. For example, the health belief model suggests using percieved benefits of behaviour change as reinforcers and the transtheoretical model of behaviour change suggests using rewards to elicit behavour change.

**Decision – Exclude:**  Some approaches to reinforcement align with health behaviour theories and may be helpful in supporting behaviour change. However extrinsic incentives are likely to undermine intrinsic motivation and reduce the likelihood of achieving behavioural change. Due to conflicitng evidence regarding rewards and reinforcement approaches this domain will not be included. It is also deemed that it may not be feasible or appropriate for doctors to use some of these techniques within clinical practice (e.g. punishment, threat, classical/covert conditioning).  |
| A13. Provide rewards contingent on successful behaviour  | B51. Vicarious reinforcement  |
| A14. Shaping | B54. Discriminative (learned) cue |
|  | B55. Punishment  |
|  | B56. Omission  |
|  | B57. Negative reinforcement  |
|  | B58. Threat  |
|  | B59. Shaping |
|  | B65. Differential reinforcement  |
|  | B66. Escape learning  |
|  | B67. Extinction  |
|  | B69. Counter-conditioning  |
|  | B72. Thinning  |
|  | B74. Negative punishment  |
|  | B75. Non-contingent reinforcement  |
|  | B77. Response cost  |
|  | B79. Satiation  |
|  | B80. Token economy  |
|  | B81. Classical conditioning  |
|  | B82. Covert conditioning  |
|  | B83. Covert sensitization  |
|  | B84. Discrimination training  |
|  | B85. Emetic therapy  |
| **Perform** new behaviour | A15. Prompting generalisation of a target behaviour  | B33. Homework (S – repetition of any BCT) | **Evidence overview**:* Advocates of Social Cognitive Theory (SCT) suggest that self-efficacy can be enhanced via mastery, behavioural performance and rehearsal [63, 64].
* Habits are shaped by repetitive actions, performance of habits are often not conscious (require little cognitive effort) and are therefore strong predictors of behaviour and often difficult to break [65].
* Habit formation can support patient weight loss [66] and uptake of physical activity [67].

**Decision - Include:** Performance and rehearsal of behaviours can be discussed relatively easily within clinical consultations. There is evidence that performing, rehearsing and mastering behaviours are very good predictors of future behaviour and there is also supportive evidence for habit formation/reversal. |
| A26. Prompt practice | B37. Behavioural rehearsal (S – A15) |
|  | B38. Role play  |
|  | B60. Chaining (S – B62) |
|  | B62. Habit formation  |
|  | B71. Fading  |
|  | B73. Habit reversal (S - B62) |
|  | B78. Stimulus generalization (S – A15) |
| **Monitoring** behavioural change | A16. Prompt self-monitoring of behaviour  | B6. (Record) Antecedents and consequences (S – A16) | **Evidence overview:*** Meta-regression highlighted self-monitoring in particular as an effective behaviour change technique for improving diet and exercise [11].
* Evidence for self-monitoring in health care settings to promote physical activity [68].
* Feedback on behaviour is important as it allows patients to learn/manage their future behaviour more effectively and may also increase self-efficacy [see, 69].

**Decision - Include:** Support for monitoring techniques, particularly self-monitoring and feedback on behaviours. It may also be possible for doctors to monitor and give feedback on patient behaviours directly due to the nature of health care settings (e.g. results of physiological measures; repeated/review consultations).  |
| A17. Prompt self-monitoring of behavioural outcome (A16) | B7. Behavioural experiments  |
| A18. Prompt focus on past success | B22. Self-monitoring of behaviour (ED) |
| A19. Provide feedback on performance  | B29. Feedback (on monitored behaviour) (S – A19) |
|  | B41. Biofeedback  |
| Provide **instruction** to the patient | A21. Provide instruction on how to perform the behaviour | B5. Verbal persuasion/ persuasive communication  | **Evidence overview:** * Traditionally doctors have based behaviour change communication with patients on persuasion and instruction and this has limited success. It doesn’t take into account individuals’ context and environments [see 41, 63].
* Social Learning Theory specifics that modelling is important in influencing the adoption of behaviours [64]. [For a discussion on role modelling see, 70].

**Decision - Exclude:** As it is not likely that doctors will be able to model health behaviours to patients within clinical interactions, and due to the researching suggesting that doctors traditionally try to use persuasion and instruction to elicit change in patients with little success, this behaviour change domain will not be included.  |
| A22. Model/demonstrate | B19. Paradoxical instructions  |
| A23. Teach to use prompts/cues | B24. Instruction  |
| A24. Environmental restructuring  | B47. Modelling |
| A27. Use of follow up prompts | B49. Prompt |
|  | B76. Overcorrection |
| **Social influence** on behaviour | A28. Facilitate social comparison  | B3. Social support (emotional) (A29) | **Evidence overview:*** Social cognitive models (and other models such as the Prototype Willingness Model) inform behaviour change interventions via social influence [71].
* Social influences are described within the context of the Theory of Planned Behaviour and exercise behaviour [72].
* The Theory of Planned behaviour has been shown to account for variance in behaviour although social norms have been identified as a weaker predictor of behaviours than other determinants [73].
* Social influence is also acknowledged to impact upon clinician behaviour [57].

**Decision – Include:** Social influences are known to predict behaviour and there is evidence for this link within clinical and health contexts. It is also feasible to discuss social influence with patients within clinical interactions. |
| A29. Plan social support/social change  | B13. Social comparison (ED) |
| A30. Prompt identification as role model/position advocate | B14. Social support (non-specific) (A29) |
|  | B44. Social skills training (S – A29) |
|  | B48. social support (instrumental) (A29) |
| **Emotional influence** on behaviour | A31. Prompt anticipated regret (as with fear arousal) | B16. Fear arousal(ED) | **Evidence overview:*** Support that emotions influence behaviour within health care contexts [57].
* Emotional regulation is associated with successful weight loss [74, 75].
* Emotions (especially in the context of obesity) can influence doctor-patient communication about health behaviour change [30].
* Fear arousal may not facilitate behaviour change as individuals may remove the source of fear rather than risk (i.e. disengage with health messages rather than stop smoking) [40].

**Decision - Include:** Emotions are important to acknowledge when facilitating behaviour change (especially obesity) for both the practitioner and patient. However, research suggests scare tactics are unsuccessful in changing behaviour as they cause individuals to reduce negative emotions as apriority rather than change behaviour (i.e. smoke to relax in reaction to inducing fear, rather than stop smoking). Techniques which emphasise managing emotions relating to health behaviour will be included but fear arousal/scare tactics will be **excluded**. Other techniques which are not appropriate/ feasible for use within clinical consultations will also be **excluded**.  |
| A32. Fear arousal | B17. Anticipated regret (ED) |
| A36. Stress management  | B21. Assertion training  |
| A37. Emotional control training  | B31. Relaxation  |
|  | B43. Rational emotive therapy (A37) |
|  | B45. Stress inoculation program(A37) |
|  | B46. Anger control training (A37) |
|  | B63. Desensitisation  |
|  | B64. Graded desensitisation  |
|  | B68. Flooding  |
|  | B70. Exposure (confront feared stimulus) |
|  | B86. Implosive therapy  |
| **Cognitive** **influences** on behaviour |  | B8. Decision making (weight pros/cons of alternative actions) | **Evidence overview:*** Supportive evidence for cognitive influences on behaviour include a review on social cognitive models [73] and research describing the mechanisms through which cognitions influence behaviour as defined within numerous behaviour change models [71].
* Outcome expectancies are important in predicting behaviour (particularly motivation to change) and thus inform strategies including eliciting thoughts about what outcomes (positive/negative) will occur as a result of behaviour change (supports ‘decision making’ technique) [52].

**Decision - Include:** Evidence supports that cognitive processes influence behavioural intentions and actual behaviour. Cognitions feature heavily within the behaviour change literature and can be targeted within clinical interactions.  |
|  | B10. Reframing  |
|  | B18. Cognitive restructuring  |
|  | B42. Distraction  |
|  | B61. Mental rehearsal (S – A34) |
| **Environmental influences** on behaviour |  | B35. Avoidance (advise client to avoid any thing with negative consequences related to desired behaviour change) | **Evidence overview:** * Research demonstrates that environmental factors influences walking behaviour and that intervention to target these can help in achieving behavioural change [59].
* Support that the environment influences health behaviour [see, 57, 71]

**Decision - Include:** The environment is known to predict health behaviour and informs behaviour change interventions. It is also feasible to discuss the potential for environmental change with patients within clinical interactions |
|  | B52. Environmental change |
|  | B53. Time out  |
| **Empowerment** | A33. Prompt self talk | B1. Reassurance  | **Evidence overview:** * Success in training medical students in motivational interviewing (MI) to enhance their health promotion skills [76, 77].
* Success in training paediatric trainees in MI to enhance health promotion skills [12].
* Research reviews provide support for using MI within health care settings [13, 15]
* Research also supports using communication skills for promoting health behaviour change with patients [78].

**Decision - Include:** There is evidence and support in the literature for MI and empowering people to change (through building self-efficacy for example). Empowerment techniques have been applied within health care settings and there is good evidence for their efficacy regarding health behaviour change.  |
| A34. Prompt use of imagery | B9. Motivational interviewing (ED) |
| A38. Motivational interviewing  | B30. Self-talk (ED) |
| A40. General communication skills training (A38) | B39. Imagery (ED) |

***Notes.*** Red = Exact duplicate (indicated by ‘ED’); or too similar to other BCT(s) (indicated by ‘S’ and the associated BCT label) (n=23) ; Blue = BCT is included within another broader BCT (n=14), numbers in parentheses indicate the associated BCT; Orange = Not feasible or appropriate to deliver within the context of a clinical interaction (n=25); Purple = Insufficient evidence to support BCT efficacy (n=33); Green = included in Tent Pegs (n=29, A36 and A37 combined, B23 and B27 combined for parsimony)**.**

**Table 2.** One-sample t-test and intraclass correlation results displaying judges’ (n = 11) BCT-domain allocations, associated confidence, and levels of agreement.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Tent Pegs behavior change domain | Mean confidence rating (S.D.) | t(df)  | Sig. (p) | 95% CI(lower-upper)  | Intraclass Correlation |
| Taking down barriers (T) | 5.06 (3.55) | 4.73 (10) | .001 | 2.68 - 7.45 | 0.81 |
| Changing the environment (EN)  | 4.72 (3.48) | 4.50 (10) | .001 | 2.38 - 7.06 | 0.93 |
| Addressing Thoughts and emotions (Th) | 4.49 (3.69) | 4.04 (10) | .002 | 2.01 – 7.00 | 0.11 |
| Perform and practice (P) | 4.03 (2.41) | 5.55 (10) | .000 | 2.41 - 5.64 | 0.88 |
| Empowering people to change (E) | 1.17 (4.02) | .96 (10) | .359 | -1.54 - 3.87 | 0.21 |
| Achieving goals (G) | 4.70 (1.62) | 9.61 (10) | .000 | 3.61 - 5.80 | 0.90 |
| Social support (S) | 4.56 (3.02) | 4.79 (9) | .001 | 2.41 - 6.72 | 0.88 |
| Other (dummy) | 2.41 (4.89) | 1.63 (10) | .133 | -.88 - 5.69 | -0.82 |

***Note.*** *Confidence ratings were on a 10-point scale, 1=not at all confident; 10=extremely confident.*