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Development of a behaviour change communication tool for medical students: The 'Tent Pegs' booklet

Anna Chisholm [a,d,*], Jo Hart [a,b], Karen Mann [b,c], Sarah Peters [a,e]

[a] Manchester Centre for Health Psychology, University of Manchester, UK
[b] Manchester Medical School, University of Manchester, UK
[c] Division of Medical Education, Dalhousie University, Canada
[d] Institute of Inflammation and Repair, University of Manchester, UK
[e] School of Psychological Sciences, University of Manchester, UK

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ABSTRACT

Objective: To describe the development and validation of a behaviour change communication tool for medical students.
Methods: Behaviour change techniques (BCTs) were identified within the literature and used to inform a communication tool to support medical students in discussing health-related behaviour 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 $p \leq 0.002$). 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 behaviour 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 behaviour 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 behaviours including smoking, alcohol consumption and diet and physical activity, behavioural 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 behaviours. At the forefront of this work is the development of a standardized vocabulary of behaviour 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 behaviour 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 'behavioural counseling' was delivered). These issues have in turn prevented replication or comparative evaluations of behaviour change interventions [7]. With standardized definitions of BCTs however, these issues can be resolved and identification of active components within behaviour 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 behaviours. For example, self-monitoring techniques which involve the individual recording their own behavioural 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 behaviour change communication skills of health professionals [12], and that using MI within clinical interactions can encourage patient behaviour change particularly in alcohol consumption [13] and substance abuse [14]. However, further evidence for the efficacy of motivational interviewing is constrained by lack of

* Corresponding author at: Williamson Building, Institute of Inflammation and Repair, University of Manchester, Oxford Road, Manchester M13 9PL, UK. Tel.: +44 0161 2750710.
E-mail address: anna.chisholm@manchester.ac.uk (A. Chisholm).

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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 behaviours. In addition, some evidence suggests that behaviour change interventions that are explicitly based upon theory are more effective than atheoretical interventions, most likely because they target salient behavioural 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 behaviour change interventions and encouraging individuals who design and deliver behaviour change interventions (e.g. psychologists/health professionals) to select techniques which target salient behavioural 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 behaviour 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 behaviour change counselling (e.g. following a myocardial infarction) [24,25]. Furthermore, medical professionals are expected to deliver tailored behaviour change interventions to patients within routine practice [26]. Despite this, doctors often miss opportunities to discuss behaviour change with patients [27–29]. Doctors also report low confidence in this area and a need for education to provide them with behaviour change facilitation skills [30].

The UK's General Medical Council (GMC) has recommended that doctors learn how to communicate with patients about obesity and behaviour 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 behaviour change is a low priority, low relevance topic, which evidence suggests can be conveyed within the hidden curriculum for topics within the behavioural and social sciences [33]. Thus early education for medical students about behaviour change facilitation may help to address an educational need for future doctors, and address issues with confidence and attitudes around engaging in behaviour 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 behaviour 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 Behaviour Change Competency (HBCC) framework [5], have been applied to medical education. In order to contribute to this research area, we argue that behaviour 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 behaviour 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 behaviour [7,8]. The HBCC [5] initially outlines behaviour change competencies for health professionals who deliver behaviour 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 behaviour 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.

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 behaviour 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 behaviour change categories identified above (e.g. '*Information giving*', '*reinforcement (positive/negative)*', '*cognitions*', '*emotions*', '*social*') and types of behaviours 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 (± 2) information chunks [37–39]. We therefore included a maximum of seven broad behaviour 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 behavioural 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. modelling behaviours to patients, or offering threats). Thirty-three (26.2%) BCTs were also judged to

Table 1
Illustration of the development procedure for the Tent Pegs behaviour change communication tool.

Initial BCT group label	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 A2. Info on consequences of behaviour to the individual A3. Info about others' approval A4. Normative info about others' behaviour A20. Info on where and when to perform behaviour	B2. General info B4. Info about the behaviour B12. Comparison B15. Discrepancy assessment	*Evidence overview*: • Traditional interventions by health professionals have commonly focused upon information provision which assumes that lack of knowledge underlies unhealthy behaviour and often results in generic health advice [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 personalized/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 and informing patients of behavioural consequences/risks (especially when information is generic rather than tailored) may not be useful in facilitating change. However in combination with other factors such as outcome expectancies and self-efficacy, risk perception may be important [52–54] *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
Goal pursuit	A5. Goal setting (behaviour) (B23) A6. Goal setting (outcome) (B23) A7. Action planning* A9. Set graded tasks* A10. Prompt review of behavioural goals (B27) A11. Prompt review of outcome goals (B27) A25. Agree a behavioural contract*	B11. Contract (ED) B23. Goal setting* B26. Action planning (ED) B27. Goal review* B28. Standard (B23) B36. Graded tasks (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
Overcoming barriers	A8. Barrier identification/problem solve* A35. Relapse prevention/coping planning (S–A8) A39. Time management*	B20. Coping strategies (B25) B25. Coping planning* B32. Time management (ED) B34. General problem solving (S–A8) B40. Relapse prevention (S–A8)	*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

Table 1 (*Continued*)

Initial BCT group label	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
Behavioural reinforcement (positive or negative)	A12. Provide rewards contingent on effort/ progress towards behaviour A13. Provide rewards contingent on successful behaviour A14. Shaping	B50. Contingent reward B51. Vicarious reinforcement 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	*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)
Perform new behaviour	A15. Prompting generalization of a target behaviour* A26. Prompt practice*	B33. Homework (S–repetition of any BCT) 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)	*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
Monitoring behavioural change	A16. Prompt self-monitoring of behaviour* A17. Prompt self-monitoring of behavioural outcome (A16) A18. Prompt focus on past success* A19. Provide feedback on performance*	B6. (Record) Antecedents and consequences (S–A16) B7. Behavioural experiments B22. Self-monitoring of behaviour (ED) B29. Feedback (on monitored behaviour) (S–A19) B41. Biofeedback	*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)

Table 1 (*Continued*)

Initial BCT group label	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 instruction to the patient	A21. Provide instruction on how to perform the behaviour A22. Model/demonstrate A23. Teach to use prompts/cues A24. Environmental restructuring A27. Use of follow up prompts	B5. Verbal persuasion/persuasive communication B19. Paradoxical instructions B24. Instruction B47. Modelling B49. Prompt B76. Overcorrection	*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
Social influence on behaviour	A28. Facilitate social comparison* A29. Plan social support/ social change* A30. Prompt identification as role model/position advocate*	B3. Social support (emotional) (A29) B13. Social comparison (ED) B14. Social support (non-specific) (A29) B44. Social skills training (S–A29) B48. Social support (instrumental) (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
Emotional influence on behaviour	A31. Prompt anticipated regret (as with fear arousal) A32. Fear arousal A36. Stress management* A37. Emotional control training*	B16. Fear arousal (ED) B17. Anticipated regret (ED) B21. Assertion training B31. Relaxation* B43. Rational emotive therapy (A37) B45. Stress inoculation programme (A37) B46. Anger control training (A37) B63. Desensitization B64. Graded desensitization B68. Flooding B70. Exposure (confront feared stimulus) B86. Implosive therapy	*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 emphasize 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

Table 1 (*Continued*)

Initial BCT group label	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
Cognitive influences on behaviour		B8. Decision making (weight pros/cons of alternative actions)* B10. Reframing* B18. Cognitive restructuring B42. Distraction* B61. Mental rehearsal (S–A34)	*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
Environmental influences on behaviour		B35. Avoidance (advise client to avoid any thing with negative consequences related to desired behaviour change)* B52. Environmental change* B53. Time out*	*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
Empowerment	A33. Prompt self talk* A34. Prompt use of imagery* A38. Motivational interviewing* A40. General communication skills training (A38)	B1. Reassurance* B9. Motivational interviewing (ED) B30. Self-talk (ED) B39. Imagery (ED)	*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

* Items included in Tent Pegs ($n = 29$, A36 and A37 combined, B23 and B27 combined for parsimony).

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 behaviour 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 behaviour 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 Fig. 1).

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 behaviour change literature, it does identify key areas of potential intervention for health care

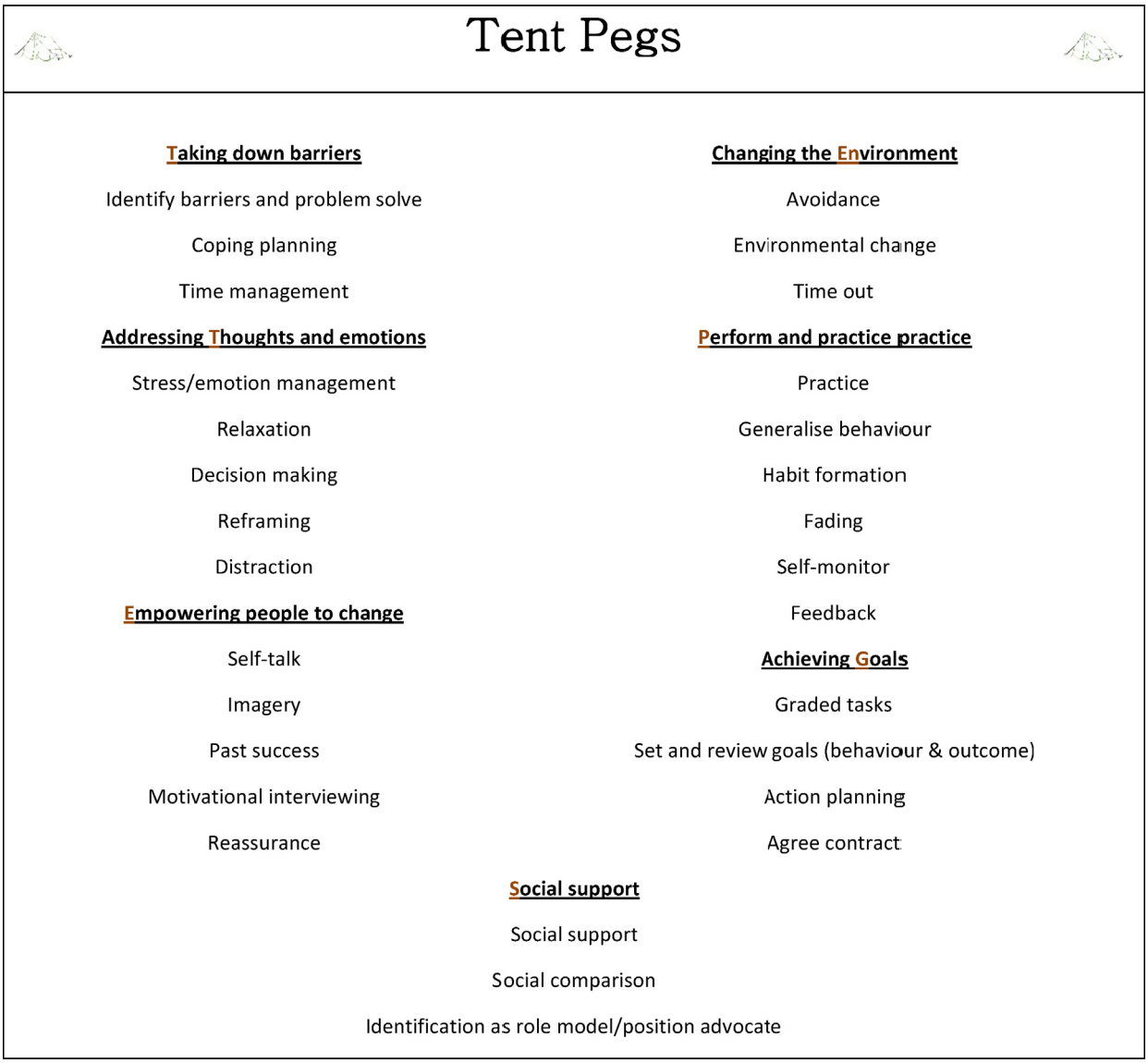

Fig. 1. 'Tent Pegs' behaviour change technique framework used within an educational intervention for medical students.

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, behaviour change discussions remain patient-centred, 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 behaviour change literature into a usable tool for medical students, we wanted to validate the Tent Pegs booklet's organization of BCTs into the seven behaviour 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 behaviour 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.

2.3. Participants and procedure

Individuals with expertise in psychology and/or behaviour 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 The task was sent with instructions to willing participants via It involved reading through definitions of eight behaviour 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 Fig. 1. Dummy BCTs comprised four techniques that exist within the behaviour 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

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 behaviour change domain	Mean confidence rating (SD)	*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 to 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 to 5.69	−0.82

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

BCTs did not 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 behaviour 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 behaviour 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.

2.4. 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 did not. 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 (0.21–0.40), moderate (0.41–0.60), or good-excellent (≥0.61) [49].

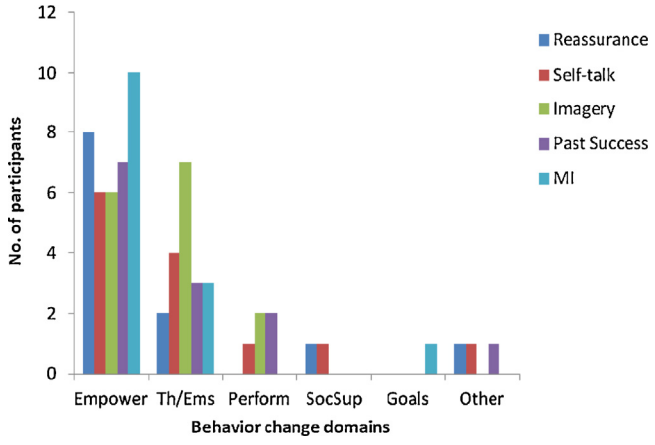

Fig. 2. Distribution of BCT-domain allocations in relation to 'empowering people to change' BCTs.

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).

To further investigate the non-significant result regarding the 'empowering people to change' domain, the distribution of judges' allocations was calculated (Fig. 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.

4. Discussion and conclusion

4.1. Discussion

To the best of 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 behaviour 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 behaviour 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 behaviour change determinants that could be addressed with patients, rather than expecting students to make sense of and apply the entire behaviour 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 did not 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 min). 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 behaviour 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 behaviour 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 behaviour 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 behaviour 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 behaviour 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.

4.3. Practice implications

By drawing upon the available evidence-base on behaviour 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 behaviour change with future patients [31]. By meeting this educational need, future doctors may be more prepared to discuss behaviour change with future patients, thereby enhancing opportunities for successful behaviour change facilitation within medical settings.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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