A service evaluation specifying the active components of a Functional RestorativeProgramme to promote management of persistent non-specific low back pain

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Background: Functional Restorative Programmes (FRP) for persistent non- specific lower back pain have been shown to be effective, but they often lack sufficient detailed reporting of the intervention components to allow for accurate replication.

Objectives: This study used the Behaviour Change Technique Taxonomy (v1) (BCTi) [1] to identify the main components of one such programme and interviewed patients to identify the most effective programme components and areas for improvement.

Design: A mixed methods design was used. Methods: Intervention data were coded using the BCT Taxonomy (v1) to identify the BCTs utilised.Following this, semi-structured interviews with nine patients evaluated the BCTs included using thematic analysis and identified possible techniques for inclusion in future developments of the programme.

Results: Forty-one different BCTs were identified in the coding phase with frequency of occurrence in the programme ranging from forty-nine to one. Four main themes emerged from the interviews: Social Support, Shaping Knowledge, Repetition and Substitution and Changes in Mindset.

Conclusion: The results of this study identify the key ingredients in a programme for persistent, non-specific lower back pain, which facilitates the replication of this intervention and identified areas patients appreciated most as well as areas for improvement.

Keywords: Behaviour Change; taxonomy; low back pain; functional restoration intervention; combined physical and psychological programm

Non-specific low back pain (NSLBP) is characterized by pain in the lower back region for which aspecific cause cannot be identified. One third of individuals experience recurring episodes, known as Persistent NSLBP (PNSLBP) [2, 3]. Combined physical and psychological interventions adopting a biopsychosocial approach to managing PNSLBP are recommended by the National Institute for Health and Care Excellence (NICE) [3,4, 5-7]. Complex interventions such as this consist of multiple 'active components'(the smallest part of an intervention that could change behaviour), interacting to facilitate behaviour change[1, 8, 9].However, limited reporting of the active components such as timing, frequency of delivery, or experience and level of facilitator expertise could hinder replication of complex interventions and reduce fidelity of intervention delivery through lack of clarity[1, 8]

The BCT Taxonomy (v1) (BCTi) is a reliable, systematic list of Behaviour Change Techniques (BCTs) allowing for transparent reporting of active components of interventions, it spans many behavioural domains that can be linked to the Behaviour Change Wheel and Theoretical Domains Framework to identify the BCTs 'mechanisms of change [1, 10, 11, 12] The BCTi is especially useful for complex interventions targeting multiple behaviours with many interacting components[13, 14] The BCTi has been used to identify BCTs within group-based interventions for musculoskeletal pain[15] back pain and osteoarthritis, [16] and physical activity

The BCTi provides a mechanism to overcome issues of poor reporting of behaviour change interventions, identified by the Consolidate Standards of Reporting Trials (CONSORT) in the reporting of active components of complex interventions due to standardised language and precisedetails around the active components of complex interventions [1,10, 11. 12].

Intervention fidelity has been previously described as a continuous process whereby intervention validity and reliability is monitored and enhanced where appropriate, more specifically, the degree to which interventions have been delivered as intended [18]. In line with the National Institute of Health (NIH) Behaviour Change Consortium, domains of treatment fidelity of interventions can bebroken down into design, training providers, delivery, receipt and enactment of interventions [19, 20].Receipt of the intervention is particularly crucial in establishing fidelity in interventions for PNSLBP. These require participants to use skills developed through the programme to facilitate self-help. Therefore, participants must appropriately recognize and understand the skills delivered inorder to successfully enact them. Despite its importance, receipt of behaviour change interventions is often the least

evaluated component of complex interventions [20]. To date the receipt of the skills delivered during an intervention for PNSLBP as an assessment of intervention fidelity has not been researched.

This paper uses a novel technique to evaluate receipt of active components during an intervention for PNSLBP. The BCTi will be mapped onto intervention materials to identify active components of the intervention. Interviews with programme participants will then be used to evaluate the extent to which participants can recognise these active components, therefore receipt of active componentsof a behaviour change intervention as well as their perceived effectiveness.

The aims of this study were to (i) use the BCTi to report the content of an existing functional rehabilitation programme for PNSLBP (‘The Back in Action programme ’[BiA]) and (ii) evaluate participants’ receipt of the identified BCTs. This method will improve understanding of the fidelityof complex interventions for PNSLBP.

Methods

Design

This study adopted a mixed-methods approach, combining structured intervention content analyses with qualitative interviews. There were two phases to the research: (1) intervention content analysisof The BiA programme using the BCTi [1] and (2) qualitative interviews to evaluate participants' receipt of the identified BCTs and explore their perceived effectiveness as well as potential use of BCTs not identified.

The Back in Action Programme uses a cognitive behavioural therapy technique called Acceptanceand Commitment Therapy, using acceptance, mindfulness and activation methods rather than focussing on changing content of patient's unhelpful thoughts and beliefs to change the impact these thoughts and beliefs have [21]. Within pain management, the focus is not to reduce patients' pain, negative automatic thoughts, or difficult emotions, but instead to accept painful sensations, feelings and thoughts [21]. Attention is focussed on opportunities of the current situation rather thanruminating about the past or catastrophising about the future, and that behaviour is focussed on function and realising valued goals instead of pain control [22]Phase 1: Intervention Content Analysis

Phase 1: Intervention Content Analysis

Design

Identification of BCTs within The BiA programme was undertaken using the BCTi [1] by the main researcher (MSc student) in collaboration with the programme leader (specialist physiotherapist), a clinical psychologist working for the programme and a health and occupational psychologist. The researcher completed the BCT Taxonomy online training tool to ensure accurate, reliable coding ofthe programme [23]. Meetings were held between the researcher and programme team members to assist in coding ambiguous aspects of the programme and ensure BCTs had not been missed.

Reliability checks were conducted between the researcher, and other members of the research teamto ensure documents were reliably coded.

Materials/Sources of Data

Intervention content data was collected using two methods:

(1)*Document analysis* including Powerpoint presentations, session plans, timetables, participant worksheets and leaflets for the cohorts from which the interviewees were chosen.

(2)*discussion between researcher and programme leader* once coding of all relevant documents and field notes was completed, was used to minimise the risk of missing BCTs. Ambiguous BCTswithin the intervention documents or field notes were also clarified

questions around BCTs that were identified or not within the intervention.

Materials

The main interview topics included:

(1) General introduction

(2) Referral and reasons for participating

(3) Experience of the programme

(4) Groupings (collection of similar BCTs) of most common BCTs in programme (5) Groupings of less common BCTs

As the first qualitative exploration of an FRP using the BCTi, questions explored participant's perceptions of which BCTs were delivered through the programme as well as perceived effectiveness of BCTs identified and potential use of BCTs not identified.

Procedure

One third of interviews were conducted in person by the primary researcher, the remainder were conducted by telephone, lasting between 12 and 35 minutes. All interviews were audio-recorded and transcribed prior to analysis. Interviews were concluded once all topic areas had been exhausted. Participants were informed they could withdraw and or request a copy of their transcript up to two weeks after the interview, after which data would be anonymised.

Data analysis

As the aim was to use a systematic method of identifying patterns within the data, Thematic analysis (TA) was used as this allows exploration of participants' perceptions of which BCTs were delivered through the programme thus their receipt of BCTs intended to be delivered, why identified BCTs were effective or not, areas for improvement and how and why additional BCTs could be incorporated into the programme [24]. Internal homogeneity was checked by ensuring coded data extracts formed a coherent pattern [24]. To ensure external homogeneity, validity of each main theme was considered by checking they accurately reflected the meanings of the whole data set [24]. Themes were further refined and data extracts for each theme organised into an internally

consistent account with the accompanying interpretative narrative.

Ethics

Ethical approval for the project was granted in addition to NHS approval of a service evaluation.

An honorary NHS contract and a Disclosure and Barring Service check were obtained to allow access to materials and interactions with patients during the programme and interviews, in line with hospital guidelines. Once consent had been obtained, participants were reassured their participation would not affect their care and the programme team would not have access to the interview transcripts or audio recordings.

Procedure

The procedure for mapping intervention content onto the BCT Taxonomy (v1) was as follows.

(1) The researcher studied in detail all documentation describing intervention content. 'The Behaviour Change Wheel Guide to Designing Interventions' was used for guidance when coding the intervention content [11] and BCTs were recorded in a table each time they were identified.

(2) Meetings were conducted with team members to clarify ambiguities and discuss BCT's to ensure agreement and full inclusion of relevant criteria.

(3) A reliability check was conducted with six per-cent of the intervention content rated by three members of the research team and BCTs included upon agreement between two of three researchers or discussion until a consensus was reached [14].

Phase 2: Interviews

Sample and Participants

Participants were recruited and interviewed using two methods. The first involved the researcher attending a gym session and inviting participants from previous cohorts to take part in the interviews. Consent was obtained on the day and three interviews were completed.

(1) Secondly, team members asked participants during programme sessions or telephone conversationsif they consented to be contacted by the researcher and participate in a telephone interview. Ten participants from a convenience sample were approached, and all agreed to

participate. Table 1 outlines participant details. One interview recording was inaudible so was not transcribed. All tookpart in a BiA programme within the previous year and completed the required 80% of the programme. Though all participants in this research had positive outcomes post intervention, the range of positive outcomes introduced heterogeneity to the data. These outcomes were representative as only one programme participant (from 96) did not achieve a clinically significant score on any outcomes.

Table 1. Participant details

Participant Letter	Gender	Age	No. of Sessions Attended	Employment Status
A	M	25	8.5/9	Employed, not working
B	F	69	9/9	Retired
C	M	37	9/9	Employed, not working
D	F	60	8.5/9	Employed, on full time duties
E	F	36	9/9	Previously employed, receiving disability
F	M	62	9/9	Self-Employed
G	F	50	8/9	Self-Employed
H	M	68	9/9	Retired
I	F	53	9/9	Employed, not working

Design

Individual interviews were conducted as participants had a range of experiences and focus groups could have led to views inconsistent with those of the group being lost. Interviews were semi structured, using open ended questions to retain focus on the main topics whilst allowing exploration of new, emerging avenues during the interview. Following the initial three interviews, minor changes were made to the interview schedule to remove less relevant questions and add

Results

Phase 1: Intervention Content Analysis

41 BCTs were agreed as being delivered analysed intervention content. The most common BCTs (Table 2) included 'Instruction on how to perform the behaviour', 'Behaviour Practice/Rehearsal', and 'Information about Emotional Consequences'. The majority of BCTs were found within materials relating to structured talks (30 of the 41 BCTs identified) with only 19 and 23 BCTs identified in class activities and supplementary materials respectively. The majority of BCTs within structured talks involved giving information regarding how and where social support could be useful in managing PNSLBP, shaping knowledge or suggesting the adoption of a new perspective. In contrast, class activities involved being told how to perform new behaviours and practicing these. Supplementary materials focused on shaping knowledge and planning. Certain groupings of BCTs such as 'Scheduled Consequences 'did not occur whilst others occurred infrequently e.g. 'Covert Learning', 'Identity', and 'Reward and Threat', though they could have occurred as a result of the programme without being explicitly included [1]. These groupings of BCTs were used to develop interview questions investigating possible benefits of incorporating these BCTs into future programmes.

Table 2. Frequency of BCTs coded for each session type within the programme ordered by frequency

Behaviour Change Technique Label	**Frequency coded in Structured Class Talks**	**Frequency coded in Class Activities**	**Frequency coded in Supplementary Materials**	**Total Frequency coded**
Instruction on how to Perform the Behaviour	18	24	7	49
Behaviour Practice/Rehearsal	3	24	0	27
Information about Emotional Consequences	14	1	4	19
Demonstration of the Behaviour	2	14	1	17
Information about Health Consequences	8	1	2	11
Information about Social and Environmental Consequences	8	2	4	14

Framing/reframing	8	2	1	11
Social Support (Unspecified)	8	0	2	10
Problem Solving	6	0	3	9
Action Planning	4	1	4	9
Information about Antecedents	6	0	3	9
Behaviour Substitution	5	1	3	9
Self-Monitoring of Behaviour	5	0	3	8
Graded Tasks	1	2	2	5
Reducing Negative emotions	4	3	0	7
Habit Reversal	4	0	3	7
Credible Source	4	0	0	4
Goal Setting (Behaviour)	4	0	1	5
Social Support (Emotional)	4	1	0	5
Re-Attribution	3	0	0	3
Exposure	0	4	0	4
Self-Talk	1	0	2	3

Pharmacological Support	1	0	1	2
Social Support (Practical)	2	1	0	3
Goal Setting (Outcome)	2	0	0	2
Pros & Cons	1	0	1	2
Verbal Persuasion about Capability	1	0	1	2
Social Comparison	1	0	0	1
Non-Specific Incentive	0	0	2	2
Self-Incentive	0	0	2	2
Non-Specific Reward	0	0	2	2
Self-Reward	0	0	2	2
Monitoring of Emotional Consequences	0	2	0	2
Focus on Past Success	0	0	0	0
Self-Monitoring of Outcomes of Behaviour	1	0	0	1
Commitment	1	0	0	1

Cue Signalling Reward	1	0	0	1
Body Changes	0	1	0	1
Vicarious Consequences	0	1	0	1
Reducing Exposure to Cues for the Behaviour	0	0	0	0
Habit Formation	0	1	0	1
Review Behaviour Goals	0	1	0	1

Table 3. Table indicating presence of BCTs in course materials, interviews or both

Behaviour Change Technique Label	**Present in course materials only**	**Present in interviews only**	**Present in both course materials and interviews**
Instruction on how to Perform the Behaviour			✓
Behaviour Practice/Rehearsal			✓
Information about Emotional Consequences	✓		
Demonstration of the Behaviour			✓
Information about Health Consequences			✓

Behaviour Change Technique Label	Present in course materials only	Present in interviews only	Present in both course materials and interviews
Information about Social and Environmental Consequences	✓		
Framing/reframing			✓
Social Support (Unspecified)			✓
Problem Solving	✓		
Action Planning	✓		
Information about Antecedents			✓
Behaviour Substitution			✓
Self-Monitoring of Behaviour	✓		
Graded Tasks			✓
Reducing Negative emotions	✓		
Habit Reversal	✓		
Credible Source	✓		
Goal Setting (Behaviour)	✓		
Social Support (Emotional)			✓

Behaviour Change Technique Label	Present in course materials only	Present in interviews only	Present in both course materials and interviews
Re-Attribution	✓		
Exposure			✓
Self-Talk	✓		
Pharmacological Support			✓
Social Support (Practical)	✓		
Goal Setting (Outcome)	✓		
Pros & Cons	✓		
Verbal Persuasion about Capability	✓		
Social Comparison			✓
Non-Specific Incentive	✓		
Self-Incentive	✓		
Non-Specific Reward	✓		
Self-Reward	✓		
Monitoring of Emotional Consequences	✓		
Focus on Past Success	✓		

Behaviour Change Technique Label	Present in course materials only	Present in interviews only	Present in both course materials and interviews
Self-Monitoring of Outcomes of Behaviour	✓		
Commitment	✓		
Cue Signalling Reward	✓		
Body Changes	✓		
Vicarious Consequences	✓		
Reducing Exposure to Cues for the Behaviour	✓		
Habit Formation	✓		
Review Behaviour Goals	✓		
Comparaitve imagining of future outcomes		✓	
Prompts/cues		√	
Identity associated with changed behaviour		√	

Disagreements during the reliability checks were discussed until a consensus could be reached between at least two of the three researchers.

Table 3 displays presence of BCTs identified in interviews, course materials or both with 7 BCTs identified in both interviews and course materials, three just in interviews and 25 in course materials only.

Phase 2: Interviews

Four main themes, each containing sub-themes emerged during analysis of the 9 interviews.

BCT cluster 3. Social Support

All participants discussed the importance of Social Support, a frequently occurring BCT. Feelings that others without PNSLBP do not understand their experiences frequently occurred leading to feelings of isolation and loneliness:

> 'you feel isolated as well because you don't feel like anybody understands '(P2).

Difficulty others have understanding why people with PNSLBP can do some activities but not others, or truly appreciate/empathise with their experiences, could hinder communication and increase feelings of isolation and loneliness:

> 'I think quite a lot of people sort of with long term back problems shut down and they stop communicating '(P4).

Participants reported feeling other members of the cohort understood their experience of PNSLBP reducing the sense of isolation:

> 'I think it helped massively in the end, I think having peers there that had the same types of problems, issues, and it's not just you've got back pain it's. ..you've got back pain, you can't work, you can't talk to your partner, your partner doesn't know and... all their experiences makes you feel that you're not on your own '(P6)

Taking part in a group programme reduced feelings of loneliness as participants realised others had similar experiences and could relate to them. The benefits of social comparison (BCT 6.2) were discussed:

> 'when we talked about things I realised everybody is doing the same and actually it wasn't as bad as I was thinking '(P7)

The support group enabled participants to see how others coped with PNSLBP and gain new perspectives on their condition and abilities. More than half of participants highlighted the social support (BCT 3.1) received from other cohort members, including sharing advice:

‘sometimes you get ideas from fellow group members ’(P5)

The group also provided emotional support (BCT 3.3) which gave participants a feeling of belonging: ‘it was like that camaraderie thing going... you know you weren’t made to feel small if you couldn’t achieve something and... we sort of boosted you forward ’(P1).

In addition to supporting participants, team members gave advice about communicating with significant others and medical professionals making it possible to have a more related dialogue and so feel less isolated and more in control (BCT 3.1):

‘although my GP is very good I’m able to have a more related conversation with him now ’(P5).

Despite this, some reported initial difficulties during group situations:

‘then you have to become friendly with somebody and it’s not something that a lot of people wanna do or perhaps they’re used to doing ’(P6).

However, all participants reported the group setting helped them find much needed advice and reduce their loneliness and isolation making it a very effective aspect of the programme.

BCT cluster 4. Shaping Knowledge

Many participants felt knowledge gained from the programme improved their self- management as they previously lacked knowledge about pain physiology including how pain and mood can be inherently linked (BCT 4.2):

‘I wouldn’t have thought exercise would help wouldn’t have thought that certain things would have helped towards the back, like mental state ’(P3)

The role play sessions demonstrating how to appropriately communicate information to healthcare professionals also came across as particularly beneficial as it increased participants knowledge of how to appropriately communicate the right information to allow them to have a more related and meaningful conversation (BCT 6.1):

‘one in particular err how to talk to your GP’…….’that was ummm when they did some play acting’…….’I think that changed my views ummmm although my GP is very good I’m able to have a more ummm related conversation with him now’

Participants found the exercise sessions beneficial, particularly increased knowledge of positive health consequences of exercising and instructions regarding safe practice of these exercises, increasing their knowledge in appropriate self-management strategies (BCT 4.1, BCT 5.1):

> 'I particularly enjoyed the exercise sessions in the mornings couldn't believe that I could actually do without damaging my back '(P5)

'you couldn't do that massive weight loss by converting fat into muscle which helped support my back a bit more if I hadn't been given the guidelines and the guidance from the programme '(P5)

Participants found value in the pain medication lectures by helping them understand their medication and its effects, giving them confidence to use it appropriately (BCT 11.1):

> 'I also enjoyed ummm the lectures they gave because you don't understand medication you're just given a little. ..prescription and sent off with things '(P1).

Participants often reported changes in their lifestyle or behaviours, perhaps in relation to new knowledge gained from the programme:

> 'Whereas before I used to get a bad back and ohhh the pain's too ahh too much today I'm gonna laze around and do nothing, that's the last thing I do now I'm up walking around '(P6)

BCT cluster 8. Repetition and Substitution

Participants also learned to pace themselves (BCT 8.7) during activities such as exercise classes or housework:

> 'yes it's important to. .not to overdo it but to pace yourself especially when you started from right....ya know .... from way down '(P8).

Teaching participants to grade tasks helped them avoid the 'boom bust cycle 'of overexerting themselves when the pain is manageable leading to an increase in pain and improve their independence as they are gradually able to do more. Participants also found practicing behaviours (BCT 8.1) such as exercise and relaxation helpful:

> It was good the way they did it because it was uhhhh kind of little and often you know so it was.....it was helpful because it got me into a routine sort of...thing so I could carry it on at home (P7)

Participants also found advice regarding the substitution of unhelpful behaviours for useful behaviours helpful for managing back pain:

> 'so whereas before I used rot get a bad back and ohhh the pains too ahhhh too much today I'm gonna laze around and do nothing, that's the last thing I do now I'm up walking around, I'll do housework, I'll go to the gym I just don't let it bother me anymore' (P6)

During the interviews, BCTs not identified as delivered in course documents were identified as potentially useful additions to the programme. Some participants felt help in the form of prompts (BCT 7.1) could be beneficial:

> 'prompts or reminders is easy especially when you're busy as most people are umm it's quite easy to slip you know and not do things for a few days or to forget '(P2).

Making the transition from a three-week intensive course to receiving help only when asked for in the six month follow up period was considered challenging, especially when returning to work when participants found it more difficult to remember or find time for activities learned during the programme.

BCT cluster 13. Changes in Mindset

One of the aims of the programme is to re-frame (BCT 13.2) individuals 'beliefs about pain and stop participants becoming consumed by pain, so they can accept its presence and live a meaningful life despite pain:

> 'this course shows you that yes you can do things your reality is different to what you perceive it to be '(P7)

Participants also discussed having a new outlook on their identity (BCT 13.5):

> 'I'm starting to feel like more ....who I was before '(P2)

The programme contained some values based educational sessions and exercises to help participants identify what their values are (BCT 13.4), although this was not always well received:

> ‘I’m not one for for...writing down feelings and and stuff something like that I so I would find it uncomfortable to do that ’(P1)

The programme also provided a level of exposure (BCT 7.7) to an undesired stimulus, e.g., exercise to help participants realise, in a safe environment, that certain stimuli are not as. Harmful as once believed:

> ‘I said at the time this is the nastiest thing ever invented’…..’ And I now booked to do pilates classes’ …….’ So if I hadn’t tried it and experienced it, I wouldn’t be doing it’ (P1)

Many participants reported feeling more confident (BCT cluster 15) post programme:

> ‘I’m more confident, I’ve spoken to my work and said look I need occupational health, I need a proper chair’ (P1)

One participant reported greater motivation to go to the gym and exercise:

> ‘it’s given me the. ...uhh motivation to keep with being active ’(P8)

There were mixed responses regarding whether a reward (BCT cluster 10) could provide a useful incentive:

> ‘you’d split the group because they’d be getting this and then you would feel a failure ’(P1)

Participants benefitted from exposure (BCT 7.7) to different activities during the programme:

> ‘If I hadn’t tried it and experienced it I wouldn’t be doing it ’(P1)

The programme used a variety of exercises and activities during the sessions to accommodate different preferences, and a variety of activities provides the opportunity to try activities participants might never previously have attempted.

Discussion

The BiA programme was found to include 41 out of 93 BCTs from the BCTi. Several BCTs occurred more than once with many aspects of the programme coded with multiple BCTs, perhaps

because they were considered more important than others, demonstrating the complexity of the intervention.

The evaluation of the receipt and effectiveness of the programme through interviews, provided support for three particular BCT clusters 'Social Support', 'Shaping Knowledge' and 'Repetition & Substitution' with some additional BCTs such as 'Pharmacological support', 'social comparison', 'demonstration of how to perform the behaviour' and 'information about health consequences'. E-mail prompts were identified as possible BCTs for future interventions, identifying BCT 7.1 'Prompts/cues ' with the use of extrinsic rewards attracting conflicting opinions.

This study supports and extends previous research by demonstrating the BCTi can be used to identify active components within a complex behaviour change intervention such as an FRP for individuals with PNSLBP as well as the more effective BCTs, as perceived by programme participants, though poor reliability of coding suggests this taxonomy is better applied during intervention development than post hoc [10, 12, 25]. This suggests the need for further clarification of BCT definitions or coding instructions [25] as identifying BCTs within interventions could lead to improved training of intervention facilitators, which could increase intervention fidelity and likelihood of achieving desired outcomes [10].

This study extended previous research by using interviews with programme participants to identify the receipt of BCTs intended to be delivered through identification of BCTs in intervention documents as well as the most useful BCTs and reasons for this. This study identified only 7 BCTs present in both the interviews and intervention materials. This could be due to difficulties in translating the language of the BCTi into that which participants could understand in order to derive the correct information in a usable way during interviews. Future researchers could seek to improve upon the interviews schedule used. As outlined previously, it is also possible that the intervention was delivered as intended but participants were unable or unwilling to use the skills outside of the intervention [20]. It is also possible frameworks used previously to assess receipt of behaviour change interventions are more appropriate such as the use of questionnaires or evaluating performance of behaviours during the intervention [18].

Many felt the BCT 'Social Support ' was useful, perhaps due to the social isolation felt as a result of others 'lack of understanding of their pain which is a commonly reported consequence of PNSLBP [26]. Though this BCT was identified as one of the most effective by programme participants, it was coded less frequently than other BCTs such as 'Instruction on how to perform the behaviour'. Future

interventions could attempt to increase occurrence by suggesting further opportunities for Social Support such as advice regarding communicating with work colleagues to increase levels of social support in work as associations have been found between increased co-worker support and reduced recovery time and time to return to work[27]. Participants reported e-mail prompts or reminders could be an effective BCT for future interventions to assist in adherence to new routines following the intervention, this could also be classed as BCT 3.1‘ Social Support (unspecified). supporting the use of increased Social Support opportunities in future interventions.

BCT 13.2 Reframing pain beliefs, BCT cluster 4 shaping knowledge and BCT cluster 2 (feedback regarding triggers or exercises to help or hinder pain management) were reportedly effective intervention components. Research found individuals with PNSLBP feel their pain takes over their life reducing ability, employment and identity[28]. Therefore, changing perspectives of pain, by increasing pain acceptance could improve outcomes. BCT cluster 15, increased self-belief in self-management was reported an effective aspect of this intervention. Previous research found loss in confidence was one of the main triggers of pain intensity and disability,[29] supporting the reported effectiveness of this BCT cluster[28, 30].

Further research into this area would be valuable to confirm initial findings. Participants ’ perceptions are crucial for informing future intervention design to facilitate engagement and meaningfulness of interventions, therefore participants were solely interviewed for this research, however future research could add value by replicating this study and instead investigating clinicians ’perspectives.

A BCT applied incorrectly is less effective, making it imperative to consider the characteristics that make a BCT a usable intervention component[31]. BCTs often co- occur and interact with each other which could influence the effectiveness of individual BCTs. Many BCTs also operate in clusters stronger than individual BCTs, obscuring their effectiveness individually[10]. Future research should investigate these issues.

A strength of this study was the amount and variety of intervention documents analysed. It is possible, despite discussions with team members, BCTs were not identified from these individual sessions due to poor recall,[13] or lack of familiarity with the Taxonomy, but training, discussion and referral to BCT guidance[12] were used to enhance the accuracy of the mapping process as

Much as possible. As a result the research shows that BCTi can be used to evaluate the ingredients of interventions post hoc which could be used to evaluate and improve existing interventions although these tools might require refinement [13] Practitioners replicating this intervention should be aware that intervention content and delivery could vary across different contexts and facilitators due to differential resource constraints [13]

Indeed, though unstructured observations were originally used to code BCTs, these proved unreliable therefore were removed from the intervention coding without much change to identified intervention content. Only one version of this programme was shadowed and it is possible BCTs were used in other cohorts but not identified within the version ofthe programme viewed. Future research could seek to map the BCTi onto different cohorts of the same programme by using video recordings of interventions to identify BCTs that were delivered but not planned within the intervention content. This could also allow identification of intensity of BCTs by identifying frequency and duration of delivery.

Another limitation of this study was having one researcher code the intervention. Although a general consensus was reached, disagreements occurred over the coding of certain BCTs during reliability checks and time constraints led to only 6% of intervention content evaluated [10, 25] Previous researchers have claimed moderate reliability for coding BCTs however the BiA programmers very large and complex in comparison to previously coded interventions. Use of two or morecoders may increase reliability and accuracy of coding of BCTs assuming agreement between coders can be reached.

The opportunistic sampling method for the interviews could have introduced bias to the sample as participants who did not benefit from the programme could be less likely to stay in contact with theteam, however, the participants within this study were thought to be representative of the whole sample. Future research could target participants with less positive outcomes to ensure drawbacks of the programme are not missed.

References

[1] Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., . . . Wood, C. E. (2013). The behaviour change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behaviour change interventions. Annals of behavioral medicine, 46(1), 81-95.

[2] NICE. (May, 2009). Low Back Pain in Adults: Early Management. Retrieved from: https://www.nice.org.uk/guidance/cg88/ifp/chapter/what-is-non- specific-low-back-pain

[3] NICE. (March, 2016). Non-Specific Low Back Pain and Sciatica Management.

Retrieved from: https://www.nice.org.uk/guidance/GID-CGWAVE0681/documents/short-version-of-draft-guideline

[4] Toye, F., & Barker, K. (2012). 'I can't see any reason for stopping doing anything, but I might have to do it differently–'restoring hope to patients with persistent non-specific low back pain–a qualitative study. Disability and rehabilitation, 34(11), 894-903.

[5] Beaudreuil, J., Kone, H., Lasbleiz, S., Vicaut, É., Richette, P., Cohen-Solal, M., ... &

Bardin, T. (2010). Efficacy of a functional restoration program for chronic low back pain: Prospective 1-year study. Joint Bone Spine, 77(5), 435-439.

[6] Hay, E. M., Mullis, R., Lewis, M., Vohora, K., Main, C. J., Watson, P., . . . Croft, P. R. (2005). Comparison of physical treatments versus a brief pain-management programme for back pain in primary care: a randomised clinical trial in physiotherapy practice. The Lancet, 365(9476), 2024-2030.

[7] Kamper, S. J., Apeldoorn, A. T., Chiarotto, A., Smeets, R. J. E. M., Ostelo, R. W. J. G., Guzman, J., & van Tulder, M. W. (2015). Multidisciplinary biopsychosocial rehabilitation for chronic low back pain: Cochrane systematic review and meta- analysis. Bmj, 350, h444.

[8] Dugdale, S., Ward, J., Hernen, J., Elison, S., Davies, G., & Donkor, D. (2016). Using the Behaviour Change Technique Taxonomy v1 to conceptualize the clinical content of Breaking Free Online: A computer-assisted therapy program for substance use disorders. Substance Abuse Treatment, Prevention, and Policy, 11, Substance Abuse Treatment, Prevention, and Policy, 2016, Vol.11.

[9] Vestjens, L., Kempen, G., Crutzen, R., Kok, G., & Zijlstra, G. (2015). Promising behaviour change techniques in a multicomponent intervention to reduce concerns about falls in old age: A Delphi study. Health Education Research, 30(2), 309- 322.

[10] Berzins, K. M., Gray, T. A., Waterman, H., & Francis, J. J. (2015). Specifying active components of educational interventions to promote adherence to treatment in glaucoma patients: Application of a taxonomy of behaviour change techniques. Psychology Research and Behaviour Management, 8, 201-209.

[11] Michie, S., Atkins, L., & West, R. (2015). The behaviour change wheel: A guide to designing interventions. London: Silverback Publishing

[12] Steinmo, S., Fuller, C., Stone, S. P., & Michie, S. (2015). Characterising an implementation intervention in terms of behaviour change techniques and theory: The 'sepsis six' clinical care bundle. Implementation Science : IS, 10(1), 111.

[13] Dombrowski, S. U., Sniehotta, F. F., Avenell, A., Johnston, M., MacLennan, G., & Araújo-Soares, V. (2012). Identifying Active Ingredients in Complex Behavioural Interventions for Obese Adults with Obesity-Related Co-Morbidities or Additional Risk Factors for Co-Morbidities: A Systematic Review. Health Psychology Review, 6(1), 7-26.

[14] Michie, S., Whittington, C., Hamoudi, Z., Zarnani, F., Tober, G., & West, R. (2012). Identification of Behaviour Change Techniques to Reduce Excessive Alcohol Consumption. Addiction, 107(8), 1431-1440.

[15] Keogh, A., Tully, M. A., Matthews, J., & Hurley, D. A. (2015). A Review of Behaviour hange Theories and Techniques used in Group Based Self- Management Programmes for Chronic Low Back Pain and Arthritis. Manual therapy, 20(6), 727-735.

[16] Hurley, D. A., Hall, A. M., Currie-Murphy, L., Pincus, T., Kamper, S., Maher, C., ... & Segurado, R. (2016). Theory-driven group-based complex intervention to support self-management of osteoarthritis and low back pain in primary care physiotherapy: protocol for a cluster randomised controlled feasibility trial (SOLAS). BMJ open, 6(1), e010728.

[17] Mitchell, J. C., Pears, S. T., Sutton, S., Hardeman, W., Vasconcelos, J., Prevost, A., & Wilson, E. (2016). Effectiveness and cost-effectiveness of a very brief physical activity intervention delivered in NHS Health Checks (VBI Trial): Study protocol for a randomised controlled trial. Trials, 17(1)

[18] Rixon, L., Baron, J., McGale, N., Lorencatto, F., Francis, J., & Davis, A. (2016). Methods used to address fidelity of receipt in health intervention research: a citation analysis and systematic review. BMC Health Services Research, 16(663), DOI 10.1186/s12913-016-1904-6

[19] Bellg, A. J., Borrelli, B., Resnick, B., Hecht, J., Minicucci, D. S., Ory, M., Ogedegbe, G., Orwig, D., Ernst, D., Czajkowski, S., & Treatment Fidelity Workgroup of the NIH Behavior Change Consortium (2004). Enhancing treatment fidelity in health behavior change studies: best practices and recommendations from the NIH Behavior Change Consortium. Health psychology, 23(5), 443–451. doi: 10.1037/0278-6133.23.5.443

[20] O'Shea, O., McCormack, R., Bradley, J. M., & O'Neill, B. (2016). Fidelity Review: A scoping review of the methods used to evaluate treatment fidelity in behavioural change interventions. Physical Therapy Reviews, 21(3-6), 207-214. https://doi.org/10.1080/10833196.2016.1261237

[21] Hann, K. E. J., & McCracken, L. M. (2014). A systematic review of randomised controlled trials of Acceptance and Commitment Therapy for adults with Chronic Back pain: Outcome domains, design quality and efficacy. Journal of Contextual behavioural Science, 3, 217-227

[22] McCracken, L. M., & Vowles, K. E. (2014). Acceptance and Commitment Therapy and Mindfulness for Chronic Back Pain: Model, Process and progress. American Psychologist, 69(2), 178-187

[23] BCT-Taxonomy (2014, May 6th). BCT Taxonomy v1 Online Training. Retrieved from: http://www.bct-taxonomy.com

[24] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77-101.

[25] Direito, A., Dale, L. P., Shields, E., Dobson, R., Whittaker, R., & Maddison, R. (2014). Do Physical Activity and Dietary Smartphone Applications Incorporate Evidence- Based Behaviour Change Techniques? BMC Public Health, 14(1), 646-646.

[26] Mathew, Singh, Garis, & Diwan. (2013). Backing up the stories: The psychological and social costs of chronic low-back pain. The International Journal of Spine Surgery, 7(1), E29-E38.

[27] Campbell, P., Wynne-Jones, G., Muller, S., & Dunn, K. M. (2013). The influence of employment social support for risk and prognosis in nonspecific back pain: a systematic review and critical synthesis. International Archives of Environmental Health, (86), 119-137

[28] Walker, J., Sofaer, B., & Holloway, I. (2006). The experience of chronic back pain: accounts of loss in those seeking help from pain clinics. European Journal of Pain, 10(3), 199-199.

[29] Costa, L. D. C. M., Maher, C. G., McAuley, J. H., Hancock, M. J., & Smeets, R. J. (2011). Self- efficacy is more important than fear of movement in mediating the relationship between pain and disability in chronic low back pain. European Journal of Pain, 15(2), 213-219.

[30] McCracken, L. M. (1998). Learning to live with the pain: acceptance of pain predicts adjustment in persons with chronic pain. Pain, 74(1), 21-27.

[31] Peters, G. J. Y., de Bruin, M., & Crutzen, R. (2015). Everything should be as simple as possible, but no simpler: towards a protocol for accumulating evidence regarding the active content of health behaviour change interventions. Health Psychology Review, 9(1), 1-14.

Highlights

- The BCT Taxonomy can highlight BCTs included within a PNSLB programme post hoc.
- Reliability of coding should be further investigated
- Participant Interviews can identify effective BCTs and BCTs to be added
- Future research should interview clinicians.
- Future research should use video recordings to identify (un)planned BCTs delivered.
- A service evaluation specifying the active components of a Functional Restorative Programme to promote management of persistent non-specificlow back pain
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