

**Evaluation of the implementation of the Back Skills Training (BeST) programme using online
training: a cohort implementation study**

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**Evaluation of the implementation of the Back Skills Training (BeST) programme using online
training: a cohort implementation study**

Contribution of the paper

- Online training is a feasible and sustainable method of training clinicians to deliver a cognitive behavioural approach for patients with low back pain.
- Improvement in patient outcomes demonstrated that research can be successfully translated into routine care.
- The online training is now available globally to enable wider implementation of a clinical and cost-effective intervention for patients with low back pain.

Keywords

Cognitive Behaviour Approach, Low Back Pain, Implementation

Background

Low back pain (LBP) is the largest cause of disability in the United Kingdom (UK), with direct costs per annum of around £2.8 billion (1, 2). The Back Skills Training (BeST) programme, a cognitive behavioural approach (CBA) for LBP, was effective in reducing pain and disability in a large randomised controlled trial (3, 4). This group intervention was highly cost-effective at current levels of willingness to pay (3). Participants attend an individual session (60 minutes) followed by six group sessions (90 minutes each). Topics include pain education, overcoming unhelpful thoughts and behaviours, goal setting, baseline setting, pacing, and the role of exercise (5). Participants undertake a collaboratively set home exercise programme. Other high-quality trials using similar interventions have added to a body of evidence (6-8) leading to guidelines recommending such combined physical and psychological interventions (9-11).

Moving an intervention from research into clinical practice is challenging (12, 13). In the BeST trial, clinicians received two-days of training from the research team. This is not feasible or sustainable for widespread implementation. Hence, online training was chosen as a viable training option. The theory of constructivism underpinned the organisation of the online training (14, 15). The Grol and Wensing Implementation of Change Model underpinned the implementation processes (16). These are described in detail in the successive qualitative and quantitative studies which were undertaken to evaluate and refine the training (17-19). The enhanced training was launched in the UK in March 2016.

We aimed to evaluate the effectiveness of the enhanced online training programme as an implementation strategy for BeST in the National Health Service (NHS) in a large cohort of NHS Trust hospitals who had no prior experience of delivering the programme. Our objectives were (i) to measure the effect of the online training on learning outcomes for clinicians who completed the training (stage 1), (ii) to estimate the treatment outcomes for patients who received the BeST intervention from clinicians who completed the online training and to compare the patient

outcomes to the results of the BeST trial (stage 2). This study also informed the final improvements to the training before making it widely available.

Methods

Design

A two-stage observational cohort implementation study.

Recruitment

Clinicians (e.g. physiotherapists, nurses, occupational therapists, psychologists) working with patients with LBP in UK NHS Trusts were eligible for stage 1. No other eligibility criteria were applied. An advertising strategy was used to raise awareness and invite clinicians to enrol in the training including academic publications, articles in professional practice journals (20), advertisements, social media, conference trade stands and personal networks. Interested clinicians registered for the training and consented to data collection.

Clinicians completing the online training were invited to take part in stage 2. If they agreed, clinicians provided all patients over 18 years of age with LBP who were due to attend a BeST group with an information sheet and an invitation to participate. Patient's eligibility to the BeST programme was determined by the treating clinician and no specific inclusion/exclusion criteria was provided by the study team.

Ethical approval

University of Oxford's Central University Research Ethics Committee (CUREC) reviewed this study and deemed it to be a service evaluation that does not require ethical approval. Clinicians implementing the programme (Stage 2) were required to register with the Trusts clinical audit team.

Clinicians (Stage 1) and patients (Stage 2) provided informed consent for sharing of personal details with the study team.

Intervention

The online training was developed on Adobe Captivate and hosted by Amazon Web services (21).

The core content for the training was unchanged from the BeST trial but adapted for the online platform. It included videos, images, case scenarios, quizzes with feedback and tests. There were 10 modules which covered the CBA to pain management, how to conduct the assessment and group sessions and guidance on barriers to implementation (18, 19). A comprehensive therapist manual and patient materials could be downloaded. Case vignettes designed to elicit clinician's knowledge about psychosocial risk factors and treatments were completed at the end of the training. Clinicians had to score 80% or above to download a completion certificate. The training took approximately 10 hours and was accredited by the British Psychological Society.

Data collection

In stage 1, learning outcomes were collected before and after completion of the training using questionnaires embedded within the training. Clinicians were categorised as course completers if they completed all the training modules. The completers were followed up 4- and 12-months after training completion via email with a link to an online questionnaire. Email reminders were used.

In stage 2, patients completed a questionnaire in the initial assessment session, and after the final group session. Independent researchers contacted patients with outcome questionnaires by post at 3- and 12-months post treatment. If questionnaires were not returned after 4 weeks, the research team carried out reminder telephone calls and collected core outcomes (pain and perception of recovery measure).

Outcome measures

In stage 1, clinicians provided name, place of work, profession, age range, prior experience of a CBA, and number of LBP patients treated per month. Learning outcomes were assessed with the Pain Attitude and Belief Scale (PABS, 19 items) (22, 23) consisting of a 'Biomedical' (scores: 10-60; higher score = greater biomedical attitudes and beliefs) and 'Psychosocial' subscale (scores: 9-54; higher score = greater psychosocial attitudes and beliefs). We assessed perceived competence to implement the programme using two items from the Perceived Competence Scale (PCS; confidence in their ability, confidence in their capability; 1 (not at all true) to 7 (very true)) (24). Intention to implement the programme was measured on training completion, 4 and 12 month follow-up by asking their agreement with the statement "I intend to implement the BeST programme" (1=strongly agree to 7=strongly disagree) (25). Actual implementation was collected at follow-up with the question "since completion of online training have you run one BeST programme?" (yes/no). Barriers to implementation were collected through free-text responses.

In stage 2, patients provided age, gender, duration of LBP, and employment status at baseline. Attendance at each session was recorded to assess compliance. At baseline, programme completion, 3- and 12-month follow-up, patients completed a Numerical Rating Scale (NRS) (26) for pain (0-10 scale; higher score = greater pain) and the Patient Specific Functional Scale (PSFS) (27). The PSFS asked patients to select and rate up to three functional activities (0-10 scale; higher score = better function). On programme completion, patients completed a Global Rating of Change (GROC) scale (28, 29) (1-7 scale; higher score=better recovery) and rated the satisfaction and usefulness of the programme using the Client Satisfaction Questionnaire (CSQ; 6 items scored 1-4) (30). The GROC was also completed at 3- and 12-month follow-up.

133 Data analysis

134 Stage 1

135 We estimated change scores between baseline and follow-up as the median and 95% confidence
136 interval (CI; due to non-normality) and compared scores using the Wilcoxon signed-rank test. We
137 dichotomised the competence scores, ≥ 4 - confident to implement and < 4 - not confident to
138 implement. For intention to implement, we assigned scores: 1-3 - intending to implement, 4 -
139 unsure, and > 4 - not intending. Reported barriers to implementation (free-text responses) were
140 collated and similar responses were grouped into categories (by TS). The characteristics of clinicians
141 who were completer/non-completers and implementers/non-implementers were compared using
142 chi-squared tests.

143 Stage 2

144 We estimated change in pain and function as the mean change and 95% CI and compared scores
145 using paired t-tests (due to normality). Effect size (Cohen's d) was calculated and interpreted as
146 small (0.2), medium (0.5) and large (0.8) (31-33). For the GROC scale, we assigned scores: 1-3 -
147 improved, 4 - no change and 5-7 - declined. The proportion of participants in each category was
148 calculated for the GROC and items of the satisfaction questionnaire. Compliance with the
149 intervention was defined as attending the initial assessment and three or more group sessions
150 consistent with the BeST trial. We assessed the levels and patterns of missing data. The
151 characteristics of compliers/non-compliers and responders/non-responders to follow-up were
152 compared using independent t-tests and chi-square tests as appropriate.

153 We compared demographics of the patients and effect sizes of the patient outcomes (GROC,
154 function and pain scales) from stage 2 with those of the participants randomised to the BeST
155 intervention in the BeST trial.

We used all available data, and as missingness varied, the contributors are not the same for each analysis. SPSS version 25 was used for all analyses.

Results

Stage 1

Stage 1 was undertaken between March 2016 and August 2018. A total of 1324 clinicians from 157 NHS trusts enrolled on the training, of which 586 clinicians (44%) from 101 NHS trusts completed the training (Figure 1). The median number of therapists who enrolled and completed training in each trust was 3 (IQR: 2.8, range: 1-73) and 1 (SD: 0-3, range: 0-40) respectively. Of the training completers, 474/586 (81%) from 88 NHS trusts completed the post-training questionnaire. However, data was only retrievable from 443/586 (76%) due to problems with the website. There were no differences in the characteristics of those who did and did not complete the training or between training completers who did and did not complete the post-training questionnaire (Supplementary Table 1).

The majority of enrollers were physiotherapists (1240/1324, 94%) with small numbers of nurses (29/1324, 2%) and occupational therapists (11/1324, 1%). More females than males enrolled (423/1324, 32% males versus 894/1324, 68% females). Professional experience ranged from less than a year to over 30 years. Half of those enrolled treated more than 20 patients with LBP per month (675/1324, 51%).

Amongst completers providing post-training data, PABS scores showed a statistically significant shift towards a biopsychosocial model (Table 1) and the majority (434/442, 98%) were confident in their ability to implement. Approximately half (230/442, 52%) felt confident in their capability to implement. More than half of the training completers intended to implement (253/443, 57%), some were unsure (85/443, 19%) and others did not intend to implement the intervention (105/443, 24%).

Clinicians with more than 10 years of experience were less intent on implementing compared to less experienced clinicians ($p=0.00$). There were no other differences between intenders and non-intenders (Supplementary Table 1).

Of those due follow-up (381/474) when the study funding period ended, 148/381 (39%) clinicians from 54 NHS Trusts provided data. There were no differences between follow-up responders and non-responders (Supplementary Table 1). One third of respondents (49/148, 33%) from 27 NHS Trusts reported undertaking at least one BeST group since completing the training. The programme was only implemented by physiotherapists. Five nurses responded to follow-up, but none had implemented the programme. Those seeing greater numbers of patients with LBP were more likely to report implementation ($p=0.003$) (Supplementary Table 1). Half (35/71, 50%) of those who intended to implement had done so. Some clinicians (13/72, 18%) who were unsure/had not intended to implement had still done so (13/72, 18%). Implementers and non-implementers were mixed in their intentions of further implementation. All implementers felt the programme was useful for their patients.

Implementers reported lack of suitable patients with LBP, patient drop-out and reluctance to attend, space and time to introduce changes in their service as barriers to implementation. Those who did not implement said that barriers included staff capacity/time, being rotational staff, managerial/organisational support and funding issues. Some participants reported using the knowledge/skills from the training programme in their routine practice although they did not run a group while some reported that other staff within their workplace were running the programme.

Stage 2

Stage 2 was undertaken between March 2016 and May 2019. The flow of patients is shown in Figure 2. A total of 21 UK NHS Trusts (England: 19, Wales: 2) delivered the BeST programme at 34 sites. In total, 923 patients attended 160 groups with a mean group size of six (SD 2.3, range 1-12). More

204 women than men attended the groups (68% versus 32%). The mean (SD) age of the patients was
 205 55.2 (14.2) years. Patients on average (SD) had LBP for 12.8 (12.1) years. Nearly half of the patients
 206 (49%; 275/562) were working, 32% (182/562) were retired and 19% (105/562) were not working.
 207 The majority of patients (651/807, 80%) attended the initial session and three or more group
 208 sessions and were classified as compliers.

209 Fifty six percent (505/901) of patients provided data at 3-month follow-up. Of those due 12-month
 210 follow-up (730/901) when the study funding period ended, 50% (364/730) provided data. Patients
 211 who were retired (32% of responders versus 8% of non-responders at 12-month follow-up) and/or
 212 those classified as compliers (79% of responders versus 60% of non-responders at 12-month follow-
 213 up) were more likely to complete follow-up assessments at all time points.

214 The mean change from baseline to each follow-up time point was statistically significant for both
 215 pain ($p < 0.001$) and function ($p < 0.001$) (table 2). Effect sizes were in the range of small to medium for
 216 pain and medium to large for function (table 2).

217 The majority of patients (488/633, 77%) reported at least some improvement post treatment with
 218 the remaining reporting no change (115/633, 18%) or a decline (30/633, 5%). 303/502 (60%) and
 219 189/359 (53%) patients reported improvement at 3 and 12 months respectively, while 75/359 (21%)
 220 patients reported decline at 12 months (figure 3). More than 80% of the patients indicated
 221 satisfaction with the programme ($n=628$, figure 4).

222 The demographics of the patients in stage 2 were similar to that of the participants allocated to the
 223 BeST groups in the BeST Trial ($n=466$) (3) (Supplementary Table 2). Both studies reported a similar
 224 effect for function at 12 months follow-up [current study: 0.56 (0.42 to 0.71); BeST trial: 0.56 (0.45
 225 to 0.67)]. Participant's perception of recovery at 12 months were also similar. At the 12-month
 226 follow-up, a medium effect size was observed for pain in the BeST trial [0.58 (0.48 to 0.68)] whereas
 227 in the current study, a small effect was observed [0.34 (0.23 to 0.45)].

228

229 **Discussion**

230 This study evaluated the translation of an evidence-based (3, 4) group CBA for people with
231 persistent LBP into routine care. To aid implementation, an online training was developed to train
232 clinicians to deliver the BeST programme. The use of web based training is increasing (34) and we
233 demonstrated that clinicians can be trained to deliver a CBA using online training. We attracted a
234 relatively high number of NHS clinicians to the training with a simple marketing strategy, and our
235 completion rates were higher than other online courses (35). A desired shift towards a
236 biopsychosocial model of thinking demonstrated successful knowledge translation.

237 Although the majority of clinicians were confident in their ability to implement BeST, their
238 confidence in their capability to implement was lower. These terms were not defined in the
239 questionnaire, but ability relates to skills and knowledge while capability refers to power or
240 potential. This definition matches the types of barriers identified in this study and our earlier work
241 (19). External factors (e.g. organisation, time) rather than individual factors (e.g. attitudes towards a
242 psychosocial model) were the main barriers to implementation. Better awareness of these barriers
243 may have contributed to the lower implementation intention in more experienced clinicians.
244 However, clinician experience did not impact actual implementation.

245 Implementation rates from those who responded were reasonable with 33% at individual level and
246 34% at trust level. Some trusts trained large numbers of therapists, for example, six trusts trained
247 over 20 physiotherapists, and it is unlikely that all would be able to deliver the programme within a
248 single Trust. Clinicians identified this as one of the reasons for non-implementation. Some clinicians
249 indicated that they did not implement the programme but used the training to inform their clinical
250 practice suggesting successful knowledge translation. We used a bottom-up implementation
251 approach targeting clinicians, and we recognise (and recommend) that this may need to be

combined with a top-down implementation approach (e.g. central coordination, pooled resources) to achieve large-scale implementation (36, 37).

An evaluation of the BeST online training was undertaken by an independent research team. This qualitative study with physiotherapists supported the use of the training but highlighted the need for interaction and support to facilitate implementation (38). This included helping clinicians deal with the challenges of implementation (38). In response, we added content on how to set up groups and overcome barriers. This revised training is now available free of charge worldwide in partnership with Future Learn (<https://www.futurelearn.com/courses/back-skills-training-programme>). Key features include learning as a group, support and feedback from course instructors, interaction and support from peer learners, reminders to complete training and technical support.

Patients who participated in the BeST programme reported improvements in pain and function and the majority considered themselves to have improved, implying successful implementation. Patients were highly satisfied with the treatment received. Changes in function reached clinical significance and were consistent with the BeST trial (39, 40). Although initial response in pain were good, these were not sustained at 12 month follow-up by the same degree as the BeST trial and did not reach clinical significance (39, 40). The main focus of the BeST programme is to help participants increase function rather than pain reduction. Better outcomes in clinical trials could be influenced by the higher motivation and engagement of participants who volunteer for a trial, the possibility of close monitoring to ensure fidelity and the availability of resources for high-quality data collection (41, 42). We did not evaluate the fidelity of group delivery which may have impacted the outcomes achieved. Future implementation work should consider fidelity assessments to ensure programmes are being delivered as intended. As we were reliant on busy clinicians to collect outcomes, data collection had to be made simple and therefore, we used different measures (NRS for pain) compared to the BeST trial (Modified Von Korff Scale). Patients in this study rated their current pain,

while in the BeST trial, it was the average pain over the last 4 weeks This may have resulted in different findings.

A limitation of the study was missing data. The most significant challenges with the online training were issues related to access and stability of the online platform which contributed to missing data and transferring the training to the Future Learn platform. Low response rates to evaluations are common with online training which is not limited to the BeST training.

The BeST intervention was designed to be delivered by all clinicians working with people with LBP, but uptake was dominated by physiotherapists. Future implementation work could focus on targeting uptake by other professionals to maximise access to the programme. The BeST programme is cost-effective (3) but we did not have funding to complete a health economic analysis of the implementation, so we would recommend this be undertaken in future.

Conclusion

Online training is a feasible and sustainable method of training clinicians to deliver a cognitive behavioural approach for patients with LBP. The training had good reach into NHS Trusts using a simple marketing campaign, although not everyone trained implemented the programme. We demonstrated worthwhile improvements in function that were consistent with the BeST trial and satisfaction levels were high amongst patients. The online training is now available globally to enable wider implementation of a clinical and cost-effective intervention for patients with low back pain.

Word count: 3147 words

Conflict of Interest: None

Table 1: Outcomes from clinicians completing the online training (Stage 1)

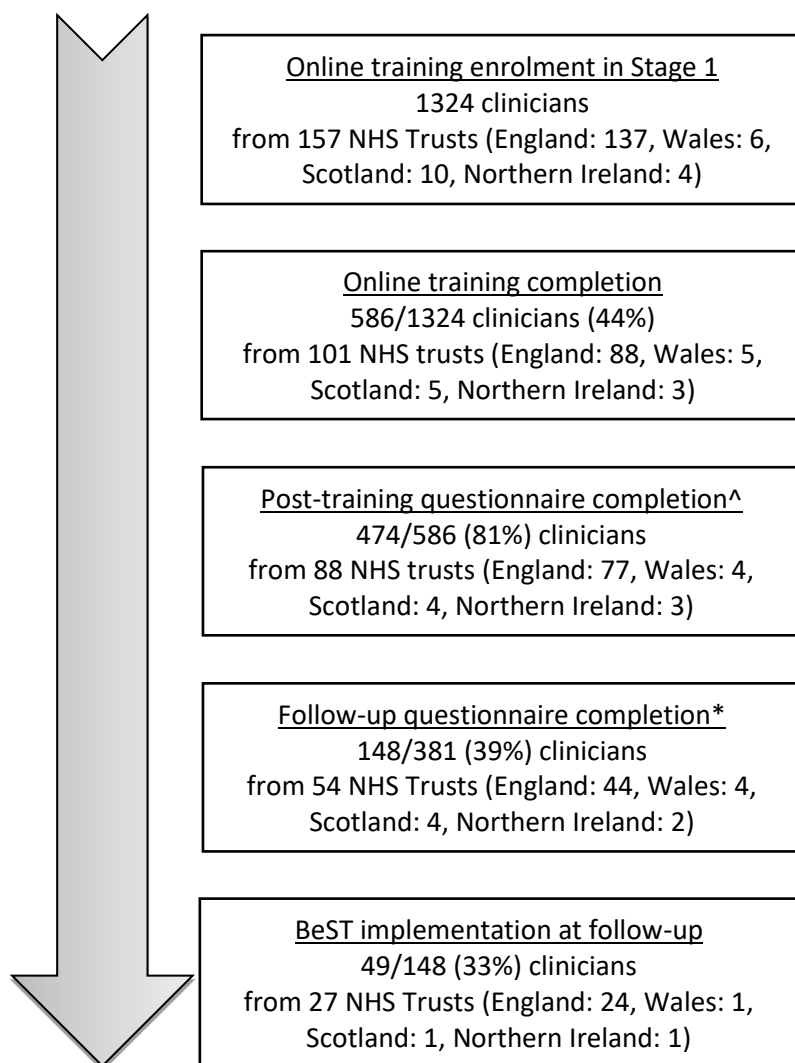
	N	Pre-training Median (IQR)	Post-training Median (IQR)	Median change (95% CI for the median)
PABS Biomedical score	370	29 (23-34)	24 (20-28)	-4 (-5 to -3)*
PABS Biopsychosocial score	370	36 (32-39)	37 (35-40.25)	2 (1 to 3)*

* - statistically significant (p<0.001)

Table 2: Results for pain and function measure (patient outcomes in Stage 2)

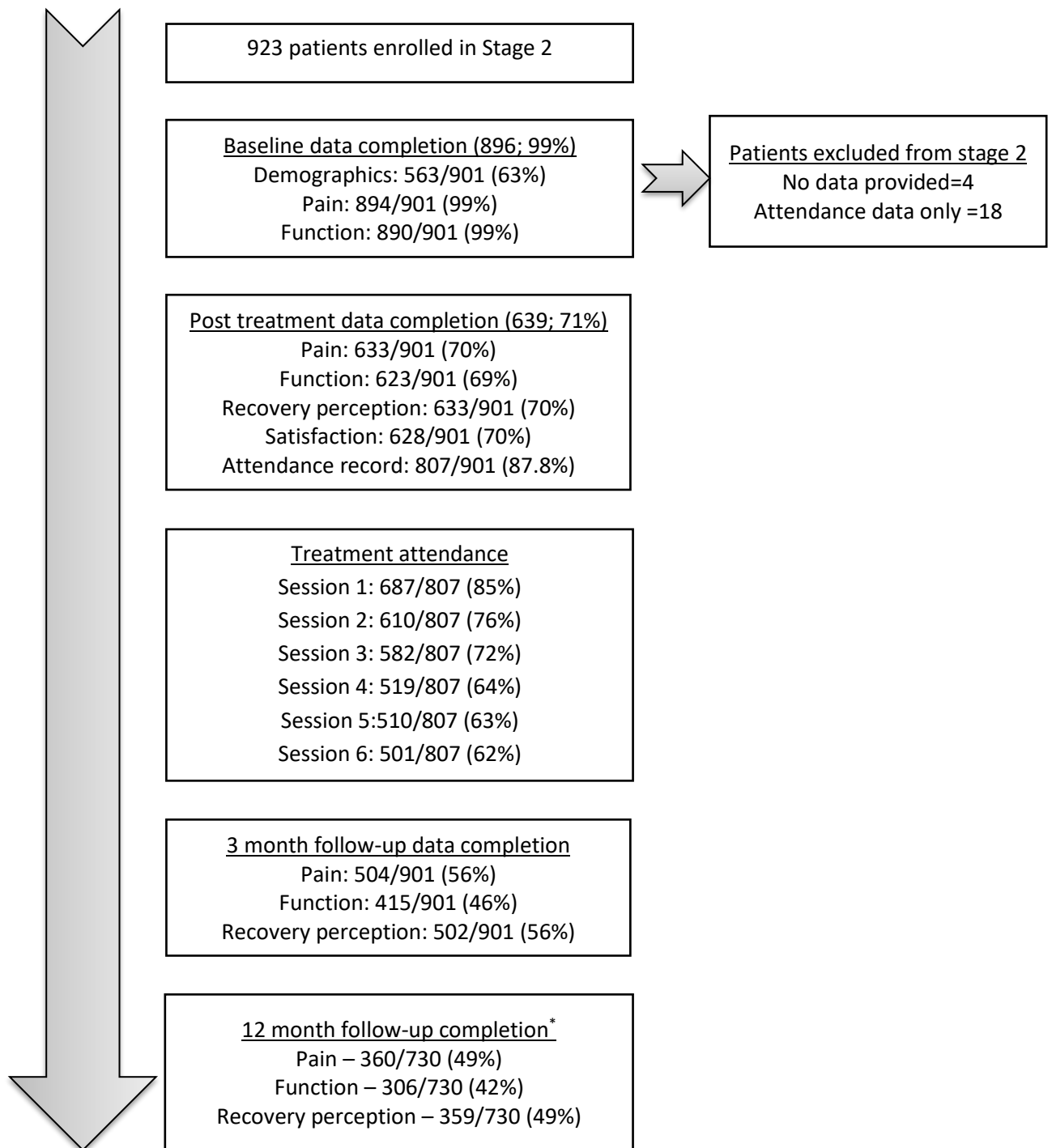
Measure	Time points	N	Baseline Mean (SD)	End point Mean (SD)	Mean change (95% CI)	Effect size: Cohen's d (95% CI)
Pain (NRS)	Post treatment	627 [^]	6.19 (1.96)	5.07 (2.1)	-1.12* (-1.28 to -0.96)	0.55 (0.47 to 0.63)
	3 month follow-up	502 [^]	6.07 (1.99)	5.16 (2.42)	-0.91* (-1.11 to -0.71)	0.40 (0.31 to 0.49)
	12 month follow-up	358 [^]	6.04 (2.05)	5.2 (2.67)	-0.84* (-1.1 to -0.58)	0.34 (0.23 to 0.45)
Function (PSFS)	Post treatment	623 [^]	3.41 (1.95)	5.41 (2.03)	2* (1.83 to 2.18)	0.89 (0.80 to 0.98)
	3 month follow-up	417 [^]	3.41 (1.82)	5.39 (2.33)	1.98* (1.71 to 2.25)	0.71 (0.58 to 0.84)
	12 month follow-up	310 [^]	3.5 (1.75)	5.05 (2.48)	1.55* (1.25 to 1.86)	0.56 (0.42 to 0.71)

* - statistically significant (p<0.001); [^]Numbers here refer to complete data sets for each time point comparison with baseline and therefore it differs from the numbers presented in Figure 2 which refer to individual time points.



^Due to technical issues with the website, post-training assessment data was available only for 443/474 clinicians *Of the 474 clinicians who had completed the post-training questionnaire, 93 were not due their follow-up at the end of the study period so are not included in this analysis.

Figure 1: Clinician flow through Stage 1



*171 patients were not due their 12 month follow-up at the end of the study period so are not included in this analysis.

Figure 2: Patient flow through stage 2

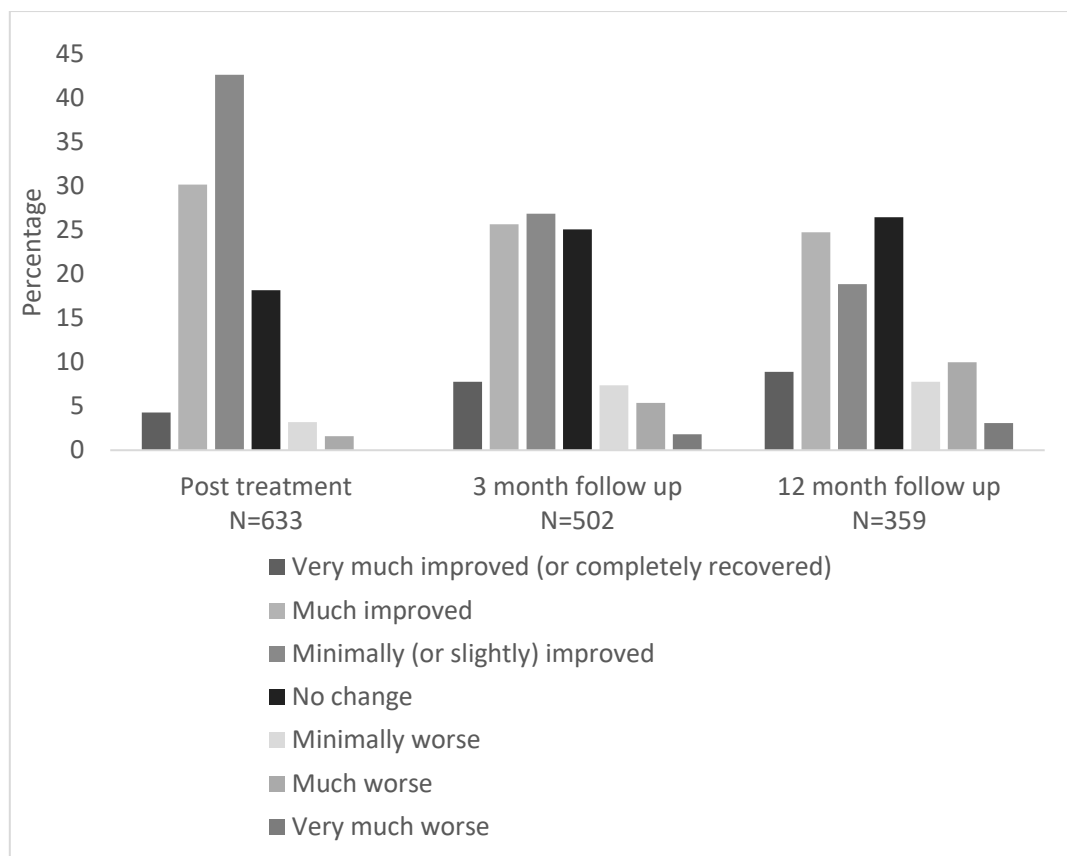
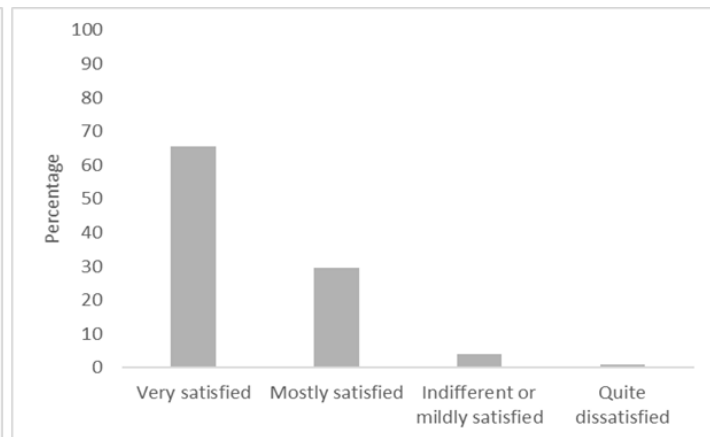


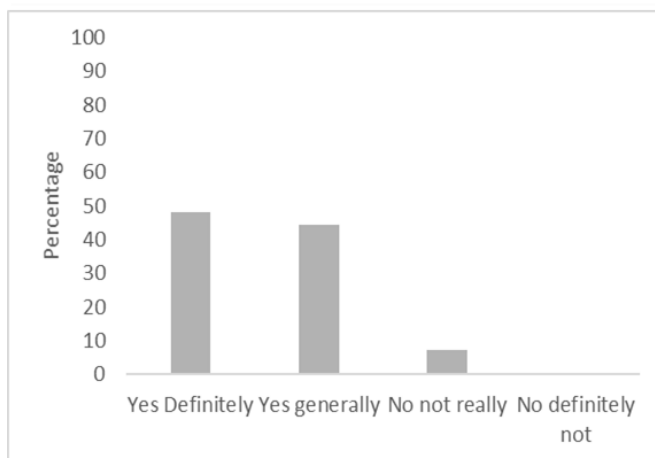
Figure 3: Perception of recovery (%) at each time point for patients (n=628) (Stage 2)



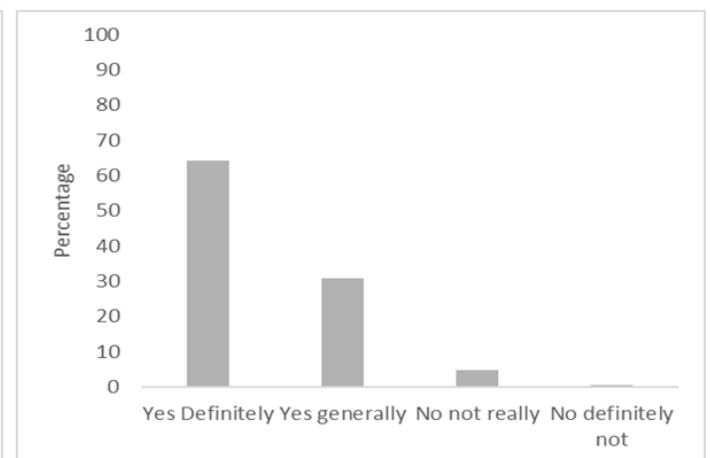
How would you rate the quality of the service you received?



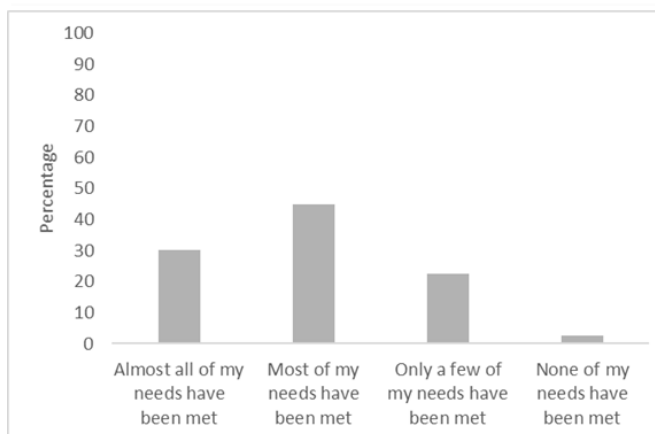
How satisfied are you with the amount of help you received?



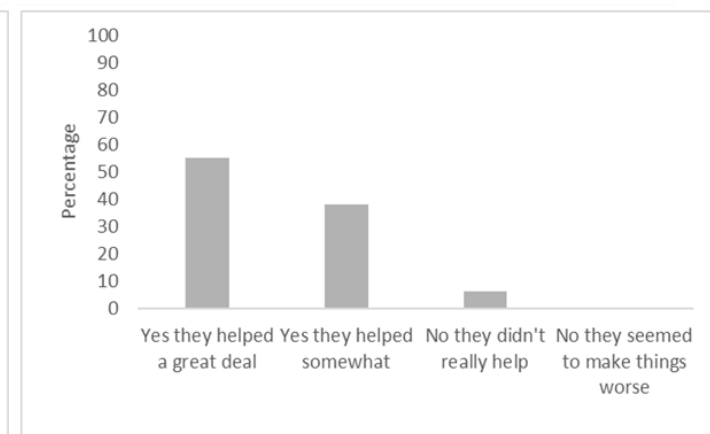
Did you get the kind of service you wanted?



If a friend were in need of similar help, would you recommend our program to him or her?



To what extent has our program met your needs?



Have the services you received helped you to deal more effectively with your problems?

319
320

Figure 4: Satisfaction responses from patients (n=628) (Stage 2)

Supplementary table 1: Demographics of clinicians at various stages of Stage 1

	Enrollers	Course completion status		Post-training assessment completion status		Implementation intention*			Follow-up assessment completion status ^{&}		Implementation at follow-up	
		Course completers	Course non-completers	Assessment completers	Assessment non-completers	Intenders	Unsure	Non-intenders	Assessment completers	Assessment non-completers	Implementers	Non-implementers
Number of clinicians	1324	586 (44%)	738 (56%)	474/586 (81%)	112/586 (19%)	253/443 (57%)	85/443 (19%)	105/443 (24%)	148/381 (39%)	233/381 (61%)	49/148 (33%)	99/148 (24%)
Occupation												
Physiotherapist	1240 (94%)	558 (95%)	682 (92%)	450 (95%)	108 (97%)	241 (95%)	83 (98%)	95 (91%)	139 (94%)	221 (95%)	45 (92%)	94 (95%)
Nurse	29 (2%)	12 (2%)	17 (2%)	12 (3%)	0	6 (2%)	1 (1%)	5 (5%)	5 (3%)	7 (3%)	0	5 (5%)
Occupational therapist	11 (1%)	3 (1%)	8 (1%)	2 (0%)	1 (1%)	0	0	2 (2%)	1 (1%)	1 (0%)	1 (2%)	0
Others	37 (3%)	10 (2%)	27 (4%)	7 (2%)	3 (3%)	4 (2%)	1 (1%)	2 (2%)	2 (1%)	3 (1%)	2 (4%)	0
Information not available	7 (1%)	3 (1%)	4 (1%)	3 (1%)	0	2 (1%)	0	1 (1%)	1 (1%)	1 (0%)	1 (2%)	0
Gender												
Female	894 (68%)	390 (67%)	504 (68%)	312 (66%)	78 (70%)	161 (64%)	54 (64%)	75 (71%)	94 (64%)	149 (64%)	34 (69%)	60 (61%)
Male	423 (32%)	194 (33%)	229 (31%)	161 (34%)	33 (29%)	91 (36%)	31 (37%)	30 (29%)	54 (37%)	83 (36%)	15 (31%)	39 (39%)
Rather not say	7 (1%)	2 (0%)	5 (1%)	1 (0%)	1 (1%)	1 (0%)	0	0	0 (0%)	1 (0%)	0	0
Prior experience (number of years worked in profession)												
<1	283 (21%)	124 (21%)	159 (22%)	101 (21%)	23 (21%)	65 (26%)	20 (24%)	13 (12%)	30 (20%)	62 (27%)	11 (22%)	19 (19%)
1-5	146 (11%)	57 (10%)	89 (12%)	50 (11%)	7 (6%)	39 (15%)	4 (5%)	5 (5%)	6 (4%)	17 (7%)	2 (4%)	4 (4%)
6-9	227 (17%)	98 (17%)	129 (18%)	79 (17%)	19 (17%)	43 (17%)	17 (20%)	13 (12%)	25 (17%)	41 (18%)	12 (25%)	13 (13%)

10-19	372 (28%)	169 (29%)	203 (28%)	133 (28%)	36 (32%)	63 (25%)	19 (22%)	38 (36%)	45 (30%)	61 (26%)	16 (33 %)	29 (29%)
20-29	191 (14%)	90 (15%)	101 (14%)	71 (15%)	19 (17%)	25 (10%)	16 (19%)	23 (22%) [§]	22 (15%)	36 (16%)	5 (10%)	17 (17%)
>30	81 (6%)	36 (6%)	45 (6%)	29 (6%)	7 (6%)	13 (5%)	6 (7%)	10 (10%) [§]	13 (9%)	13 (6%)	3 (6%)	10 (10%)
Information not available	24 (2%)	12 (2%)	12 (2%)	11 (2%)	1 (1%)	5 (2%)	3 (4%)	3 (3%)	7 (5%)	3 (1%)	0	7 (7%)
Number of low back pain patients treated per month												
0-5	103 (8%)	39 (7%)	64 (9%)	28 (6%)	11 (10%)	15 (6%)	5 (6%)	7 (7%)	6 (4%)	16 (7%)	3 (6%)	3 (3%)
6-10	149 (11%)	62 (11%)	87 (12%)	47 (10%)	15 (13%)	25 (10%)	9 (11%)	11 (11%)	15 (10%)	29 (12%)	2 (4%)	13 (13%) [^]
11-15	181 (14%)	74 (13%)	107 (15%)	61 (13%)	13 (12%)	29 (12%)	12 (14%)	13 (12%)	18 (12%)	31 (13%)	2 (4%)	16 (16%) [^]
16-20	187 (14%)	81 (14%)	106 (14%)	68 (14%)	13 (12%)	34 (13%)	13 (15%)	15 (14%)	19 (13%)	34 (15%)	11 (22%)	8 (8%) [^]
>20	675 (51%)	316 (54%)	359 (49%)	257 (54%)	59 (53%)	143 (57%)	43 (51%)	56 (53%)	81 (55%)	120 (52%)	31 (63%)	50 (51%) [^]
Information not available	29 (2%)	14 (2%)	15 (2%)	13 (3%)	1 (1%)	7 (3%)	3 (4%)	3 (3%)	9 (6%)	3 (1%)	0	9 (9%) [^]

322 * Due to technical issues with the website, post-training assessment data was available only for 443/474 clinicians; [&]Of the 474 clinicians who had
323 completed the post-training questionnaire, 93 were not due their follow-up at the end of the study period so are not included in this analysis; [§]Statistically
324 significant (p=0.000); [^]Statistically significant (p=0.003).

Supplementary Table 2: Demographics and outcomes from Stage 2 compared with the BeST trial

		Stage 2 Study	BeST Trial
Demographics	No. of participants	563/901	466
	Age (mean (SD))	55.2 (14.2)	54 (15)
	Gender	Female: 68% Male: 32%	Female: 60% Male: 39%
	Employed	49%	51%
	Baseline pain (mean (SD))	6.3 (2.0)	5.7 (2.1)
GRoC scale scores at 12-month follow-up	Improved	189/359 (53%)	199/397 (50%)
	No change	95/359 (27%)	138/397 (35%)
	Declined	75/359 (21%)	60/397 (15%)
Effect size (95% CI) at 12-month follow-up	Pain*	0.34 (0.23 to 0.45) [n=358]	0.58 (0.48 to 0.68) [n=394]
	Function/disability^	0.56 (0.42 to 0.71) [n=310]	0.56 (0.45 to 0.67) [n=366]

*A single item from the Modified Von Korff Scale pain sub-scale “In the past 4 weeks, on average how bad has your back pain been on a scale of 0-10?” from the original trial was compared to the NRS scores in the current study.

^The Modified Von Korff Scale disability sub-scale scores from the original trial were compared to the PSFS scores in the current study.

References

1. Hong J, Reed C, Novick D, Happich M. Costs associated with treatment of chronic low back pain: an analysis of the UK General Practice Research Database. *Spine*. 2013;38(1):75-82.
2. NHS England. 2018 [Available from: <https://www.england.nhs.uk/>].
3. Lamb SE, Hansen Z, Lall R, Castelnuovo E, Withers EJ, Nichols V, et al. Group cognitive behavioural treatment for low-back pain in primary care: a randomised controlled trial and cost-effectiveness analysis. *Lancet (London, England)*. 2010;375(9718):916-23.
4. Lamb SE, Mistry D, Lall R, Hansen Z, Evans D, Withers EJ, et al. Group cognitive behavioural interventions for low back pain in primary care: extended follow-up of the Back Skills Training Trial (ISRCTN54717854). *Pain*. 2012;153(2):494-501.
5. Hansen Z, Daykin A, Lamb SE. A cognitive-behavioural programme for the management of low back pain in primary care: a description and justification of the intervention used in the Back Skills Training Trial (BeST; ISRCTN 54717854). *Physiotherapy*. 2010;96(2):87-94.
6. Hall A, Richmond H, Copsey B, Hansen Z, Williamson E, Jones G, et al. Physiotherapist-delivered cognitive-behavioural interventions are effective for low back pain, but can they be replicated in clinical practice? A systematic review. *Disability and Rehabilitation*. 2018;40(1):1-9.
7. Richmond H, Hall AM, Copsey B, Hansen Z, Williamson E, Hoxey-Thomas N, et al. The Effectiveness of Cognitive Behavioural Treatment for Non-Specific Low Back Pain: A Systematic Review and Meta-Analysis. *PLoS ONE*. 2015;10(8):e0134192.
8. Cherkin DC, Sherman KJ, Balderson BH, Cook AJ, Anderson ML, Hawkes RJ, et al. Effect of Mindfulness-Based Stress Reduction vs Cognitive Behavioral Therapy or Usual Care on Back Pain and Functional Limitations in Adults With Chronic Low Back Pain: A Randomized Clinical Trial. *Jama*. 2016;315(12):1240-9.
9. National Institute for Health and Care Excellence. Low Back Pain and Sciatica in Over 16s: Assessment and Management. London: NICE; 2016 Nov.
10. Qaseem A, Wilt TJ, McLean RM, Forciea MA, for the Clinical Guidelines Committee of the American College of Physicians. Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians. *Annals of Internal Medicine*. 2017;166(7):514-30.
11. Oliveira CB, Maher CG, Pinto RZ, Traeger AC, Lin C-WC, Chenot J-F, et al. Clinical practice guidelines for the management of non-specific low back pain in primary care: an updated overview. *European Spine Journal*. 2018;27(11):2791-803.
12. Peters DH TN, Adam T, Ghaffar A. Implementation research in health: a practical guide. Alliance for Health Policy and Systems Research, World Health Organization; 2013.
13. Brownson RC, Colditz GA, Proctor EK. Dissemination and implementation research in health: translating science to practice. Second ed. New York Oxford University Press 2017.
14. Mayes T, de Freitas S. Review of e-learning theories, frameworks and models. London: Joint Information Systems Committee; 2004.
15. Richmond H. The dissemination and implementation of the Back Skills Training Trial (BeST). [Doctoral thesis]: University of Warwick; 2014.
16. Grol R, Wensing M, Eccles M, Davis D. Improving patient care: The implementation of change in health care. Second ed. West Sussex: John Wiley & Sons, Ltd; 2013.
17. Richmond H, Copsey B, Hall AM, Davies D, Lamb SE. A systematic review and meta-analysis of online versus alternative methods for training licensed health care professionals to deliver clinical interventions. *BMC Medical Education*. 2017;17(1):227.
18. Richmond H, Hall AM, Hansen Z, Williamson E, Davies D, Lamb SE. Using mixed methods evaluation to assess the feasibility of online clinical training in evidence based interventions: a case study of cognitive behavioural treatment for low back pain. *BMC Medical Education*. 2016;16(1):163.
19. Richmond H, Hall AM, Hansen Z, Williamson E, Davies D, Lamb SE. Exploring physiotherapists' experiences of implementing a cognitive behavioural approach for managing low back pain and identifying barriers to long-term implementation. *Physiotherapy*. 2017.

20. Richmond H. Using a CBT approach to manage low back pain. *Nursing times*. 2016;112(18):12-4.
21. Amazon Web Services 2014 [Available from: <https://aws.amazon.com/>].
22. Houben RM, Ostelo RW, Vlaeyen JW, Wolters PM, Peters M, Stomp-van den Berg SG. Health care providers' orientations towards common low back pain predict perceived harmfulness of physical activities and recommendations regarding return to normal activity. *European journal of pain* (London, England). 2005;9(2):173-83.
23. Ostelo RW, Stomp-van den Berg SG, Vlaeyen JW, Wolters PM, de Vet HC. Health care provider's attitudes and beliefs towards chronic low back pain: the development of a questionnaire. *Manual therapy*. 2003;8(4):214-22.
24. Williams GC, Deci EL. Internalization of biopsychosocial values by medical students: a test of self-determination theory. *Journal of personality and social psychology*. 1996;70(4):767-79.
25. Michie S, Rumsey N, Fussell A, Hardeman W, Johnston M, Newman S, et al. *Improving Health: Changing Behaviour*, NHS Health Trainer Handbook. Department of Health; 2008.
26. Childs JD, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. *Spine*. 2005;30(11):1331-4.
27. Stratford P, Gill C, Westaway M, Binkley J. Assessing Disability and Change on Individual Patients: A Report of a Patient Specific Measure. *Physiotherapy Canada*. 1995;47(4):258-63.
28. Dworkin RH, Turk DC, Farrar JT, Haythornthwaite JA, Jensen MP, Katz NP, et al. Core outcome measures for chronic pain clinical trials: IMMPACT recommendations. *Pain*. 2005;113(1-2):9-19.
29. Fischer D, Stewart AL, Bloch DA, Lorig K, Laurent D, Holman H. Capturing the patient's view of change as a clinical outcome measure. *Jama*. 1999;282(12):1157-62.
30. Attkisson CC, Zwick R. The client satisfaction questionnaire: Psychometric properties and correlations with service utilization and psychotherapy outcome. *Evaluation and Program Planning*. 1982;5(3):233-7.
31. Kadel R, Kip K, editors. A SAS Macro to Compute Effect Size (Cohen's) and its Confidence Interval from Raw Survey Data. Annual Southeast SAS Users Group Conference; 2012; Durham, NC, USA.
32. Morris SB, DeShon RP. Combining effect size estimates in meta-analysis with repeated measures and independent-groups designs. *Psychological Methods*. 2002;7(1):105-25.
33. Cohen J. *Statistical power analysis for the behavioral sciences*. Second ed. USA: Lawrence Erlbaum Associates; 1988.
34. Jackson CB, Quetsch LB, Brabson LA, Herschell AD. Web-Based Training Methods for Behavioral Health Providers: A Systematic Review. *Administration and Policy in Mental Health and Mental Health Services Research*. 2018;45(4):587-610.
35. Bawa P. Retention in Online Courses: Exploring Issues and Solutions—A Literature Review. *SAGE Open*. 2016;6(1):2158244015621777.
36. de Silva D. What's getting in the way? Barriers to improvement in the NHS. London: The Evidence Centre, The Health Foundation; 2015.
37. Ham C, Berwick D, Dixon J. *Improving quality in the English NHS. A strategy for action*. London: The King's Fund; 2016.
38. Christou B, Sellars J. What are the experiences of therapists using the online Back Skills training and implementing it within clinical practice? *Physiotherapy*. 2019;105:e67.
39. Abbott JH, Schmitt J. Minimum important differences for the patient-specific functional scale, 4 region-specific outcome measures, and the numeric pain rating scale. *The Journal of orthopaedic and sports physical therapy*. 2014;44(8):560-4.
40. Maughan EF, Lewis JS. Outcome measures in chronic low back pain. *European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society*. 2010;19(9):1484-94.
41. Templeton AJ, Vera-Badillo FE, Wang L, Attalla M, De Gouveia P, Leibowitz-Amit R, et al. Translating clinical trials to clinical practice: outcomes of men with metastatic castration resistant

434 prostate cancer treated with docetaxel and prednisone in and out of clinical trials. Ann Oncol.
435 2013;24(12):2972-7.
436 42. Falkenstrom F. Does psychotherapy for young adults in routine practice show similar results
437 as therapy in randomized clinical trials? Psychother Res. 2010;20(2):181-92.
438