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The behaviour change techniques used by Australian physiotherapists to promote non-treatment physical activity to patients with musculoskeletal conditions

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ABSTRACT

Objectives: To determine: (i) the behaviour change techniques used by a sample of Australian physiotherapists to promote non-treatment physical activity; and (ii) whether those behaviour change techniques are different to the techniques used to encourage adherence to rehabilitation exercises.
Design: Cross-sectional survey.
Method: An online self-report survey was advertised to private practice and outpatient physiotherapists treating patients with musculoskeletal conditions. The use of 50 behaviour change techniques were measured using five-point Likert-type scale questions.
Results: Four-hundred and eighty-six physiotherapists responded to the survey, with 216 surveys fully completed. Most respondents (85.1%) promoted non-treatment physical activity often or all of the time. Respondents frequently used 29 behaviour change techniques to promote non-treatment physical activity or encourage adherence to rehabilitation exercises. A similar number of behaviour change techniques was frequently used to encourage adherence to rehabilitation exercises (n = 28) and promote non-treatment physical activity (n = 26). Half of the behaviour change techniques included in the survey were frequently used for both promoting non-treatment physical activity and encouraging adherence to rehabilitation exercises (n = 25). *Graded tasks* was the most, and *punishment* was the least, frequently reported technique used to promote non-treatment physical activity and encourage adherence to rehabilitation exercises.
Conclusions: Respondents reported using similar behaviour change techniques to promote non-treatment physical activity and encourage adherence to rehabilitation exercises. The variability in behaviour change technique use suggests the behaviour the physiotherapist is promoting influences their behaviour change technique choice. Including the frequently-used behaviour change techniques in non-treatment physical activity promotion interventions might improve their efficacy.

1. Introduction

Adults need to participate in 150–300 min of moderate intensity activity or 75–150 min of vigorous intensity activity weekly, as well as muscle strengthening for all major muscle groups twice weekly, to meet the minimum recommended physical activity (PA) guidelines.[1] Adults worldwide are not sufficiently physically active, with 31.1% of adults globally not meeting the guidelines.[2] The situation is worse in Australia, where 44.5% of adults do not meet the guidelines.[3]

The more physically active a person is, the less likely they are to experience musculoskeletal conditions.[4] Physiotherapists are responsible for treating patients with musculoskeletal conditions and preventing recurrence[5], thus it is important that they focus on improving patients' symptoms and on promoting NTPA.

Physiotherapists have a role in promoting health[5], including promoting non-treatment physical activity (NTPA), which is PA for improving and maintaining general health rather than for treat-

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ment of a musculoskeletal condition.[6] With PA levels being low, and a high prevalence of overweight and obesity[7], Australian physiotherapists must make every patient contact count.[8] This includes asking patients about their PA levels and advising on how to improve them.[8] Physiotherapists are reported to have the skills and qualifications necessary to promote NTPA[9], but it is currently unclear how Australian physiotherapists promote NTPA. It is necessary to establish how physiotherapists promote NTPA to determine if their efforts are evidence-based.

The promotion of NTPA involves helping patients to change their behaviour. Encouraging a patient to adhere to rehabilitation exercises also involves behaviour change. Arguably, exercise adherence is a behaviour change physiotherapists promote regularly as part of their role, potentially by using several different techniques. Behaviour change interventions are often based on behavioural theory to guide intervention design and, in doing so, comprise several components called behaviour change techniques (BCTs).[10] Compared to usual care and interventions not using theory, theory-based PA promotion interventions can increase the amount of PA performed by people with disabilities.[11] A recent systematic review found that physiotherapists use as few as seven BCTs to promote PA to patients with musculoskeletal and other non-communicable diseases in clinical settings.[12] Thus, physiotherapists might not be sufficiently basing their NTPA promotion efforts on theory It is important to identify the type and number of BCTs a sample of Australian physiotherapists use to promote NTPA and compare these to the BCTs used when encouraging patients to adhere to their rehabilitation exercises.

The aims of the present study were to identify:

1. The BCTs a sample of Australian physiotherapists currently use to promote NTPA to patients with musculoskeletal conditions; and
2. If physiotherapists use different BCTs to promote NTPA compared to when they encourage adherence to rehabilitation exercises.

2. Methods

Ethics approval was obtained from the Federation University Australia Human Research Ethics Committee (project number B16-026). An online self-report survey was available from July 2016 to April 2017. Australian physiotherapists were recruited by cold-calling random physiotherapy clinics around Australia and asking the reception staff to distribute an email with a link to the survey. The survey was also advertised on social media (Facebook and Twitter) and twice in Australian Physiotherapy Association and Sports Medicine Australia member news lists. Respondents were offered the incentive of receiving a $AU20 gift card or being entered into a draw to win one of several $AU200 gift cards to participate.

This survey was part of a larger national survey that also identified the factors that influence NTPA promotion by physiotherapists. The entire survey was delivered using an online program (Qualtrics, Provo, UT) and was expected to take 25–30 min to complete. The survey was piloted with 15 physiotherapists prior to study commencement with minor changes made in response to feedback. Responses to most questions in the survey were through 5-point Likert scales (e.g. never, sometimes, about half the time, most of the time and always).

Demographic information (age, sex, work setting, number of patients treated weekly, years practicing physiotherapy, consultation duration, education, PA level and frequency of NTPA promotion) was collected prior to 100 questions asking what BCTs the respondent used to promote NTPA and encourage adherence to rehabilitation exercises. Respondents were shown a case study involving a patient (Brian) who presented to physiotherapy with elbow pain and was physically inactive. The treating physiotherapist used 50 different BCTs to either promote NTPA to Brian or help him adhere to his rehabilitation exercises throughout the case study. Each BCT appears in the Behaviour Change Technique Taxonomy (BCTTv1)[13] and were chosen from a systematic review identifying the BCTs used by physiotherapists[12] and previous studies that reported the BCTs used for PA promotion or encouraging adherence to rehabilitation exercises (e.g. see Peek et al.).[14] Each BCT was the focus of each question, where respondents were reminded of how the BCT was used in the case study, and were asked how often they used the BCT when promoting NTPA or encouraging adherence to rehabilitation exercises. The survey, including the case study, is in Supplement A.

Physiotherapists needed to be registered and currently practicing in an Australian private practice or outpatient clinic to be eligible to participate. Additionally, they needed to see at least one patient weekly and 50% or more of their caseload needed to include patients with musculoskeletal complaints. Physiotherapists working in inpatient hospital services or practicing less than weekly were excluded.

In December 2015, 26 901 physiotherapists were practicing in Australia.[15] Using the number of total physiotherapists, an estimated true proportion of 0.5, confidence level of 0.95 and a precision of 0.05 resulted in a desired sample size of 380. As the number of physiotherapists meeting our inclusion criteria was unclear, 380 was used as an overestimate of the sample size needed.

The frequency of self-reported BCT use was calculated separately for NTPA promotion and for encouraging adherence to rehabilitation exercises and presented using descriptive statistics and 95% confidence intervals (95%CI). Incomplete responses were included and missing data were removed pairwise. Due to the lack of variation in responses at the extremes, data from the 5-point Likert questions were collapsed into three groups: 'infrequently used', 'used about half the time' and 'frequently used'. The 'infrequently used' category consisted of 'never' and 'sometimes' options, the 'frequently used' category consisted of 'always' and 'most of the time' options and the 'used about half the time' group consisted of just this category. All BCTs were clustered into their respective hierarchies, or groups of BCTs that are similar to each other, as defined elsewhere.[13]

3. Results

Overall, 486 surveys were opened and 216 respondents (44%) completed the entire survey. The section of the survey examining BCT use was started by 260 respondents and completed by 216, suggesting 16.9% (44/260) of respondents dropped out while completing the BCT section of the survey. The greatest number of respondents were aged between 25 and 34 years, physically active and had been practicing physiotherapy for over 15 years. More than half of respondents saw more than 26 patients a week, were female and worked in private practice settings. Most respondents reported not having additional health-specific education but promoted NTPA to patients all of the time (Table 1). Respondents reported frequently using 29 different BCTs for either promoting NTPA or encouraging adherence to rehabilitation exercises.

Respondents reported using 26 BCTs to promote NTPA, which clustered into 13 different hierarchies (Table 2). The Goals and Planning hierarchy contributed the most frequently used BCTs (BCTs = 7 [27% of frequently used BCTs]). None of the BCTs from the Comparison of Outcomes, Covert Learning and Social Support hierarchies were reported by respondents as frequently used to promote NTPA (Table 2).

Table 1
Demographic information of 486 Australian physiotherapists who responded to the national survey about their NTPA promotion practices.

		n	%
Age	18–24	35	11.4
	25–34	151	49.0
	35–44	54	17.5
	45–54	47	15.3
	55–64	18	5.8
	65–74	3	1.0
Sex	Female	190	61.7
	Male	118	38.3
Work setting	Private practice	234	79.3
	Outpatients	61	20.7
Patients treated weekly	1–5	6	2.0
	6–15	31	10.1
	16–25	47	15.4
	26+	222	72.5
Years practicing physiotherapy in Australia	0–2	60	19.5
	3–5	70	22.7
	6–10	68	22.1
	11–15	37	12.0
	16+	73	23.7
Exercise science education[a]	Yes	138	46.8
	No	147	49.8
Health promotion education[a]	Yes	78	26.4
	No	193	65.4
Psychology education[a]	Yes	111	37.6
	No	167	56.6
PA level	Active[b]	128	43.4
	Half active[c]	106	35.9
	Inactive	61	20.7
Frequency of NTPA promotion	All of the time	128	43.4
	Often	123	41.7
	Sometimes	42	14.2
	Rarely	2	0.7
	Never	0	0

NTPA = Non-treatment physical activity.
PA = Physical Activity.
% = percentage that does not include missing cases.
[a] 'Unsure' results not reported.
[b] Defined as meeting the minimum recommended physical activity level.
[c] Meeting the recommended levels of cardiovascular OR strength activity.

The most frequently reported BCT used for NTPA promotion was *graded tasks* (74.9%, 95%CI: 68.9%–80.1%), followed by *social reward* (73.8%, 95%CI: 67.6%–79.1%) and *reward approximation* (72.4%, 95%CI: 66.2%–77.9%) (Table 2). Few respondents reported frequently using *punishment* (5.1%, 95%CI: 2.8%–9.1%), followed by *behavioural contract* (10.8%, 95%CI: 7.4%–15.5%) and *material reward (behaviour)* (12.1%, 95%CI: 8.3%–17.2%) (Table 2).

Respondents reported using two more BCTs more frequently to encourage adherence to rehabilitation exercises (n = 28) than they did to promote NTPA (n = 26) (Table 2). The 28 BCTs clustered into the same 13 hierarchies as those used for NTPA promotion (Table 2). The Goals and Planning hierarchy contributed the most frequently used BCTs (BCTs = 8 [29% of frequently used BCTs]). None of the BCTs from the Comparison of Outcomes, Covert Learning and Social Support hierarchies were reported by respondents as frequently used to encourage adherence to rehabilitation exercises (Table 2).

Graded tasks (87.0%, 95%CI: 82.0%–90.8%) was the most frequently reported BCT used to encourage adherence to rehabilitation exercises, followed by *body changes* (81.1%, 95%CI: 75.6%–85.6%), *reward approximation* (79.6%, 95%CI: 73.8%–84.4%) and *social reward* (79.6%, 95%CI: 73.8%–84.4%). Few respondents reported frequently using *punishment* (4.7%, 95%CI: 2.5%–8.5%), followed by *behavioural contract* (11.7%, 8.1%–16.5%) and *material reward (behaviour)* (11.6%, 95%CI: 8.0%–16.7%) (Table 2).

Respondents reported frequently using 25 BCTs for both promoting NTPA and encouraging adherence to rehabilitation exercises. Four BCTs were used more to either promote NTPA (*behaviour substitution*) or to promote adherence to rehabilitation exercises (*adding objects to the environment*, *social comparison* and *discrepancy between current behaviour and goal*) (Table 2).

4. Discussion

This study has identified the BCTs that a sample of Australian physiotherapists use to promote NTPA and encourage adherence to rehabilitation exercises. Respondents frequently used a similar number for both behaviours. Most of the BCTs reported as frequently used by respondents belonged to the Goals and Planning hierarchy. The most frequently used BCT was *graded tasks*. Few respondents reported using *punishment*, *behavioural contract* and *material reward* (*behaviour*) frequently for either NTPA promotion or encouraging adherence to rehabilitation exercises. The BCTs frequently used for NTPA promotion and encouraging adherence to rehabilitation exercises were largely similar. Respondents used *behaviour substitution* mostly to promote NTPA and used *adding objects to the environment*, *social comparison* and *discrepancy between current behaviour and goal* mostly for encouraging adherence to rehabilitation exercises.

Respondents reported frequently using 29 of the 50 presented BCTs, which is similar to other studies. A recent review reported physiotherapists promoting PA to patients at risk of non-communicable disease used 32 BCTs.[12] Physiotherapists used 54 BCTs in another review of diet and PA interventions.[16] Physiotherapist-led PA interventions can double the odds of patients meeting PA guidelines; however, these results are not maintained beyond 1 year.[17] The low use of BCTs by physiotherapists could contribute to the lack of patient PA maintenance.

It is currently unclear if the number of BCTs used within an intervention is associated with improved PA outcomes. Using more BCTs could lead to better PA outcomes for adults with musculoskeletal pain[18] and disabilities.[19] However, a review of BCTs used in behavioural interventions for obese adults found the number of BCTs was not associated with improved outcomes.[20] Therefore, the association between improvements in patient PA levels and the number of BCTs used might depend on context. Thus, the type of BCTs used, and the contexts they are used in, requires attention.

The context in which a NTPA intervention is used can influence physiotherapists' BCT choice. The context can be specific to the encouraged behaviour (e.g. PA vs. adherence to rehabilitation exercises), environment (e.g. community vs. private practice or outpatients) or the patient's condition (e.g. ankylosing spondylitis vs. schizophrenia). Most physiotherapists always used *information about health consequences* (discussing physical benefits) when educating patients about a stroke exercise program.[21] In contrast, the present study found just over half of respondents reported frequently using this BCT to promote NTPA. Physiotherapists promoting PA to patients with ankylosing spondylitis used a mix of BCTs from 12 hierarchies[22], whereas physiotherapists promoting PA to patients with schizophrenia focused on *social support* (*unspecified* and *practical*).[23] Therefore, BCT use changes as intervention context changes.

Respondents reported frequently using 25 BCTs for both NTPA promotion and encouraging adherence to rehabilitation exercises. This suggests physiotherapists use similar BCTs to address different behaviours. In the context of this study, this included increasing patient participation in PA and improving adherence to rehabilitation exercises. A study of 139 physiotherapists reported that they

Table 2
The frequency of BCT use by 486 Australian physiotherapists for NTPA promotion and encouraging adherence to rehabilitation exercises.

BCT (Hierarchy)	NTPA promotion (number of responses, % (95%CI))			Exercise adherence (number of responses, % (95%CI))		
	Infrequently used	About half the time	Frequently used	Infrequently used	About half the time	Frequently used
Action planning (Goals and planning) n = 231	71	52	**108**	35	40	**156**
	30.7% (25.1% to 37.0%)	22.5% (17.6% to 28.3%)	**46.8% (40.4% to 53.2%**	15.2% (11.1% to 20.4%)	17.3% (13.0% to 22.8%)	**67.5% (61.2% to 73.3%)**
Adding objects to the environment (Antecedents) n = 221	**89**	45	87	47	43	**131**
	40.3% (34.0% to 46.9%)	20.4% (15.6% to 26.2%)	39.4% (33.2% to 45.9%)	21.3% (16.4% to 27.2%)	19.5% (14.8% to 25.2%)	**59.3% (52.7% to 65.6%)**
Anticipated regret (Natural consequences) n214	**149**	36	29	**148**	28	38
	69.6% (63.2% to 75.4%)	16.8% (12.4% to 22.4%)	13.6% (9.6% to 18.8%)	**69.2% (62.7% to 75.0%)**	13.1% (9.2% to 18.3%)	17.8% (13.2% to 23.5%)
Behaviour substitution (Repetition and substitution) n = 215	76	40	**99**	**91**	39	85
	35.4% (29.3% to 42.0%)	18.6% (13.9% to 24.4%)	**46.1% (39.5% to 52.7%)**	**42.3% (35.9% to 49.0%)**	18.1% (13.5% to 23.9%)	39.5% (33.3% to 46.2%)
Behavioural contract (Goals and planning) n = 231	**198**	8	25	**192**	12	27
	85.7% (80.6% to 89.7%)	3.5% (1.7% to 6.8%)	10.8% (7.4% to 15.5%)	**83.1% (77.7% to 87.4%)**	5.2% (2.9% to 8.6%)	11.7% (8.1% to 16.5%)
Behavioural practice/rehearsal (Repetition and substitution) n = 238	56	44	**138**	45	38	**155**
	23.5% (18.6% to 29.3%)	18.5% (14.0% to 23.9%)	**58.0% (51.6% to 64.1%)**	18.9% (14.4% to 24.4%)	16.0% (11.8% to 21.2%)	**65.1% (58.9% to 70.1%)**
Biofeedback (Feedback and monitoring) n = 214	**137**	31	46	**98**	38	78
	64.0% (57.4% to 70.2%)	14.5% (10.4% to 19.9%)	21.5% (16.5% to 27.5%)	**45.8% (39.3% to 52.5%)**	17.8% (13.2% to 23.5%)	36.5% (30.3% to 43.1%)
Body changes (Antecedents) n = 238	53	33	**152**	22	23	**193**
	22.3% (17.4% to 28.0%)	13.9% (10.0% to 18.9%)	**63.9% (57.6% to 69.7%)**	9.2% (6.1% to 13.7%)	9.7% (6.5% to 14.1%)	**81.1% (75.6% to 85.6%)**
Commitment (Goals and planning) n = 231	85	53	**93**	63	47	**121**
	36.8% (30.8% to 43.2%)	22.9% (18.0% to 28.8%)	**40.3% (34.1% to 46.7%)**	27.3% (21.9% to 33.4%)	20.3% (15.6% to 26.0%)	**52.4% (46.0% to 58.7%)**
Comparative imagining of future outcomes (Comparison of outcomes) n = 215	**122**	37	56	**116**	41	58
	56.7% (50.1% to 63.2%	17.2% (12.7% to 22.9%)	26.1% (20.6% to 32.3%)	**54.0% (47.3% to 60.5%)**	19.1% (14.4% to 24.9%)	27.0% (21.5% to 33.3%)
Credible source (Comparison of outcomes) n = 238	**155**	32	51	**148**	35	55
	65.1% (58.9% to 70.9%)	13.5% (9.7% to 18.4%)	21.4% (16.7% to 27.1%)	**62.2% (55.9% to 68.1%)**	14.7% (10.7% to 19.8%)	23.1% (18.2% to 28.9%)
Demonstration of the behaviour (Comparison of behaviour) n = 231	92	37	**102**	35	16	**180**
	39.8% (33.7% to 46.3%)	16.0% (11.8% to 21.3%)	**44.2% (37.9% to 50.6%)**	15.2% (11.1% to 20.4%)	6.9% (4.2% to 11.0%	**77.9% (72.1% to 82.8%)**
Discrepancy between current behaviour and goal (Goals and planning) n = 215	**84**	54	77	49	50	**116**
	39.1% (32.8% to 45.7%)	25.1% (19.8% to 31.3%)	35.8% (29.7% to 42.4%)	22.8% (17.7% to 28.9%)	23.3% (18.1% to 29.4%)	**54.0% (47.3% to 60.5%)**

Table 2 (*Continued*)

BCT (Hierarchy)	NTPA promotion (number of responses, % (95%CI))			Exercise adherence (number of responses, % (95%CI))		
	Infrequently used	About half the time	Frequently used	Infrequently used	About half the time	Frequently used
Feedback on behaviour (Feedback and monitoring) *n = 221*	45	30	**146**	19	27	**175**
	20.4% (15.6% to 26.2%)	13.6% (9.6% to 18.8%)	**66.1% (59.6% to 72.0%)**	8.6% (5.5% to 13.1%)	12.2% (8.5% to 17.2%)	**79.2% (73.3% to 84.0%)**
Feedback on outcome(s) of behaviour (Feedback and monitoring) *n = 221*	52	44	**125**	19	34	**168**
	23.5% (18.4% to 29.6%)	19.9% (15.2% to 25.7%)	**56.6% (50.0% to 62.9%)**	8.6% (5.5% to 13.1%)	15.4% (11.2% to 20.8%)	**76.0% (70.0% to 81.2%)**
Focus on past success (Self-belief) *n = 221*	67	38	**116**	50	34	**137**
	30.3% (24.6% to 36.7%)	17.2% (12.8% to 22.8%)	**52.5% (45.9% to 59.0%)**	22.6% (17.6% to 28.6%)	15.4% (11.2% to 20.8%)	**62.0% (55.4% to 68.1%)**
Framing/reframing (Identity) *n = 215*	80	44	**91**	75	44	**96**
	37.2% (31.0% to 43.9%)	20.5% (15.6% to 26.4%)	**42.3% (35.9% to 49.0%)**	34.9% (28.8% to 41.5%)	20.5% (15.6% to 26.4%)	**44.7% (38.2% to 51.3%)**
Goal setting (behaviour) (Goals and planning) *n = 231*	57	47	**127**	29	35	**167**
	24.7% (19.5% to 30.6%)	20.4% (15.6% to 26.0%)	**55.0% (48.5% to 61.3%)**	12.6% (8.8% to 17.5%)	15.2% (11.1% to 20.4%)	**72.3% (66.2% to 77.7%)**
Goal setting (outcome) (Goals and planning) *n = 231*	78	45	**108**	45	37	**149**
	33.8% (28.0% to 40.1%)	19.5% (14.9% to 25.1%)	**46.8% (40.4% to 53.2%)**	19.5% (14.9% to 25.1%)	16.0% (11.8% to 21.3%)	**64.5% (58.1% to 70.4%)**
Graded tasks (Repetition and substitution) *n = 231*	29	29	**173**	10	20	**201**
	12.6% (8.8% to 17.5%)	12.6% (8.8% to 17.5%)	**74.9% (68.9% to 80.1%)**	4.3% (2.3% to 7.9%)	8.7% (5.6% to 13.1%)	**87.0% (82.0% to 90.8%)**
Identification of self as role model (Identity) *n = 238*	**146**	34	58	**148**	37	53
	61.3% (55.0% to 67.3%)	14.3% (10.4% to 19.3%)	24.4% (19.3% to 30.2%)	**62.2% (55.9% to 68.1%)**	15.6% (11.5% to 20.7%)	22.3% (17.4% to 28.0%)
Information about emotional consequences (Natural consequences) *n = 238*	60	49	**129**	74	29	**135**
	25.2% (20.1% to 31.1%)	20.6% (15.9% to 26.2%)	**54.2% (47.9% to 60.4%)**	31.1% (25.5% to 37.2%)	12.2% (8.6% to 17.0%)	**56.7% (50.4% to 62.9%)**
Information about health consequences (Natural consequences) *n = 238*	63	42	**133**	31	19	**188**
	26.5% (21.3% to 32.4%)	17.7% (13.3% to 23.0%)	**55.9% (49.5% to 62.1%)**	13.0% (9.3% to 17.9%)	8.0% (5.1% to 12.2%)	**79.0% (73.4% to 83.7%)**
Information about social and environmental consequences (Natural consequences) *n = 238*	91	48	**99**	81	39	**118**
	38.2% (32.2% to 44.6%)	20.2% (15.5% to 25.7%)	**41.6% (35.5% to 47.9%)**	34.0% (28.3% to 40.3%)	16.4% (12.2% to 21.7%)	**49.6% (43.3% to 55.9%)**
Instruction on how to perform the behaviour (Shaping knowledge) *n = 231*	68	40	**123**	32	26	**173**
	29.4% (23.9% to 35.6%)	17.3% (13.0% to 22.8%)	**53.3% (46.8% to 59.6%)**	13.9% (10.0% to 18.9%)	11.3% (7.8% to 16.0%)	**74.9% (68.9% to 80.1%)**
Material reward (behaviour) (Reward and threat) *n = 215*	**173**	16	26	**171**	19	25
	80.5% (74.6% to 85.2%)	7.4% (4.6% to 11.8%)	12.1% (8.3% to 17.2%)	**79.5% (73.6% to 84.4%)**	8.8% (5.7% to 13.5%)	11.6% (8.0% to 16.7%)

Table 2 (*Continued*)

BCT (Hierarchy)	NTPA promotion (number of responses, % (95%CI))			Exercise adherence (number of responses, % (95%CI))		
	Infrequently used	About half the time	Frequently used	Infrequently used	About half the time	Frequently used
Monitoring of outcome(s) of behaviour without feedback (Feedback and monitoring) n = 214	**150**	29	35	**136**	32	46
	70.1% (63.6% to 75.8%)	13.6% (9.6% to 18.8%)	16.4% (12.0% to 21.9%)	**63.6% (56.9% to 69.7%)**	15.0% (10.8% to 20.4%)	21.5% (16.5% to 27.5%)
Pharmacological support (Regulation) n = 238	**136**	38	64	**92**	55	91
	57.1% (50.8% to 63.3%)	16.0% (11.8% to 21.2%)	26.9% (21.7% to 32.9%)	**38.7% (32.7% to 45.0%)**	23.1% (18.2% to 28.9%)	38.2% (32.3% to 44.6%)
Problem solving (Goals and planning) n = 231	67	36	**128**	43	41	**147**
	29.0% (23.5% to 35.2%)	15.6% (11.4% to 20.9%	**55.4% (49.0% to 61.7%)**	18.6% (14.1% to 24.2%)	17.8% (13.3% to 23.2%)	**63.6% (57.3% to 69.6%)**
Prompts/cues (Associations) n = 221	63	64	**107**	27	86	**161**
	28.5% (23.0% to 34.8%)	23.1% (23.4% to 35.3%)	**48.4% (41.9% to 55.0%)**	12.2% (8.5% to 17.2%)	14.9% (32.7% to 45.5%)	**72.9% (66.6% to 78.3%)**
Pros and cons (Comparison of outcomes) n = 238	**134**	46	58	**119**	35	84
	56.3% (50.0% to 62.5%)	19.3% (14.8% to 24.8%)	24.4% (19.3% to 30.2%)	**50.0% (43.7% to 56.3%)**	14.7% (10.7% to 19.8%)	35.3% (29.5% to 41.6%)
Punishment (Reward and threat) n = 214	**194**	9	11	**196**	8	10
	90.7% (85.9% to 93.9%)	4.2% (2.1% to 7.9%)	5.1% (2.8% to 9.1%)	**91.6% (87.0% to 94.7%)**	3.7% (1.8% to 7.3%)	4.7% (2.5% to 8.5%)
Reduce negative emotions (Regulation) n = 215	70	43	**102**	56	46	**113**
	32.6% (26.6% to 39.1%)	20.0% (15.2% to 25.9%)	**47.4% (40.9% to 54.1%)**	26.0% (20.6% to 32.3%)	21.4% (16.4% to 27.4%)	**52.6% (45.9% to 59.1%)**
Restructuring the physical environment (Antecedents) n = 221	90	40	**91**	73	36	**112**
	40.7% (34.5% to 47.3%)	18.1% (13.6% to 23.8%)	**41.2% (34.0% to 47.8%)**	33.0% (27.2% to 39.5%)	16.3% (12.0% to 21.8%)	**50.7% (44.1% to 57.2%)**
Restructuring the social environment (Antecedents) n = 221	**94**	37	90	**93**	39	89
	42.5% (36.2% to 49.1%)	16.7% (12.4% to 22.3%)	40.7% (34.5% to 47.3%)	**42.1% (35.8% to 48.7%)**	17.7% (13.2% to 23.2%)	40.3% (34.0% to 46.9%)
Review behaviour goal(s) (Goals and planning) n = 221	73	40	**108**	34	26	**161**
	33.0% (27.2% to 39.5%)	18.1% (13.6% to 23.7%)	**48.9% (42.4% to 55.4%)**	15.4% (11.2% to 20.8%)	11.8% (8.1% to 16.7%)	**72.9% (66.6% to 78.3%)**
Review outcome goal(s) (Goals and planning) n = 221	62	50	**109**	41	31	**149**
	28.0% (22.5% to 34.3%)	22.6% (17.6% to 28.6%)	**49.3% (42.8% to 55.9%)**	18.6% (14.0% to 24.2%)	14.0% (10.0% to 19.3%)	**67.4% (61.0% to 73.3%)**
Reward approximation (Scheduled consequences) n = 221	32	29	**160**	25	20	**176**
	14.5% (10.4% to 19.8%)	13.1% (9.3% to 18.3%)	**72.4% (66.2% to 77.9%)**	11.3% (7.7% to 16.2%)	9.0% (5.9% to 13.6%)	**79.6% (73.8% to 84.4%)**
Salience of consequences (Natural consequences) n = 214	**159**	24	31	**143**	25	46
	74.3% (68.0% to 79.7%)	11.2% (7.6% to 16.2%)	14.5% (10.4% to 19.9%)	**66.8% (60.3% to 72.8%)**	11.7% (8.0% to 16.7%)	21.5% (16.5% to 27.5%)

Table 2 (*Continued*)

BCT (Hierarchy)	NTPA promotion (number of responses, % (95%CI))			Exercise adherence (number of responses, % (95%CI))		
	Infrequently used	About half the time	Frequently used	Infrequently used	About half the time	Frequently used
Self-incentive (Reward and threat) n = 215	**137**	27	51	**134**	31	50
	63.7% (57.1% to 69.9%)	12.6% (8.7% to 17.7%)	23.7% (18.5% to 29.9%)	**62.3% (55.7% to 68.5%)**	14.4% (10.3% to 19.8%)	23.3% (18.1% to 29.4%)
Self-monitoring of behaviour (Feedback and monitoring) n = 231	**151**	35	45	**144**	42	45
	65.4% (59.0% to 71.2%)	15.2% (11.1% to 20.4%)	19.5% (14.9% to 25.1%)	**62.3% (55.9% to 68.3%)**	18.2% (13.7% to 23.7%)	19.5% (14.9% to 25.1%)
Self-monitoring of outcome(s) of behaviour (Feedback and monitoring) n = 231	**151**	34	46	**118**	41	72
	65.4% (59.0% to 71.2%)	14.7% (10.7% to 19.9%)	19.9% (15.3% to 25.6%)	**51.1% (44.7% to 57.5%)**	17.8% (13.3% to 23.2%)	31.2% (25.5% to 37.4%)
Self-reward (Reward and threat) n = 215	**157**	20	38	**159**	20	36
	73.0% (66.7% to 78.5%)	9.3% (6.0% to 14.0%)	17.7% (13.1% to 23.4%)	**74.0% (67.7% to 79.4%)**	9.3% (6.0% to 14.0%)	16.7% (12.3% to 22.3%)
Self-talk (Self-belief) n = 215	**103**	36	76	**98**	41	76
	47.9% (41.3% to 54.6%)	16.7% (12.3% 22.3%)	35.4% (29.3% to 42.0%)	**45.6% (39.1% to 54.3%)**	19.1% (14.4% to 24.9%)	35.4% (29.3% to 42.0%)
Social comparison (Comparison of behaviour) n = 214	**96**	39	79	57	43	**114**
	44.9% (38.3% to 51.6%)	18.2% (13.6% to 24.0%)	36.9% (30.7% to 43.6%)	26.6% (21.2% to 33.0%)	20.1% (15.3% to 26.0%)	**53.3% (46.6% to 59.8%)**
Social reward (Reward and threat) n = 221	27	31	**163**	13	32	**176**
	12.2% (8.5% to 17.2%)	14.0% (10.0% to 19.3%)	**73.8% (67.6% to 79.1%)**	5.9% (3.4% to 9.9%)	14.5% (10.4% to 19.8%)	**79.6% (73.8% to 84.4%)**
Social support (practical) (Social support) n = 221	**104**	43	74	**90**	50	81
	47.1% (40.6% to 53.6%)	19.5% (14.8% to 25.2%)	33.5% (27.6% to 40.0%)	**40.7% (34.5% to 47.3%)**	22.6% (17.6% to 28.6%)	36.7% (30.6% to 43.2%)
Social support (unspecified) (Social support) n = 221	**92**	49	80	**104**	39	78
	41.6% (35.3% to 48.2%)	22.2% (17.2% to 28.1%)	36.2% (30.1% to 42.7%)	**47.1% (40.6% to 53.6%)**	17.7% (13.2% to 23.2%)	35.3% (29.3% to 41.8%)
Verbal persuasion about capability (Self-belief) n = 221	51	47	**123**	35	45	**141**
	23.1% (18.0% to 29.1%)	21.3% (16.4% to 27.2%)	**55.7% (49.1% to 62.1%)**	15.8% (11.6% to 21.3%)	20.4% (15.6% to 26.2%)	**63.8% (57.3% to 69.9%)**
Vicarious consequences (Covert learning) n = 215	**144**	28	43	**138**	33	44
	67.0% (60.4% to 72.9%)	13.0% (9.1% to 18.2%)	20.0% (15.2% to 25.9%)	**64.2% (57.6% to 70.3%)**	15.4% (11.1% to 20.8%)	20.5% (15.6% to 26.4%)
Total	24	0	26	22	0	28

BCT = Behaviour change technique.
NTPA = Non-treatment physical activity.
% = percentage that does not include missing cases.
Majority cases are bolded.

use the same BCTs across different behaviours (e.g. using *information on health consequences* for both PA promotion and smoking cessation).[24] Including the BCTs used to encourage adherence to rehabilitation exercises in an NTPA promotion intervention might improve intervention fidelity and efficacy.

Graded tasks was reported as most frequently used to promote NTPA and encourage adherence to rehabilitation exercises potentially because it involves progressively making tasks harder for the patient, supporting them to achieve their goals, which is necessary for successful treatment of a condition (e.g. gradually increase strength to reduce pain). Using *graded tasks* has been reported as

associated with diet and PA intervention success for obese and overweight adults.[16] Moreover, *goal setting* (*behaviour*) and *self-monitoring of behaviour* predicted positive short and long term outcomes, suggesting these BCTs are useful in the initial stages of changing behaviour and maintaining it.[16] The majority of respondents in the present study frequently used *goal setting* (*behaviour*) for NTPA promotion, but not *self-monitoring of behaviour*. This suggests Australian physiotherapists frequently use some of the BCTs that can successfully change PA behaviours in the obese and overweight population with people with musculoskeletal conditions.

The frequent use of *goal setting* (*behaviour*) and infrequent use of *self-monitoring of behaviour* by physiotherapists in this study is supported by a review of BCTs used by physiotherapists when promoting PA in clinical and experimental settings.[12] In that review, *goal setting* (*behaviour*) was among the most observed BCTs in experimental studies, with *self-monitoring of behaviour* observed less frequently.[12] Patient adherence to paper-based weight loss self-monitoring tools has been reported as worse than that for technology-based tools.[25] Therefore, to support adherence to rehabilitation exercises and participation in PA, physiotherapists might encourage patients to purchase technology-based self-monitoring tools to measure progress. This cost could act as a barrier for physiotherapists when deciding whether to use *self-monitoring of behaviour*.

Few respondents reported frequently using *Behavioural contracts* when promoting NTPA in the present study. This is despite behavioural interventions, such as *behavioural contracts*, being more effective at increasing PA levels than cognitive interventions (e.g. providing education).[26] A survey of Australian physiotherapists reported that 37.1% of physiotherapists familiar with *behavioural contracts* rarely use them to encourage patients with back pain to return to usual activities.[27] This suggests that being familiar with a BCT is not sufficient to use it. Infrequent use could be due to lack of exposure to the technique during formal education. Future qualitative research is needed to understand why physiotherapists do or do not use BCTs.

More training in BCT use might increase the number of BCTs physiotherapists use. It has been suggested that counselling for health behaviour change should be taught as a clinical competency in physiotherapy degrees.[28] iIn response to this, an Australian university has recently implemented new NTPA promotion course content.[29] However, being trained to deliver a behaviour change intervention does not necessarily increase use.[27] Therefore, any change in Australian physiotherapists' use of BCTs and NTPA promotion should be assessed in an education component evaluation.

Several factors need to be considered when interpreting the findings of this study. The number of physiotherapists needed to power this study could not be accurately calculated due to not knowing the number of physiotherapists primarily treating patients with musculoskeletal conditions in private practice and outpatient settings in Australia. Less than the estimated 380 full responses needed was received, despite providing an incentive that has been demonstrated to improve response rates, potentially underpowering this study.[30] The survey tool was not validated, although the pilot process improved the tool prior to use. Of the 93 available BCTs[13], 50 BCTs relevant to PA and adherence to rehabilitation exercises were included in the survey. Thus, this study does not cover all possible BCTs a physiotherapist could use. Using a self-report survey, as opposed to clinical observation, suggests BCT use could be under or overestimated. The lack of clarification of response definitions (e.g. selecting 'always' means using the BCT each time you promote NTPA) could have also reduced finding accuracy. The use of 100 questions, following demographic questions and other questions, could have led to respondent fatigue and drop out and only those particularly interested in NTPA promotion completing the survey. Questions were presented in a matrix to allow faster survey completion time. However, this could have encouraged respondents to provide similar answers to successive questions, potentially explaining why physiotherapists used similar BCTs for both behaviours. Finally, nine BCTs included in the survey were from the Goals and Planning hierarchy, potentially explaining why most of the used BCTs were from this hierarchy.

This study reported that physiotherapists use similar BCTs for promoting NTPA and encouraging adherence to rehabilitation exercises, suggesting physiotherapists transfer their skills between different tasks. For example, physiotherapists could use *graded tasks* to help a patient increase their PA levels because it worked to help them to adhere to their rehabilitation exercises. Therefore, future NTPA promotion interventions should include the BCTs physiotherapists use for other behaviours and hypothesise that they will be used to promote NTPA. More research is needed to establish if this approach will improve the efficacy of NTPA promotion efforts.

5. Conclusion

Australian physiotherapists reported frequently using 29 BCTs in total. A similar number of BCTs were frequently used to promote NTPA and encourage adherence to rehabilitation exercises. *Graded tasks* was the most frequently used BCT, while *punishment* was used less, for both NTPA promotion and encouraging adherence to rehabilitation exercises. Thus, physiotherapists approach behaviour change for PA and exercise adherence in similar ways. Future NTPA promotion interventions should include the BCTs physiotherapists frequently use for promoting a variety of behaviours and test to see if using these BCTs enhances NTPA promotion efficacy.

Practical implications

- Australian physiotherapists use similar techniques to promote non-treatment physical activity and encourage patients to adhere to their rehabilitation exercises.
- *Graded tasks* was the behaviour change technique reported as most frequently used by physiotherapists, whereas *punishment* was reported the least.
- Four behaviour change techniques were used more to either promote non-treatment physical activity or encourage adherence to rehabilitation exercises, suggesting physiotherapists' choice to use some techniques is related to the context they are used in.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.jsams.2018.06.002.

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