

## **Physiotherapists implicitly evaluate bending and lifting with a round back as dangerous**

**JP Caneiro**, PT, PhD, FACP<sup>1,2</sup>

Peter O'Sullivan, PT, PhD, FACP<sup>1,2</sup>

Anne Smith, PT, PhD<sup>1</sup>

Ingrid Rask Ovrebek, PT, MSc<sup>1</sup>

Luke Tozer, PT, MSc<sup>1</sup>

Michael Williams, PT, MSc<sup>1,2</sup>

Magdalene Li Wen Teng, PT, MSc<sup>1</sup>

Ottmar V. Lipp, PSych, PhD<sup>3</sup>

**1.** School of Physiotherapy and Exercise Science, Curtin University, Perth, Australia.

**2.** Body Logic Physiotherapy Clinic, Perth, Australia

**3.** School of Psychology, Curtin University, Perth, Australia

### **Address correspondence to JP Caneiro:**

Body Logic Physiotherapy Clinic, 215 Nicholson Road, Shenton Park, WA 6008 Australia

**E-mail:** [jp.caneiro@curtin.edu.au](mailto:jp.caneiro@curtin.edu.au) | [caneiro.jp@gmail.com](mailto:caneiro.jp@gmail.com)

## **Highlights**

- Physiotherapists generally reported mixed beliefs about bending posture and safety.
- Physiotherapists displayed implicit associations between round-back bending and danger.
- There was some concordance between explicit and implicit measures of beliefs.
- This implicit bias may influence physiotherapists recommendations in practice.

## Abstract

**Background:** Beliefs can be assessed using explicit measures (e.g. questionnaires) that rely on information of which the person is ‘aware’ and willing to disclose. Conversely, implicit measures evaluate beliefs using computer-based tasks that allow reduced time for introspection thus reflecting ‘automatic’ associations. Thus far, physiotherapists’ beliefs about back posture and safety have not been evaluated with implicit measures.

**Objectives:** (1) Evaluate implicit associations between bending lifting *back posture* (straight-back *vs* round-back) and *safety* (safe *vs* danger); (2) Explore correlations between implicit and explicit measures of beliefs towards vulnerability of the back.

**Design:** Exploratory cross-sectional quantitative study.

**Methods:** 47 musculoskeletal physiotherapists completed explicit measures of fear of movement (TSK-HC), back beliefs (BackPAQ<sub>Danger</sub>) and beliefs related to bending and lifting back posture and safety (BSB). An Implicit Association Test (IAT) was used to assess implicit associations between (i) images of people bending/lifting with a ‘round-back’ or with a ‘straight-back’ posture, and (ii) words representing ‘safety’ and ‘danger’. A one-sample t-test assessed the degree and direction of the sample’s IAT score. Cohen’s *d* provided an effect size of the estimated bias. Correlation between IAT and each explicit measure was assessed using Pearson’s coefficient.

**Results:** The sample displayed an implicit association between ‘round-back’ and ‘danger’ ( $\mu = 0.213$ , 95% CI [.075-.350],  $p=.003$ ), with an effect size magnitude of 0.45. There were fair to moderate correlations between IAT and BSB ( $r = .320$ , 95% CI [ .036-.556],  $p=.029$ ) and, IAT and BackPAQ<sub>Danger</sub> ( $r=.413$ , 95% CI [.143-.626],  $p=.004$ ).

**Conclusions:** Physiotherapists displayed an implicit bias towards bending and lifting with a round-back as dangerous.

**Key-Words:** Implicit bias; Musculoskeletal physiotherapists; Bending and lifting beliefs

## Physiotherapists implicitly evaluate bending and lifting with a round back as dangerous

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## Introduction

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3 Beliefs that the back is vulnerable, and requires protection are common among people with<sup>1,2</sup>  
4 and without<sup>3-6</sup> LBP. Encounters with health care clinicians such as physiotherapists, who  
5 provide advice about LBP, are thought to play a role in the development of such societal  
6 beliefs<sup>7</sup>. Several studies have investigated beliefs of clinicians towards LBP<sup>8-11</sup>. Despite  
7 limited evidence<sup>12-14</sup>, clinicians share the view that ‘improper’ posture (e.g. round-back)  
8 while bending and lifting is dangerous for the back<sup>8, 15-17</sup>, and possibly one of the causes of  
9 LBP<sup>8, 15-17</sup>. Specifically, physiotherapists have self-reported a perception of the back as  
10 vulnerable and a belief that adopting straight-back postures is safest<sup>18</sup>. Physiotherapist’  
11 beliefs can strongly influence their advice to patients, potentially fuelling unhelpful  
12 protective and/or avoidance behaviours<sup>7, 16, 19-21</sup>. For example, Lakke et al (2015) found that  
13 healthy adults’ lifting capacity was significantly reduced when examined by physiotherapy  
14 students with high fear-avoidant beliefs<sup>22</sup>. Clinicians who hold such beliefs are also less  
15 likely to adopt evidence-based treatments<sup>11,16</sup>. Not surprisingly, it has been proposed that  
16 disability associated with LBP may be in part iatrogenic<sup>7, 23</sup>.

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19 Beliefs can be assessed via explicit and implicit measures. Studies assessing beliefs of  
20 clinicians typically employed **explicit** measures (e.g. self-reported questionnaires<sup>24-26</sup>), which  
21 evaluate beliefs that are deliberately formed upon reflection. However, explicit measures are  
22 sensitive only to what people are aware of and are willing to disclose<sup>27-29</sup>. **Implicit** measures  
23 on the other hand, assess beliefs based on ‘automatic’ associations in memory (e.g. bending  
24 posture and danger). These associations can be assessed via computer-based reaction-time  
25 tests, which reduce the person’s ability to control their response, minimizing effects of social  
26 desirability<sup>29, 30</sup>. The Implicit Association Test (IAT), is a well-validated and extensively used  
27 measure<sup>31, 32</sup>, which requires the person to associate words or images as quickly and as  
28 accurately as possible<sup>29, 33</sup>. The speed with which the person performs the task reflects the

1 strength of the associations, and can indicate the degree of **implicit bias**<sup>27</sup>. Depending on  
2 factors such as time and context<sup>27-29</sup>, implicit biases can influence behaviour<sup>27, 34, 35</sup> in a  
3 manner that a person may not be aware of<sup>29, 36</sup>.  
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7 Considering physiotherapists often make clinical decisions under contexts of pressure (e.g.  
8 consultation time, patient's expectations and distress), an implicit bias may influence their  
9 advice to patients with LBP on bending and lifting posture<sup>37</sup>. **Thus far, physiotherapists'**  
10 **implicit associations between back posture and safety have not been investigated.** Based  
11 on studies assessing explicit beliefs about bending/lifting<sup>1, 4, 18</sup>, we **hypothesised** that **i)**  
12 physiotherapists would display an implicit bias towards evaluating bending and lifting with a  
13 round-back as dangerous, and **ii)** this bias would correlate only moderately with their explicit  
14 beliefs. Therefore, the **aims** were:  
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- 26 **1)** To evaluate implicit associations (IAT) between bending and lifting back posture  
27 (straight-back vs round-back) and safety (safe vs danger) in physiotherapists;  
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- 30 **2)** To explore correlations between implicit (IAT) and explicit measures of beliefs towards  
31 vulnerability of the back (bending safety beliefs, back beliefs, and fear of movement).  
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## 41 **Materials & Methods**

### 42 **Design**

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47 This was an exploratory cross-sectional quantitative study.  
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### 51 **Participants and recruitment**

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54 This study used a sample of convenience. Potential participants were recruited in the period  
55 of April to June 2016 via email, phone call (to place of work) or approached in person by one  
56 of the investigators for participation in this study. Inclusion criteria: Physiotherapists, who  
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1 were currently registered with the Australian Health Practitioners Registration Authority  
2 (AHPRA), practicing in the metropolitan area of Perth (Western Australia), and treating  
3 patients with musculoskeletal conditions. Exclusion criteria: Participants were excluded if  
4 they had difficulty to read and understand English. Informed consent was obtained upon  
5 agreement to participate. Ethics approval (HREC number: HRE2016-0192) was obtained  
6 from Curtin University's Health Science Human Research Ethics Committee.  
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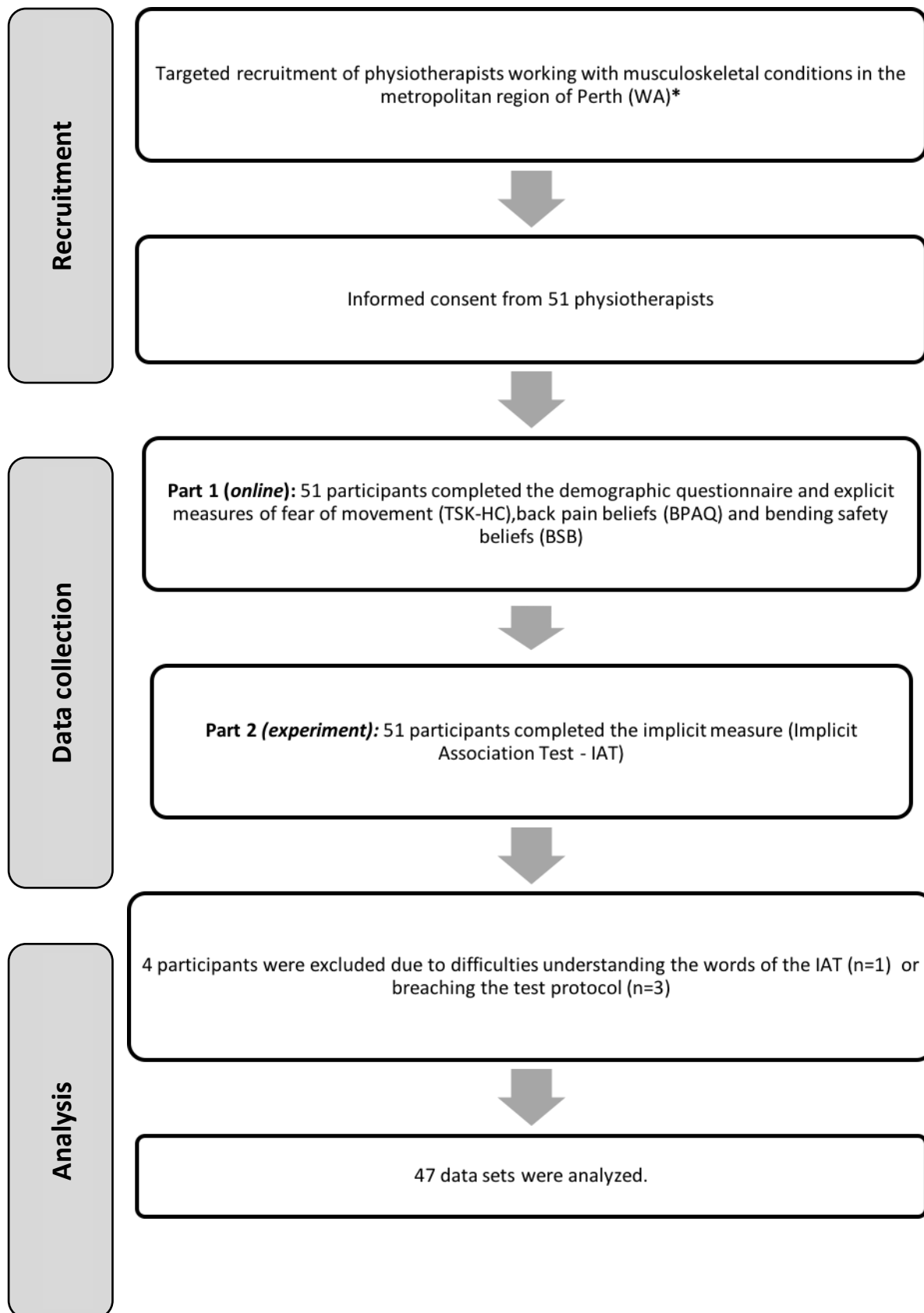
### 14 **Procedure**

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16 Participants were first invited to complete three questionnaires *online*. Thereafter, time was  
17 arranged with each participant to complete the *experiment* (IAT) at an agreed upon location,  
18 either at Curtin University or the participant's workplace. The study procedure is summarized  
19 in Figure 1.  
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### 32 **Demographic questionnaire**

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34 Participants' age, gender, years of practice, educational level, previous and current history,  
35 and management of LBP were recorded for sampling purposes only.  
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**Figure 1.** Flow diagram outlining study procedure.

\*Footnote: There are a total of 3475 Physiotherapists working in Western Australia, who hold a general registration with AHPRA. The number of Physiotherapists specifically working with musculoskeletal conditions is not available.

## Outcome measures

This study employed an *implicit* measure of bending/lifting back posture and safety of the spine, and *explicit* measures of beliefs towards vulnerability of the back (bending safety beliefs, back beliefs, and fear of movement).

### Implicit measure

#### *Implicit Association Test (IAT)*

The IAT is a computer-based test that assesses strength of association between categories, indicating implicit biases<sup>29, 32</sup>. The IAT<sup>18</sup> is a well-established measure, which was adapted to assess associations between bending/lifting posture and safety in a group of people with back pain<sup>38</sup>. The same IAT was used in this study, and included two categories of stimuli (either word or image). The *target categories* (images) were ‘**Round-back**’ and ‘**Straight-back**’ while the *attribute categories* (words) were ‘**Safe**’ and ‘**Danger**’.

The words selected to represent the attribute category ‘**Safe**’ were: *harmless, certainty, protecting, confident, secure*; and ‘**Danger**’ were: *alarming, vulnerable, risky, damaging, threatening*. To represent the target categories, twelve (10) side view images of males and females bending and lifting an object with a round back (target category ‘**Round-back**’) or with a straight back (target category ‘**Straight-back**’), were created for this test (Figure 2).

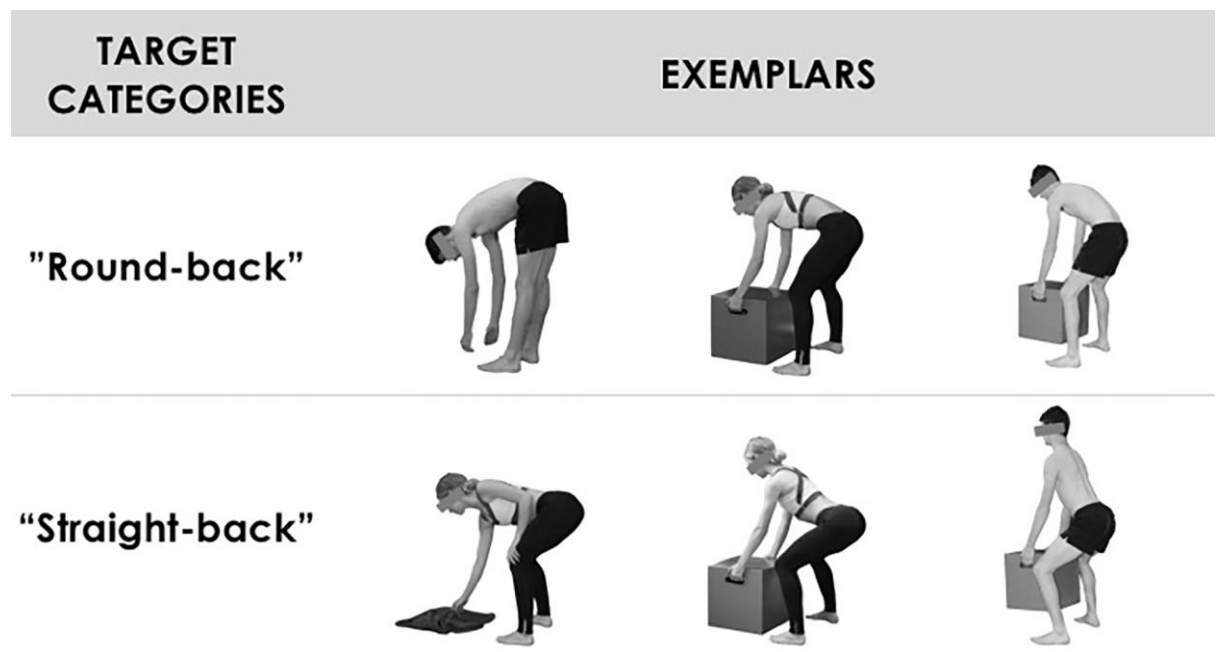
The IAT was set up on the researchers’ laptops, allowing data collection at the physiotherapists’ workplace. The words were presented in bold, 20-point Arial font in white lower case on a black background. The images were presented embedded in a white square frame of 450x440 pixels on a black background. Categories remained on screen throughout an entire phase.

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*Procedure:* Instructions were provided on the screen prior to commencement of the experiment. The IAT consisted of 7 stages<sup>38</sup>, (Table 1). For each stage, the participant was instructed to assign a stimulus (image/word displayed in the centre of the screen) to its suitable category (displayed in the left and right upper hand corner of the screen) by pressing the left or right “Shift” keys, as quickly as possible, while avoiding mistakes. Feedback (“correct” or “wrong”) was provided to participants on each trial. In stage 1 (20 trials), participants sorted each of the 10 images twice, into the categories “Round-back” and “Straight-back”. In stage 2 (20 trials), participants sorted the 10 words twice into the categories “Safe” and “Danger”. In stages 3 and 4 (20 and 40 trials each) participants sorted words and images into the combined categories (e.g. Danger / Round-back and Safe / Straight-back). In stage 5 (20 trials) participants sorted images with the location of the categories switched. In stages 6 and 7 (30 and 40 trials each) the category combinations of phases three and four were reversed (e.g. Danger / Straight-back and Safe / Round-back). Half the participants were tested with the category combination (Danger / Round-back and Safe / Straight-back) first whereas the remaining saw the combinations (Danger / Straight-back and Safe / Round-back) first.

*Data processing:* Each trial started with the display of a fixation cross for 1000ms followed by a word or image for 1000ms and an inter-trial interval of 1000ms. Presentation of the tasks and reaction time recording was controlled by DMDX<sup>47</sup>. Response time was defined as the time elapsed from the presentation of the word or image to when the left or right shift key was pressed. This time was recorded and incorrect responses, times shorter than 100 ms or longer than 1000ms were considered as errors. A bias score ( $IAT_{D-score}$ ) was calculated using the improved scoring algorithm recommended by Greenwald et al (2003)<sup>40</sup> with an error penalty of 2 standard deviations. The  $IAT_{D-score}$  is a standardised difference between response

1 times during the two stages when danger is paired with round back versus the two stages  
 2 when danger is paired with a straight back. The  $IAT_{D-score}$  can therefore be either positive or  
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 5 negative, with **zero** indicating no implicit bias, a **positive score** indicating implicit bias  
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 7 towards a round-back posture as dangerous and a **negative score** indicating implicit bias  
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 9 towards a straight-back posture as dangerous. The IAT exhibits adequate reliability and,  
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 12 internal, construct and predictive validity<sup>36, 38, 40</sup>.



39 **Figure 2.** Exemplars of the images developed to represent target categories in the IAT.

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46 Explicit measures

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48 *Bending Safety Belief (BSB)*

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52 To assess specific beliefs related to bending and lifting back posture and safety of the spine,  
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 54 the BSB was developed. The BSB consists of a pictorial scale containing two images of a  
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 56 person bending forward and lifting a light object (e.g. shoe) – one with a round-back and one  
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 58 with a straight-back (Appendix). The participants were asked, “how would you rate the level  
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1 of risk to this person's back?" for each image using a Likert scale (anchored on "0" meaning  
2 safe, and "10" meaning danger). A **thermometer score** (**BSB<sub>Thermometer</sub>**) was derived to  
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4 determine the participant's belief about safety of bending. The danger rating of the picture  
5 illustrating bending with a 'straight-back' was subtracted from the danger rating of the  
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7 picture illustrating bending with a 'round-back'. In line with the implicit IAT<sub>D-score</sub>, a **positive**  
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9 **value** therefore indicated a **higher danger rating for round-back** than a straight-back and a  
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11 negative score indicated higher danger rating for straight-back than a round-back. The BSB  
12 pictorial scale was developed based on the item "reaching to the floor" on the Fear of Daily  
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14 Activities Questionnaire<sup>25</sup>. The Fear of Daily Activities Questionnaire has been shown to  
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16 have adequate internal consistency (Cronbach alpha=.91), and adequate reliability (intraclass  
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18 correlation coefficient=.90) in determining fear of specific activities<sup>25</sup>. The BSB pictorial  
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20 scale has been used in another study<sup>39</sup>.  
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### 33 *Back Pain Attitudes Questionnaire (Back-PAQ)*

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36 The Back-PAQ was designed to assess back pain attitudes of the public, healthcare  
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38 professionals, or those with back pain<sup>24</sup>. The Back-PAQ consists of 34 items that assesses  
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40 five key components including, but not limited to 'vulnerability and 'protection' of the back<sup>24</sup>.  
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42 Participants answered the items on a 5-point Likert scale from "false" to "true" (intermediate  
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44 labels: 'Possibly False', 'Unsure', 'Possibly True). Scoring boundaries range from 34-170,  
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46 with higher scores indicating more unhelpful beliefs about the back. The 34-item long form  
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48 of the questionnaire has been shown to have acceptable internal consistency ( $\alpha=0.70$ ; 95% CI  
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50 0.66 to 0.73), construct validity and test-retest reliability<sup>24, 40</sup>. For the purpose of this study, a  
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52 subscale called 'danger scale' (**BackPAQ<sub>Danger</sub>**) was formed by 14 items from the  
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54 questionnaire (questions 1-12, 14 and 21), which are representative of 'vulnerability and  
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‘protection’ themes. These themes emerged from the qualitative study that the BackPAQ originated from<sup>26</sup>. The ‘danger scale’ score was assessed for correlation with other explicit and implicit scores.

*Tampa Scale of Kinesiophobia – Health Care clinicians (TSK-HC)*

The TSK was designed to measure fear of movement in patients, and it was previously modified by Houben et al (2005)<sup>40</sup> to measure concerns for movement that clinicians may have for their patients by rewording the items in order to target them at clinicians’ beliefs<sup>37</sup>,<sup>41</sup>. For example, the item “*my* lower back pain would probably be relieved if *I* were to do exercises” was reworded to “*the* lower back pain would probably be relieved if *the patient* were to do exercises”. The TSK-HC<sup>40</sup> consists of 17 items using a six-point Likert scale that ranges from ‘totally agree’ to ‘totally disagree’. Scores range from 17 to 68, with a high score reflecting a strong concern for the possibility of physical movement being harmful<sup>37</sup>. Cronbach’s alpha in the study by Houben et al (2004)<sup>26</sup> was 0.81, which showed high internal consistency.

**Table 1.** Schematic representation of Implicit Association Test (IAT)

PHASE	TASK	SEQUENCE 1	
1	Target-discrimination	Round-back	Straight-back
2	Attribute-discrimination	Danger	Safe
3	Combined-discrimination_1	Danger/Round-back	Safe/Straight-back
4	Combined-discrimination_2	Danger/Round-back	Safe/Straight-back
5	Target-discrimination reversed	Straight-back	Round-back
6	Combined-discrimination_3	Danger/Straight-back	Safe/Round-back
7	Combined-discrimination_4	Danger/Straight-back	Safe/Round-back

## Statistical analysis

Summary descriptive statistics were calculated for demographic data. For the measure of implicit bias ( $IAT_{D-score}$ ), a one-sample t-test was used to assess the degree and direction of the deviation of the score from zero, with 95% confidence intervals used to interpret the size and precision of the estimate. Normality of the data was tested before the t-test was undertaken. Additionally, Cohen's  $d$  was calculated to provide a standardised effect size to assist in the interpretation of the size of the estimated bias<sup>42</sup>.

As for the  $IAT_{D-score}$ , a one-sample t-test was used to assess the degree and direction of the deviation of the  $BSB_{Thermometer}$  score from zero. The correlation between the  $IAT_{D-score}$  and each of the explicit measures ( $BSB_{Thermometer}$ ,  $BackPAQ_{Danger}$  and TSK-HC) was assessed using Pearson's correlation coefficient with associated 95% confidence intervals. For reporting of correlations, the magnitude of association was interpreted as: little or no relationship (from .00 to .25), fair to moderate relationship (from .25 to .50), moderate to good relationship (from .50 to .75), good to excellent relationship (above .75)<sup>43</sup>. An *a priori* power calculation estimated a sample of 50 participants would have 80% power to detect a standardised  $IAT_{D-score}$  difference from 0 of  $\pm 0.4$  and correlations between implicit and explicit measures of  $\pm 0.4$  or greater (two-sided tests,  $\alpha = .05$ ). SPSS version 24 statistical software was used for statistical analysis (IBM SPSS Statistics for Windows, version 24, IBM Corp., Armonk, N.Y., USA).

## Results

### Participants

Data was collected for 51 participants; four participants were excluded due to difficulties understanding the words of the IAT (1), or breaching the test protocol (3) – e.g. asking for instructions during the test, being disrupted during the test. Forty-seven data sets were included in the analysis, and there was no missing data for any of the participants. Participants' demographic characteristics are summarized in Table 2.

**Table 2.** Participants' Characteristics

Characteristics	n (percentage)	Mean (SD (range))
Age	-	31.9 (6.6 (21-56))
Female	22 (46.8)	-
Male	25 (53.2)	-
Years as physiotherapist	-	7.9 (7.1 (1-35))
Physiotherapist	31 (66)	-
Postgraduate Physiotherapist	16 (34)	-
Present back pain	11 (23)	-
Previous history of back pain	20 (42)	-
Family history of back pain	26 (55)	-
Use of medication for back pain	15 (31)	-
Physical impairment from back pain	18 (38)	-
Use of management for back pain	26 (55)	-

### Implicit measure

The mean IAT<sub>D-score</sub> was 0.213 (SD=0.470) and significantly larger than zero ( $p=.003$ , 95% CI [.075-.350],  $t(46)=3.103$ ), indicating a **bias** towards **round-back being associated with danger** in this group of physiotherapists currently treating musculoskeletal conditions. The magnitude of this estimated effect size as measured by Cohen's  $d$  was 0.45.

### Explicit measures

The mean BSB<sub>Thermometer</sub> score was -0.7 (SD=3.6), which was **not significantly different from zero** ( $p=.193$ , 95% CI [-1.8 – 0.4],  $t(46)=-1.32$ ). Analysis of the distribution of **BSB**



1 Thermometer score across the sample revealed that **30%** of the sample had a **positive** score  
2 indicating a **higher danger rating for round-back** than a straight-back as dangerous, **23%**  
3 had score of **zero**, and **47%** had a **negative** score indicating a **higher danger rating for**  
4 **straight-back** than a round-back as dangerous. The mean TSK-HC score was 30.3 (SD= 6.2)  
5 for fear of movement, and the mean BackPAQ score was 29.4 (SD= 15.7) for back beliefs  
6 with the subscale BackPAQ<sub>Danger</sub> having a mean of 31.4 (SD=10.0).  
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### 10 11 12 13 14 15 **Associations between implicit and explicit measures**

16 There were fair to moderate significant correlations between the IAT<sub>D-score</sub> and the BSB  
17 Thermometer score ( $r = .320$ , 95% CI [ .036-.556],  $p=.029$ ) and between the IAT<sub>D-score</sub> and the  
18 BackPAQ<sub>Danger</sub> score ( $r=.413$ , 95% CI [.143-.626],  $p=.004$ ). There was no correlation  
19 between the IAT<sub>D-score</sub> and TSK-HC ( $r = .231$ , 95% CI [ -.060-.486],  $p=.119$ ).  
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### 32 33 **Discussion**

34 This study aimed to evaluate physiotherapists' implicit associations between bending and  
35 lifting *back posture* (straight-back vs. round-back) and *safety* (safe vs. danger); and whether  
36 the implicit measure correlated with explicit measures of beliefs towards vulnerability of the  
37 back (bending safety beliefs, back beliefs, and fear of movement).  
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47 **Our first hypothesis was supported.** Results from the *implicit* measure (IAT), indicate that  
48 physiotherapists were faster to associate images of bending and lifting with a 'round-back'  
49 with words representing 'danger', rather than with words representing 'safety', meaning that  
50 this sample of physiotherapists displayed an **implicit bias** towards 'round-back' bending and  
51 lifting as dangerous for the back.  
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**Our second hypothesis was only partially supported** because only two of three explicit measures correlated moderately and significantly with the implicit measure. These correlations were between bending safety belief (BSB<sub>Thermometer</sub>) and the IAT<sub>D-score</sub>, and between LBP beliefs (BackPAQ<sub>Danger</sub>) and the IAT<sub>D-score</sub>, indicating some alignment of the constructs assessed by these measures. The magnitude of these correlations nonetheless indicates a level of mismatch between the reports in the different measures, and suggests that these measures may assess a common core construct, but distinct aspects of that construct. The three explicit measures have varying degrees of alignment to the specific construct that was assessed by the IAT. While the TSK-HC assesses fear of movement, none of its items relate to how a person moves or specifically, about the person's back posture during bending and lifting. In contrast, the BackPAQ<sub>Danger</sub> scale has specific questions about back posture, bending and lifting, and the BSB uses an image to ensure specificity of the construct assessed (bending posture and safety)<sup>44, 45</sup>. In support of our results, a meta-analysis of correlations between explicit measures and the IAT across 126 studies in the field of social psychology suggested that the association between these measures is influenced by the conceptual correspondence of the constructs being assessed<sup>46</sup>. In other words, the magnitude of the correlations is likely to differ depending on whether the questionnaire and the implicit measure target the same construct.

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**Our results are intriguing** as they provide some indication that under a time-constraint *context*, physiotherapists may display associations in memory that are not entirely reflective of their self-reported beliefs. Considering the proposed role of implicit attitudes on a person's behavior<sup>27, 34, 47</sup> such as the clinical choices physiotherapists make, our results require further consideration. The following section will make sense of these results and reflect on the potential impact of this *implicit 'round-back/danger' bias* in **physiotherapy practice**.

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Physiotherapy training in musculoskeletal pain has historically been largely based on a patho-anatomical and biomechanical paradigm<sup>8, 48</sup>. This includes amongst other factors, the ability to recognize patterns of posture and movement and its relationship with clinical presentations (e.g. lifting posture and LBP). With training and experience, these clinical profiles may be accessed with reduced deliberate thought for efficient decision-making<sup>49, 50</sup>. In physiotherapy practice however, managing patient's beliefs, expectations and pain-related distress, while providing treatment under the time constraints of an appointment poses a significant challenge. In that *context*, reliance on automatic associations of clinical profiles (e.g. lifting posture and LBP) and treatment advice (e.g. protect the back) may influence the clinician's treatment behaviour unintendedly<sup>30, 36, 49</sup>. For instance, Houben et al (2005) investigated explicit and implicit attitudes (biomedical vs. biopsychosocial) of physiotherapy students on treatment recommendation for LBP<sup>37</sup>. The authors used three videos of different clinical contexts (1: examination of patient with back pain; 2: advice on activity or rest after a flare up of back pain; 3: advice on time-contingent vs pain-contingent approach after a flare up of back and leg pain) to which the students had one minute to provide treatment advice, creating time-pressure resembling clinical practice. The study reported that explicit biomedical attitudes were predictive of treatment advice by physiotherapy students in two videos, while implicit biomedical attitudes were predictive of biomedical treatment advice in one video. Their results suggest that both explicit and implicit attitudes can predict behaviour depending on the clinical context<sup>37</sup>.

It has been proposed that a person's behaviour may be the result of the interaction of implicit associations and deliberate reasoning on the situation at hand<sup>27, 28, 30</sup>. The level to which this interaction influences a person's behavior relates to several factors that form a *context*, including *motivation, opportunity, ability, and awareness*<sup>27, 28</sup>. In the context of physiotherapy practice for example, the clinician may have the knowledge and motivation to

1 adopt an evidence-based biopsychosocial approach, however factors such as restricted  
2 consultation time (opportunity), experience and clinical reasoning level (ability), and beliefs  
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4 (awareness of how one feels about a construct - e.g. round-back lifting is safe) may affect the  
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6 clinician's advice in the consult. Although speculative, it is plausible that in certain *contexts*,  
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9 the implicit 'round-back/danger bias' displayed by the physiotherapists in our study may  
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11 have the potential to influence their recommendations in practice. For example, this may  
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13 involve reinforcing prevailing beliefs in society that bending and lifting are dangerous and  
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15 'good' posture (e.g. straight-back posture) protects the back <sup>1, 9, 15</sup>. However, the extent to  
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17 which physiotherapists' implicit bias influences clinical processes is not known<sup>37</sup>. Future  
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19 research examining potential influences of this implicit 'round-back/danger bias' on clinical  
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21 decision-making and physiotherapy advice for people with LBP, would be valuable.  
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### 27 *Limitations*

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29 To the authors' knowledge, this is the first study to assess implicit attitudes of experienced  
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31 physiotherapists, specifically related to bending and lifting safety. However, this study has  
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33 some limitations. *First*, the authors acknowledge that no specific sampling frame was used  
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35 and this was a sample of convenience. Consequently, this sample may not accurately reflect  
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37 population characteristics in terms of factors that may potentially be associated with the  
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39 degree of implicit bias, such as history of back pain or postgraduate training. However, the  
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41 sample characteristics (presented in Table 2) demonstrate that this sample is a reasonable  
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43 representation of the population of physiotherapists treating musculoskeletal conditions, and  
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45 hence any sampling bias of the average level of IAT<sub>D-score</sub> in this population is likely to be  
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47 small. *Second*, the use of a cohort from a single city could potentially reflect similar training  
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49 backgrounds. However, demographics of this group indicate that physiotherapists with varied  
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51 education level, years of experience and training background were included. *Third*, this study  
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53 was not powered to investigate the relationship between factors such as physiotherapist's  
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1 education level and history of back pain with an implicit bias. Such analysis could be a focus  
2 of future research. *Fourth*, the question used in the BSB is clinically relevant when assessing  
3 beliefs about bending, as it provides information whether there is a perception of danger in  
4 relation to the way a person bends. However, although this question was adapted from a  
5 validated questionnaire<sup>25</sup>, and used in a previous study involving people with LBP<sup>38</sup>, its  
6 psychometric properties have not been tested. *Fifth*, the reliability of implicit measures has  
7 been questioned in the past<sup>51</sup>. Although the IAT has adequate psychometric properties<sup>31</sup>, the  
8 task used in this study was purposefully adapted to address a question of interest. Therefore,  
9 before firmer conclusions can be derived from this study replication of these findings is  
10 warranted.

## 11 **Conclusion**

12 The current study demonstrated that physiotherapists displayed an implicit bias to associate  
13 bending and lifting with a round-back (vs. straight-back) with danger, while generally  
14 reporting mixed explicit beliefs about bending safety. There was some concordance between  
15 explicit bending/lifting safety beliefs and the implicit measure. Considering implicit attitudes  
16 may influence behaviour, future studies investigating whether this implicit ‘round-  
17 back/danger bias’ is associated with physiotherapist’s clinical advice on bending and lifting  
18 posture for people with LBP are indicated.

## References

1. Darlow B, Dean S, Perry M, Mathieson F, Baxter GD, Dowell A. Easy to Harm, Hard to Heal: Patient Views About the Back. *Spine (Phila Pa 1976)*. 2015; 40(11):842-50. DOI:10.1097/brs.0000000000000901.
2. Bunzli S, Smith A, Schutze R, O'Sullivan P. Beliefs underlying pain-related fear and how they evolve: a qualitative investigation in people with chronic back pain and high pain-related fear. *BMJ Open*. 2015; 5(10):e008847. DOI:10.1136/bmjopen-2015-008847.
3. Munigangaiah S, Basavaraju N, Jadaan DY, Devitt AT, McCabe JP. Do "Myths" of low back pain exist among Irish population? A cross-sectional study. *Eur J Orthop Surg Traumatol*. 2016; 26(1):41-6. DOI:10.1007/s00590-015-1698-y.
4. Darlow B, Perry M, Stanley J, Mathieson F, Melloh M, Baxter GD, et al. Cross-sectional survey of attitudes and beliefs about back pain in New Zealand. *BMJ Open*. 2014; 4(5):e004725. DOI:10.1136/bmjopen-2013-004725.
5. Briggs AM, Jordan JE, Buchbinder R, Burnett AF, O'Sullivan PB, Chua JY, et al. Health literacy and beliefs among a community cohort with and without chronic low back pain. *Pain*. 2010; 150(2):275-83. DOI:10.1016/j.pain.2010.04.031.
6. Gross DP, Ferrari R, Russell AS, Battie MC, Schopflocher D, Hu RW, et al. A population-based survey of back pain beliefs in Canada. *Spine (Phila Pa 1976)*. 2006; 31(18):2142-5. DOI:10.1097/01.brs.0000231771.14965.e4.
7. Darlow B, Dowell A, Baxter GD, Mathieson F, Perry M, Dean S. The enduring impact of what clinicians say to people with low back pain. *Ann Fam Med*. 2013; 11(6):527-34. DOI:10.1370/afm.1518.
8. Synnott A, O'Keefe M, Bunzli S, Dankaerts W, O'Sullivan P, O'Sullivan K. Physiotherapists may stigmatise or feel unprepared to treat people with low back pain and psychosocial factors that influence recovery: a systematic review. *J Physiother*. 2015; 61(2):68-76. DOI:10.1016/j.jphys.2015.02.016.
9. Darlow B. Beliefs about back pain: The confluence of client, clinician and community. *International Journal of Osteopathic Medicine*. 2016 [cited 2016/12/20]; 20:53-61. DOI:10.1016/j.ijosm.2016.01.005.
10. Bishop A, Thomas E, Foster NE. Health care practitioners' attitudes and beliefs about low back pain: a systematic search and critical review of available measurement tools. *Pain*. 2007; 132(1-2):91-101. DOI:10.1016/j.pain.2007.01.028.
11. Coudeyre E, Rannou F, Tubach F, Baron G, Coriat F, Brin S, et al. General practitioners' fear-avoidance beliefs influence their management of patients with low back pain. *Pain*. 2006; 124(3):330-7. DOI:10.1016/j.pain.2006.05.003.

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12. Dreischarf M, Rohlmann A, Graichen F, Bergmann G, Schmidt H. In vivo loads on a vertebral body replacement during different lifting techniques. *J Biomech.* 2016; 49(6):890-5. DOI:10.1016/j.jbiomech.2015.09.034.
  13. Roffey DM, Wai EK, Bishop P, Kwon BK, Dagenais S. Causal assessment of workplace manual handling or assisting patients and low back pain: results of a systematic review. *Spine J.* 2010; 10(7):639-51. DOI:10.1016/j.spinee.2010.04.028.
  14. Bazrgari B, Shirazi-Adl A, Arjmand N. Analysis of squat and stoop dynamic liftings: muscle forces and internal spinal loads. *Eur Spine J.* 2007; 16(5):687-99. DOI:10.1007/s00586-006-0240-7.
  15. Stevens ML, Steffens D, Ferreira ML, Latimer J, Li Q, Blyth F, et al. Patients' and Physiotherapists' Views on Triggers for Low Back Pain. *Spine (Phila Pa 1976).* 2016; 41(4):E218-24. DOI:10.1097/brs.0000000000001193.
  16. Darlow B, Fullen BM, Dean S, Hurley DA, Baxter GD, Dowell A. The association between health care professional attitudes and beliefs and the attitudes and beliefs, clinical management, and outcomes of patients with low back pain: a systematic review. *Eur J Pain.* 2012; 16(1):3-17. DOI:10.1016/j.ejpain.2011.06.006.
  17. Nijs J, Roussel N, Paul van Wilgen C, Koke A, Smeets R. Thinking beyond muscles and joints: therapists' and patients' attitudes and beliefs regarding chronic musculoskeletal pain are key to applying effective treatment. *Man Ther.* 2013; 18(2):96-102. DOI:10.1016/j.math.2012.11.001.
  18. Nolan D, O'Sullivan K, Stephenson J, O'Sullivan P, Lucock M. What do physiotherapists and manual handling advisors consider the safest lifting posture, and do back beliefs influence their choice? *Musculoskelet Sci Pract.* 2018; 33:35-40. DOI:10.1016/j.msksp.2017.10.010.
  19. Bishop A, Foster NE, Thomas E, Hay EM. How does the self-reported clinical management of patients with low back pain relate to the attitudes and beliefs of health care practitioners? A survey of UK general practitioners and physiotherapists. *Pain.* 2008; 135(1-2):187-95. DOI:10.1016/j.pain.2007.11.010.
  20. Vlaeyen JW, Linton SJ. Are we "fear-avoidant"? *Pain.* 2006; 124(3):240-1. DOI:10.1016/j.pain.2006.06.031.
  21. O'Sullivan P, Caneiro JP, O'Keefe M, O'Sullivan K. Unraveling the Complexity of Low Back Pain. *J Orthop Sports Phys Ther.* 2016; 46(11):932-937. DOI:10.2519/jospt.2016.0609.
  22. Lakke SE, Soer R, Krijnen WP, van der Schans CP, Reneman MF, Geertzen JH. Influence of Physical Therapists' Kinesiophobic Beliefs on Lifting Capacity in Healthy Adults. *Phys Ther.* 2015; 95(9):1224-33. DOI:10.2522/ptj.20130194.

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23. Lin IB, O'Sullivan PB, Coffin JA, Mak DB, Toussaint S, Straker LM. Disabling chronic low back pain as an iatrogenic disorder: a qualitative study in Aboriginal Australians. *BMJ Open*. 2013; 3(4) DOI:10.1136/bmjopen-2013-002654.
  24. Darlow B, Perry M, Mathieson F, Stanley J, Melloh M, Marsh R, et al. The development and exploratory analysis of the Back Pain Attitudes Questionnaire (Back-PAQ). *BMJ Open*. 2014; 4(5):e005251. DOI:10.1136/bmjopen-2014-005251.
  25. George SZ, Valencia C, Zeppieri G, Jr., Robinson ME. Development of a self-report measure of fearful activities for patients with low back pain: the fear of daily activities questionnaire. *Phys Ther*. 2009; 89(9):969-79. DOI:10.2522/ptj.20090032.
  26. Houben RM, Vlaeyen JW, Peters M, Ostelo RW, Wolters PM, Stomp-van den Berg SG. Health care providers' attitudes and beliefs towards common low back pain: factor structure and psychometric properties of the HC-PAIRS. *Clin J Pain*. 2004; 20(1):37-44. Available
  27. Nosek BA, Hawkins CB, Frazier RS. Implicit social cognition: from measures to mechanisms. *Trends Cogn Sci*. 2011; 15(4):152-9. DOI:10.1016/j.tics.2011.01.005.
  28. Fazio RH, Olson MA. Implicit measures in social cognition. research: their meaning and use. *Annu Rev Psychol*. 2003; 54:297-327. DOI:10.1146/annurev.psych.54.101601.145225.
  29. Greenwald AG, McGhee DE, Schwartz JL. Measuring individual differences in implicit cognition: the implicit association test. *J Pers Soc Psychol*. 1998; 74(6):1464-80. Available
  30. Gawronski B, Bodenhausen GV. Associative and propositional processes in evaluation: an integrative review of implicit and explicit attitude change. *Psychol Bull*. 2006; 132(5):692-731. DOI:10.1037/0033-2909.132.5.692.
  31. Greenwald AG, Nosek BA, Banaji MR. Understanding and using the implicit association test: I. An improved scoring algorithm. *J Pers Soc Psychol*. 2003; 85(2):197-216. Available
  32. Harvard. Project Implicit. 2011 [cited 1st March]. Available from: <https://implicit.harvard.edu/implicit/>.
  33. Van Ryckeghem DM, De Houwer J, Van Bockstaele B, Van Damme S, De Schryver M, Crombez G. Implicit associations between pain and self-schema in patients with chronic pain. *Pain*. 2013; 154(12):2700-6. DOI:10.1016/j.pain.2013.07.055.
  34. Greenwald AG, Poehlman TA, Uhlmann EL, Banaji MR. Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *J Pers Soc Psychol*. 2009; 97(1):17-41. DOI:10.1037/a0015575.



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35. Sabin JA, Greenwald AG. The influence of implicit bias on treatment recommendations for 4 common pediatric conditions: pain, urinary tract infection, attention deficit hyperactivity disorder, and asthma. *Am J Public Health*. 2012; 102(5):988-95. DOI:10.2105/ajph.2011.300621.
  36. Gawronski B, Hofmann W, Wilbur CJ. Are "implicit" attitudes unconscious? *Conscious Cogn*. 2006; 15(3):485-99. DOI:10.1016/j.concog.2005.11.007.
  37. Houben RM, Gijssen A, Peterson J, de Jong PJ, Vlaeyen JW. Do health care providers' attitudes towards back pain predict their treatment recommendations? Differential predictive validity of implicit and explicit attitude measures. *Pain*. 2005; 114(3):491-8. DOI:10.1016/j.pain.2005.01.017.
  38. Caneiro JP, O'Sullivan P, Smith A, Moseley GL, Lipp OV. Implicit evaluations and physiological threat responses in people with persistent low back pain and fear of bending. *Scand J Pain*. 2017; 17:355-366. DOI:10.1016/j.sjpain.2017.09.012.
  39. Caneiro JP, O'Sullivan P, Lipp OV, Mitchinson L, Oeveraas N, Bhalvani P, et al. Evaluation of implicit associations between back posture and safety of bending and lifting in people without pain. *Scand J Pain*. 2018; 18(4):719-728. DOI:10.1515/sjpain-2018-0056.
  40. Moran RW, Rushworth WM, Mason J. Investigation of four self-report instruments (FABT, TSK-HC, Back-PAQ, HC-PAIRS) to measure healthcare practitioners' attitudes and beliefs toward low back pain: Reliability, convergent validity and survey of New Zealand osteopaths and manipulative physiotherapists. *Musculoskeletal Science and Practice*. 2017; 32(Supplement C):44-50. DOI:<https://doi.org/10.1016/j.msksp.2017.08.008>.
  41. 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. *Eur J Pain*. 2005; 9(2):173-83. DOI:10.1016/j.ejpain.2004.05.002.
  42. Sabin JA, Rivara FP, Greenwald AG. Physician implicit attitudes and stereotypes about race and quality of medical care. *Med Care*. 2008; 46(7):678-85. DOI:10.1097/MLR.0b013e3181653d58.
  43. Portney LG, Watkins MP. *Foundations of Clinical Research: Applications to Practice*. 3rd ed: Prentice-Hall, Upper Saddle River, New Jersey 2015.
  44. Leeuw M, Goossens ME, van Breukelen GJ, Boersma K, Vlaeyen JW. Measuring perceived harmfulness of physical activities in patients with chronic low back pain: the Photograph Series of Daily Activities--short electronic version. *J Pain*. 2007; 8(11):840-9. DOI:10.1016/j.jpain.2007.05.013.

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45. Hofmann W, Gawronski B, Gschwendner T, Le H, Schmitt M. A meta-analysis on the correlation between the implicit association test and explicit self-report measures. *Pers Soc Psychol Bull.* 2005; 31(10):1369-85. DOI:10.1177/0146167205275613.
  46. Hoffman BM, Papas RK, Chatkoff DK, Kerns RD. Meta-analysis of psychological interventions for chronic low back pain. *Health Psychol.* 2007; 26(1):1-9. DOI:10.1037/0278-6133.26.1.1.
  47. Dovidio JF, Fiske ST. Under the radar: how unexamined biases in decision-making processes in clinical interactions can contribute to health care disparities. *Am J Public Health.* 2012; 102(5):945-52. DOI:10.2105/ajph.2011.300601.
  48. Pincus T, Vogel S, Breen A, Foster N, Underwood M. Persistent back pain--why do physical therapy clinicians continue treatment? A mixed methods study of chiropractors, osteopaths and physiotherapists. *Eur J Pain.* 2006; 10(1):67-76. DOI:10.1016/j.ejpain.2005.01.008.
  49. Chapman EN, Kaatz A, Carnes M. Physicians and implicit bias: how doctors may unwittingly perpetuate health care disparities. *J Gen Intern Med.* 2013; 28(11):1504-10. DOI:10.1007/s11606-013-2441-1.
  50. Harman K, Bassett R, Fenety A, Hoens A. "I think it, but don't often write it": the barriers to charting in private practice. *Physiother Can.* 2009; 61(4):252-8; discussion 259-60. DOI:10.3138/physio.61.4.252.
  51. Leeuw M, Peters ML, Wiers RW, Vlaeyen JW. Measuring fear of movement/(re)injury in chronic low back pain using implicit measures. *Cogn Behav Ther.* 2007; 36(1):52-64. DOI:10.1080/16506070601070400.

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4 **APPENDIX**  
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28 **Figure** - Images used for the bending and lifting safety beliefs thermometer score. The question,  
29 “how would you rate the level of risk to this person’s back?” was displayed above each image, and a  
30 Likert scale (anchored on “0” meaning safe, and “10” meaning danger) was displayed below each  
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**Authors' contribution**

JP Caneiro, Peter O'Sullivan, Anne Smith and Ottmar Lipp provided concept/idea/research design. Ingrid Ovrebekk, Luke Tozer, Michael Williams and Magdalene Teng performed data collection. JP Caneiro, Peter O'Sullivan, Ottmar Lipp, Anne Smith, Ingrid Ovrebekk, and Magdalene Teng provided data analysis. All authors contributed to discussion of results and writing of the manuscript (including review of manuscript before submission).

### **Acknowledgements**

We would like to thank the participants for sparing the time out of their busy schedule to take part in this study. We are also grateful for the physiotherapy clinics that accommodated our research team during periods of data collection. To Dr Leo Ng, our thanks for the valuable assistance with the images developed for this project.