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2 **Full title: Construct and discriminant validity of STarT**  
3 **Back Screening Tool – Brazilian version**

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5 **Short title: SBST-Brazil psychometric properties**

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1 **Abstract**

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3 **BACKGROUND:** The STarT Back Screening Tool (SBST) was developed to stratify low  
4 back pain patients according to their risk of future physical disability so that prognostic  
5 subgroups can receive matched treatments in primary care. **OBJECTIVE:** To measure the  
6 construct and discriminative validity of the SBST-Brazil questionnaire. **METHOD:** A  
7 hundred and fifty one patients were recruited to test the construct and discriminative validity  
8 comparing the SBST-Brazil to the Brazilian Version of the Oswestry Disability Index (ODI),  
9 Roland Morris Disability Questionnaire (RMDQ) and Fear-Avoidance Beliefs Questionnaire  
10 - Work (FABQ-W) and Physical Activity (FABQ-PA) subscales at baseline. Spearman's  
11 rank-order correlation and area under the curve (AUC) derived from receiver operating  
12 curves (ROC) for total scores and psychosocial subscale score of the SBST-Brazil were  
13 used for construct and discriminant validity analysis, respectively. **RESULTS:** The SBST-  
14 Brazil total and psychosocial subscale scores had good and moderate correlation with ODI  
15 ( $r=0.61$ ;  $r=0.56$ , respectively) and good with RMDQ ( $r=0.70$ ;  $r=0.64$ , respectively). Both  
16 scores of the SBST-Brazil total and psychosocial subscale correlated weakly and  
17 moderately with the FABQ-PA ( $r=0.28$ ;  $r=0.34$ , respectively) and weakly with the FABQ-W  
18 ( $r=0.18$ ;  $r=0.20$ , respectively). The discriminant validity with AUCs for the total and  
19 psychosocial subscale scores against reference standard ranged from 0.66 for  
20 kinesiophobia to 0.88 for disability. **CONCLUSION:** The SBST-Brazil showed a moderate  
21 to good correlation with the disability tools, but a weak correlation with fear-avoidance  
22 beliefs. The results of discriminant validity suggest that SBST-Brazil is able to discriminate  
23 low back pain patients with disability and fear-avoidance beliefs.

24 **Keywords:** Physical therapy; low back pain; STarT Back Screening Tool; outcome  
25 measurement; validity.

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31 **Bullet Points**

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- 33 • SBST-Brazil showed a moderate to good correlation with disability tools.
- 34 • SBST-Brazil demonstrated weak correlations with fear-avoidance beliefs.
- 35 • SBST-Brazil discriminates LBP patients with disability and fear-avoidance beliefs.

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## 1        **1. Introduction**

2            The high prevalence of low back pain (LBP) and its socioeconomic  
3 implications have led to a search for improved methods of diagnosis, treatment,  
4 and especially assessment of physical disability, which may be either temporary  
5 or permanent<sup>1</sup>. Currently, LBP is the primary cause of years lived with disability  
6 in Brazil, as well as in most developed and developing countries<sup>2</sup>. Many  
7 psychosocial factors, such as fear, kinesiophobia, depression, pain  
8 catastrophizing, and bothersomeness, can influence the prognosis of LPB  
9 patients, increasing the chance of developing chronic pain over time<sup>3-7</sup>.

10           The early identification of individuals who are at risk of poor clinical  
11 outcomes is an important component in the management of LBP. Identification  
12 of elevated psychosocial factors has been strongly linked to poor clinical  
13 outcomes in a variety of health care settings<sup>3,6,8,9</sup>. The optimal method of  
14 assessing psychosocial factors is the subject of debate<sup>10</sup>.

15           More recently, the STarT Back Screening Tool (SBST) was developed  
16 and validated by Hill et al.<sup>11</sup> to identify subgroups of patients and to guide initial  
17 treatment decision-making in primary care<sup>8,11-13</sup>. The SBST has already been  
18 translated and cross-culturally adapted to Brazilian Portuguese (SBST-Brazil)<sup>12</sup>.  
19 Its reliability (measured by intraclass correlation coefficient) has been tested,  
20 showing acceptable results of 0.79 (95% CI 0.63 – 0.95) for the classification  
21 score, Standard Error Measurement (SEM) of 1.9%, and internal consistency of  
22 0.74 for the SBST total score and 0.70 for the SBST psychosocial subscale  
23 score<sup>12</sup>. The Brazilian version also showed good correlation with OMPSQ  
24 ( $r=0.73$ ), as well as with the Tampa Scale of Kinesiophobia (TSK) ( $r=0.60$ ) and  
25 with the Roland Morris Disability Questionnaire (RMDQ) ( $r=0.76$ ). However,  
26 when correlated with pain intensity at the time of assessment, it demonstrated  
27 moderate correlation ( $r=0.31$ )<sup>14</sup>. Some other versions of the SBST have also  
28 been translated and have had their psychometric properties tested<sup>1,11,15-17,19,20</sup>.  
29 It is adequate that the Brazilian version of the SBST has its construct and  
30 discriminative validity established, as this will increase its applicability and  
31 external validity.

32           The aim of this study is to measure the construct and discriminative  
33 validity of the SBST-Brazil questionnaire by assessing its association with the  
34 Oswestry Disability Index (ODI), the Roland Morris Disability Questionnaire

1 (RMDQ), and the Fear-Avoidance Beliefs Questionnaire - Work (FABQ-W) and  
2 Physical Activity (FABQ-PA) subscales in a sample of low back pain patients.

## 3 4 **2. Method**

### 5 **2.1 Sample**

6 One hundred and fifty one patients were conveniently recruited at a  
7 private clinic called *Instituto Wilson Mello* in Campinas, SP, Brazil. All subjects  
8 had low back pain of any duration, with or without nerve root compromise, were  
9 at least 18 years old, and could read and speak Brazilian Portuguese. As part of  
10 a standard examination procedure, patients were screened and excluded from  
11 the study if they had potentially serious spinal pathology (e.g., cauda equina  
12 compression, lumbar fracture, malignancy, and cognitive, neurological, or  
13 rheumatological disorders), pregnancy, or history of spinal surgery in the past 6  
14 months.

15 All participants provided written informed consent and the study protocol  
16 was approved by the Research Ethics Committee of *Pontifícia Universidade*  
17 *Católica de Campinas* (PUC-Campinas), Campinas, São Paulo, Brazil (number  
18 150.139).

### 19 20 **2.2 Description of the SBST questionnaire**

21 The SBST is based on the presence of modifiable physical and  
22 psychosocial factors for persistent and disabling symptoms, measured by nine  
23 questions. Of these, the first four items are related to referred leg pain,  
24 disability, and comorbid shoulder or neck pain, and the other five items make up  
25 a psychosocial subscale (items 5 to 9) that investigates bothersomeness, pain  
26 catastrophizing, fear, anxiety, and depression. The patients are classified as  
27 having a high risk of poor prognosis (high levels of psychosocial prognostic  
28 factors are present with or without the physical factors present); medium risk  
29 (physical and psychosocial factors are present, but not a high level of  
30 psychosocial factors); or low risk (few physical or psychosocial prognostic  
31 factors are present)<sup>8,11-13</sup>.

### 32 33 **2.3 Instruments used to measure construct and discriminative validity**

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### 1 2.3.1 Oswestry Disability Index (ODI)

2 The ODI includes 10 six-point scales, and the results vary from 0-100%,  
3 where higher scores represent worst function. The items are related to intensity  
4 of pain, personal care (washing, dressing, *etc.*), lifting, walking, sitting, standing,  
5 sleeping, sex life, social life, and traveling. The Brazilian version of this tool was  
6 tested in accordance with the internationally recommended methodology and  
7 showed good internal consistency (Cronbach's alpha of 0.87) and good  
8 reliability (ICC of 0.99)<sup>21</sup>. The ODI showed moderate correlation with pain  
9 intensity ( $r=0.66$ ) and a relatively high correlation with the RMDQ scores  
10 ( $r=0.81$ ). A significant correlation ( $P\leq 0.01$ ) was also found between the ODI  
11 scores and the 8 scales of the SF-36<sup>21</sup>.

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### 13 2.3.2 Roland Morris Disability Questionnaire (RMDQ)

14 The RMDQ is a 24-item questionnaire related to normal activities of daily  
15 living<sup>22,23</sup>, and the results vary from 0-24 points, where higher scores represent  
16 worst function. The ICC score was 0.94 for the test-retest reliability and 0.95 for  
17 the inter-rater reliability. The correlation coefficient was 0.80 ( $P<0.01$ ) between  
18 the Pain Scale and the RMDQ score and 0.79 ( $P<0.01$ ) between the Visual  
19 Analog Scale and the RMDQ score<sup>22</sup>.

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### 21 2.3.2 Fear-Avoidance Beliefs Questionnaire (FABQ)

22 This instrument assesses how beliefs and fear of individuals with lower  
23 back pain affect two subscales related to physical activities (FABQ-PA) and  
24 work (FABQ-W). The results of the FABQ-PA vary from 0-24 points, where  
25 higher scores represent more fear avoidance related to physical activities. In  
26 addition, the results of the FABQ-W vary from 0-42 points, where higher scores  
27 represent more fear avoidance related to work. The test-retest intraclass  
28 correlation coefficients (ICC=0.84 and 0.91) and the internal consistency  
29 (Cronbach's alpha = 0.80 and 0.90) for the FABQ-PA and FABQ-W,  
30 respectively, were acceptable. The correlation coefficient (Pearson correlation)  
31 between the FABQ-W and RMDQ-Brazil was  $r=0.72$ ;  $p<0.01$ , and  $r=0.35$ ;  
32  $p<0.01$  for the FABQ-PA and the same questionnaire. It was also correlated  
33 with the numeric pain scale ( $r=0.76$ ;  $p<0.01$  for FABQ-Work  $r=0.35$ ;  $p<0.05$  for  
34 FABQ-PA)<sup>24</sup>.

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## 2 **2.4 Construct and Discriminant Validity**

3 Construct validity was tested by comparing the SBST-Brazil total and  
4 psychosocial subscale scores with the Brazilian Portuguese version of the ODI,  
5 RMDQ, and FABQ-W and FABQ-PA subscales applied at baseline. For  
6 discriminant validity, AUCs derived from receiver operating Curves for the  
7 SBST-Brazil total and subscale scores were calculated against reference  
8 standards for disability (ODI and RMDQ), fear-avoidance beliefs related to  
9 physical activity (FABQ-PA subscale), and fear-avoidance beliefs related to  
10 work (FABQ-W subscale).

11 The hypothesis is that the SBST-Brazil will demonstrate a good  
12 correlation with the Brazilian version of the RMDQ and ODI as the SBST-Brazil  
13 has two disability items that are related to these measures (Items 3 and 4) and  
14 because other versions have already demonstrated good correlations<sup>1,17</sup> and  
15 excellent discriminant validity with disability reference standards<sup>19,20</sup>. Another  
16 hypothesis is that the SBST-Brazil psychosocial subscale should correlate well  
17 with the Brazilian version of the FABQ-PA, as both are sensitive to change in  
18 the individual's fear-avoidance beliefs regarding physical activity<sup>24</sup>.

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## 20 **2.5 Statistical analysis**

21 All analyses were calculated using the software PASW Statistics 18.0  
22 (SPSS Inc., Chicago, IL, USA), with a significance level ( $\alpha$ ) of 5%. Construct  
23 validity was evaluated by correlating the SBST-Brazil with the ODI, RMDQ, and  
24 Physical Activity and Work subscales of the FABQ at baseline, using  
25 Spearman's Rank Order Correlation. According to Fleiss<sup>25</sup>,  $r < 0.30$  indicates  
26 weak correlation,  $r \geq 0.30$  and  $< 0.60$  indicates moderate correlation, and  $r \geq 0.60$   
27 indicates good correlation. A score of 0.70 has been recommended for  
28 instruments that measure the same construct. When similar constructs are  
29 compared, scores lower than 0.70 should be accepted<sup>26,27</sup>.

30 The discriminative validity of the SBST-Brazil was described using the  
31 AUC statistic derived from receiver operating curves for the total score and the  
32 psychosocial subscale score of the SBST-Brazil against baseline reference  
33 standards. These instruments were dichotomized to provide cases and non-  
34 cases using established cutoffs from the available literature. The definitions for

1 reference standard were: Disability (RMDQ>7<sup>11</sup> and ODI>13<sup>28</sup>), kinesiophobia  
2 (FABQ-PA>13)<sup>29</sup>, fear related to work activities (FABQ-W>25)<sup>29</sup>. Strength of  
3 discrimination was classified according to the following descriptors: 0.70-0.80  
4 indicated acceptable discrimination, 0.80-0.90 indicated excellent  
5 discrimination, and 0.90 indicated outstanding discrimination<sup>11</sup>.

### 6 7 **3. Results**

8 A total of 151 eligible patients were recruited and Table 1 shows the  
9 characteristics of the study participants for construct and discriminant validity.

#### 10 11 **3.1 Construct validity**

12 Table 2 presents the construct validity of the SBST-Brazil total and  
13 psychosocial subscales. The scores of the SBST-Brazil total and psychosocial  
14 subscales correlated better with the RMDQ (r=0.64, r=0.70), respectively, but  
15 weakly with FABQ-W (r=0.18, r=0.20), respectively.

#### 16 17 **3.2 Discriminant validity**

18 The discriminant validity of the screening tool is presented in Table 3,  
19 with AUCs for SBST-Brazil total and psychosocial subscale scores against  
20 reference standard cases, which ranged from 0.66 for kinesiophobia to 0.88 for  
21 disability.

### 22 23 **4. Discussion**

24 The aim of this study was to analyze the construct and discriminant  
25 validity of the Brazilian version of the STarT Back Screening Tool so it can be  
26 used with Brazilian low back pain patients. Our first hypothesis was that the  
27 SBST-Brazil would correlate well with the tools for disability (RMDQ and ODI),  
28 as it contains two specific items for this construct (items 3 and 4). Similar to the  
29 French<sup>1</sup>, Iranian<sup>17</sup>, and Brazilian versions<sup>14</sup>, our results showed good to  
30 moderate correlations on both the total score (r=0.70 with RMDQ and r=0.61  
31 with ODI) and the psychosocial subscale score (r=0.64 with RMDQ and r= 0.56  
32 with ODI). For discriminant validity, our findings for disability reference  
33 standards ranged from 0.78 to 0.88, being classified as acceptable to excellent  
34 discrimination<sup>11</sup>. These findings are consistent with the psychometric studies of

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Parece que está faltando informação aqui.  
Favor verificar.

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1 the English<sup>11</sup> (0.92 for disability - RMDQ), Chinese<sup>19</sup> (0.87 and 0.89 for disability  
2 – RMDQ), and Danish<sup>20</sup> versions (0.84 and 0.85 for disability – RMDQ),  
3 suggesting that the SBST-Brazil appropriately discriminates disability for  
4 patients with low back pain.

5 On the other hand, our second hypothesis was that the SBST-Brazil  
6 would be correlated with the FABQ, mostly with its physical activity subscale  
7 (FABQ-PA). However, our results showed weak correlations. These correlations  
8 with the FABQ-W were expected because the SBST does not have any item  
9 related specifically to fear about work. In addition, it must be noted that our  
10 sample did not have many patients with work-related problems. In a previous  
11 report, the original English version has showed a similar weak correlation with  
12 the FABQ-W<sup>15</sup> ( $r=0.23$ ), but no other translated version had its correlation  
13 checked with the FABQ scale. The correlation of the Brazilian SBST version  
14 and the TKS was also good ( $r=0.60$ ), which has the same construct as the  
15 FABQ-PA<sup>14</sup>.

16 Our analyses for discriminant validity showed better results for the SBST-  
17 Brazil total and psychosocial subscale scores against the FABQ-PA (0.66 and  
18 0.68, respectively) and also against the FABQ-W (0.71 and 0.70, respectively),  
19 suggesting that even though the correlations were weak, the SBST-Brazil was  
20 still able to discriminate low back pain patients with fear-avoidance beliefs.

21

## 22 **5. Conclusion**

23 The SBST-Brazil showed a good to moderate correlation with the  
24 disability tools (RMDQ and ODI); however, it demonstrated weak correlations  
25 with the FABQ-PA and FABQ-W subscales. The discriminant validity ranged  
26 from 0.66 to 0.88, representing acceptable to excellent results and suggesting  
27 that the SBST-Brazil is able to discriminate low back pain patients with disability  
28 and fear-avoidance beliefs.

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1 **Table 1.** Subjects' demographic and clinical characteristics.

Characteristic	Baseline (n=151)
<b>Gender: N (%)</b>	
Male	69 (45.7)
Female	82 (54.3)
<b>Body mass index</b> (kg/m <sup>2</sup> ): mean (SD)	26.1 (3.78)
<b>Age</b> (years): Mean (SD); range [min-max]	47.4 (14.4); [19 -81]
<b>Pain NRS:</b> Mean (SD); range [min-max]	5.6 (2.2); [1-10]
<b>Education level, N (%)</b>	
Elementary Level	0 (0%)
High School Level	27 (17.8%)
University Level	124 (82.2%)
<b>FABQ-W:</b> Mean (SD); range [min-max]	10.4 (9.5); [0-39]
<b>FABQ-PA:</b> Mean (SD); range [min-max]	14.5 (6.2); [0-28]
<b>RMDQ:</b> Mean (SD); range [min-max]	10 (5.3); [0-23]
<b>ODI:</b> Mean (SD); range [min-max]	26 (15); [2-70]
<b>SBST-Brazil:</b> Mean (SD); range [min-max]	3.97 (1.97); [0-9]
Low Risk (n, %)	68 (45 %)
Medium Risk (n, %)	61 (40.5 %)
High Risk (n, %)	22 (14.5 %)

SD: standard deviation; Pain NRS: Pain numerical rating scale; FABQ -W: Fear-Avoidance Beliefs Questionnaire - Work Subscale, Brazilian version; FABQ -PA: Fear-Avoidance Beliefs Questionnaire Physical Activity Subscale, Brazilian version; RMDQ: Roland Morris Disability Questionnaire, Brazilian version; ODI: Oswestry Disability Index, Brazilian version.

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Table 2. Construct validity of the SBST-Brazil total and psychosocial subscale scores.

	Spearman Correlation Coefficient (r) SBST Brazil Total Score	Spearman Correlation Coefficient (r) SBST Brazil Psychosocial scale score
FABQ-W	0.18*	0.20*
FABQ-PA	0.28*	0.34*
RMDQ	0.70*	0.64*
ODI	0.61*	0.56*

\* (P<0.05).

Table 3. Discriminant validity: AUC for screening SBST-Brazil total scores and psychosocial subscale scores. Against reference cases at baseline.

Reference Standards	Case Definition	SBST-Brazil Total Score ROC (95%CI)	SBST-Brazil Psychosocial Subscale score ROC (95% CI)
FABQ-W (Fear related to work)	> 25	0.71 (0.54-0.87) *	0.70 (0.56-0.84)*
FABQ-PA (Kinesiophobia)	> 13	0.66 (0.56-0.77)*	0.68 (0.58-0.78)*
RM (Disability)	> 7	0.88 (0.81-0.95)*	0.84 (0.77-0.92)*
ODI (Disability)	> 20	0.81 (0.72-0.89)*	0.78 (0.70-0.86)*

\* (P<0.05).