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Review

Comparison between the STarT Back Screening Tool and the Örebro Musculoskeletal Pain Screening Questionnaire: Which tool for what purpose? A semi-systematic review☆

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ABSTRACT

Background: Prevention of chronicization of low back pain requires accurate detection of at-risk patients. Questionnaires have been validated, including the STarT Back Screening Tool (SBST) and the Örebro Musculoskeletal Pain Screening Questionnaire (OMPSQ). This review aims to compare these questionnaires in terms of predictive value and in terms of aims, to guide the choice in clinical practice.
Methods: This study is a semi-systematic literature review. Studies evaluating at least one of the questionnaires and written between 1997 and October 10th 2017 were selected from Pubmed database. Inclusion criteria were pain duration < 3 months, outcomes including pain, function and/or global recovery. For work outcomes, inclusion criteria were extended to chronic patients. Studies had to provide information on sensitivity, specificity and area under the ROC Curve (AUC).
Results: Twenty-eight studies met our inclusion criteria (7 SBST, 21 original OMPSQ, 3 short OMPSQ). The OMPSQ best predicted a Pain NRS ≥ 3 at 3 months (AUC = 0.64 (0.50–0.78)) and at 6 months (AUC between 0.70 (no confidence interval provided) and 0.84 (0.71–0.97)). The SBST and the OMPSQ are comparable to predict an Oswestry Disability Index $\geq 30\%$ at 6 months. A single study showed no difference between the SBST and the OMPSQ to predict absenteeism ≥ 30 days at 6 months. The two questionnaires cannot be compared for "global recovery" outcomes.
Conclusion: The OMPSQ seems better than the SBST for predicting "pain" and "work" outcomes, the SBST may be better for "function" outcomes. These results should be taken with caution because of the high heterogeneity between studies. It should be noted that the OMPSQ was elaborated with the aim of creating a prognostic tool while the SBST was devised as a treatment-allocating tool and is easier to use in clinical practice. This should guide the choice of using one questionnaire rather than the other.

1. Introduction

Spinal pain is the most frequent musculoskeletal pathology [1], with a 70% lifetime prevalence of low back pain (LBP) in industrialised countries [2,3]. About 90% of patients with acute LBP appear to show much improvement [4] or heal within 6 weeks [2,3] to 3 months [5]. However, the financial aspect of acute, subacute and chronic LBP is substantial, with massive direct but mostly indirect costs (e.g., sickness absenteeism) [6,7]. Chronic LBP accounts for most of the costs associated with LBP [8,9].

Therefore, the challenge for health professionals is to avoid the chronicization of acute/subacute LBP and its consequences [10,11]. It seems important to detect at-risk patients within 8 weeks after the onset of pain [12]. To this end, factors favoring the persistence of LBP have been studied and are often described as "yellow", "orange", "blue" and "black" flags [13]. Yellow flags are defined as inappropriate beliefs and attitudes about LBP [13]: the belief that LBP indicates the existence of danger, the development of fear-avoidance behaviors etc. Orange flags are psychiatric symptoms such as clinical depression or personality disorders.

☆ This semi-systematic review compared 2 prognostic questionnaires about back pain (STarT Back Screening Tool and Örebro Musculoskeletal Pain Screening Questionnaire) in terms of prognostic power and clinical aims, to guide the healthcare provider in choosing a questionnaire. By its large inclusion criteria, our study is the broadest on the topic. Although the 2 questionnaires present good and equivalent predictive power, we highlight important differences between them in clinical objectives and usefulness, which may be the most important to consider when deciding which tool to use.

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Blue flags are related to perceptions about the relation between work and health: beliefs that work is likely to cause further injury or that workmates are unsupportive etc. Black flags refer to system or contextual obstacles the patient has to face: conflict with insurance, legislation restricting options for return to work etc. To quickly determine which patients present a significant risk of chronicity, multidimensional questionnaires such as the Örebro Musculoskeletal Pain Screening Questionnaire (OMPSQ) [14–16] and the STarT Back Screening Tool (SBST) [17] have been developed and validated in several countries and languages.

The OMPSQ [16], formerly known as the Acute Low Back Pain Screening Questionnaire (ALBPSQ), presents 25 items (Appendix A). Linton et al. (1998) [16] created the OMPSQ to determine the risk of long-term absenteeism from work due to LBP. Items from already validated questionnaires were selected to evaluate the main psychosocial risk factors for chronic musculoskeletal pain [14,15]. As a result, the 25 items of the OMPSQ cover most of these psychosocial factors. The initial versions of this questionnaire distinguished two patient subgroups: "at risk" and "not at risk". Several cutoff scores have been proposed; they differ according to the studies and the outcomes considered (pain, disability, work absence). The OMPSQ-short [18] is a 10-item shortened version of the original OMPSQ developed for easier clinical use, with predictive properties comparable to those of the initial OMPSQ [18] (Appendix B).

The SBST [17] is a 9-item questionnaire. The tool distinguishes 3 levels of risk of chronicity: low, medium and high [17] (Appendix C). The "low risk" group consists of patients with none or a low number of poor prognostic factors. The "medium risk" group, with a poorer prognosis, includes patients with a high score in items concerning the physical domain but a low score in psychosocial risk factors. Patients in the "high risk" group have poor prognosis, with a high psychosocial sub-score. The intentions behind the creation of the SBST were to create a tool that could (1) identify modifiable risk factors in patients consulting in primary care settings for nonspecific LBP and (2) allow therapists to assign patients to tailored treatments [17]. The authors also wanted to make the questionnaire easy and quick to complete and the score to be more user-friendly than that from other questionnaires [17]. The purpose was also to divide people into 3 distinct risk groups. Initially, the existence of 3 potential patient sub-groups and treatments was assumed: low risk patients suitable for primary care management, high physical risk patients in need of physiotherapy, and high psychosocial risk patients for whom a combination of physical and cognitive-behavioral treatments is needed [19]. However, the authors observed that these sub-groups actually corresponded to low, medium, and high risk of chronicity, respectively.

A recent meta-analysis by Karran et al. [20] compared the predictive power of several questionnaires, including the OMPSQ and the SBST. Although the meta-analysis provided accurate and valuable information about the predictive power of these questionnaires, it did not provide practical advice regarding their clinical use. The purpose of this semi-systematic literature review was to provide a broader and a thorough analysis of these 2 questionnaires to offer more complete and useful information for clinicians. To this end, we compared these questionnaires in terms of general aims as well as predictive power but for a wider range of outcomes included in the International Classification of Functioning of the World Health Organisation (WHO-ICF).

2. Methods

2.1. Study design

This study was a semi-systematic review of the literature comparing the predictive value of SBST and OMPSQ in terms of performance (sensitivity/specificity/area under the receiver operating characteristic [ROC] curve [AUC]) for different outcomes, for non-specific low back and/or neck pain.

2.2. Search strategy

The PubMed/MEDLINE database was systematically searched by a single reviewer (AL) to identify eligible studies. Studies were eligible if they were published between 1997 (creation of the OMPSQ) and October 2017 and were written in English or French. Several combinations of keywords were used: "start back screening tool", "start back", "örebro musculoskeletal pain screening questionnaire", "örebro musculoskeletal pain", "OMPSQ", "OMSQ", "acute low back pain screening questionnaire", "ALBPSQ".

2.3. Inclusion criteria

Patients were adults over 18 years of age, of both sexes, with acute or subacute non-specific spinal pain (lumbar/cervical), without a red flag classification and without surgical intervention on the spine. Studies of chronic patients were accepted if outcomes were work-related. We also included studies of patients with musculoskeletal pain in other areas than the spine but concomitant with spinal pain.

Patients initially completed the SBST and/or OMPSQ original/short form. The Örebro Musculoskeletal Screening Questionnaire (OMSQ) and the ALBPSQ were assimilated with the original OMPSQ.

Each study investigated at least one outcome related to 4 main groups of outcomes: "pain", "function", "work" or "global recovery". The duration of follow-up had to be provided. Extending the results to 4 major themes, without prior selection of precise outcomes and follow-up, aimed to offer the widest possible view, in light of the heterogeneity of the literature.

The source of the participants and the method of analysis were explained.

Studies provided data on sensitivity, specificity and/or AUC. Cut-off scores used to calculate the sensitivity and specificity of a questionnaire were specified.

2.4. Data extraction and analysis

Data recorded were the questionnaire(s) studied, country, type of study, sample size, percentages of patients with acute/subacute/chronic pain (when available), outcomes, cut-off scores, and sensitivity/specificity/AUC (with 95% confidence intervals, when available) of the questionnaires for each outcome.

The ROC curve is a graphical representation of the association between sensitivity and specificity of a test for each cut-off value considered. To determine the validity of a test, the AUC must be calculated. The AUC indicates the overall predictive power of an instrument. Thus, when the test is perfectly predictive, the AUC is equal to 1. An AUC of 0.5–0.6 indicates a "non-informative" test and values of 0.6–0.7 suggest "low" predictive power, 0.7–0.8 "acceptable" power, 0.8–0.9 "excellent" power and $>$ 0.9 "outstanding" power[21]. Thus, the AUC is the statistical tool most used to determine the predictive power of a test or questionnaire [22]. The different outcomes were ordinal values; no mathematical operation was performed.

2.5. Methodologic quality

The Quality in Prognostic Studies tool (QUIPS) was used to assess the methodologic quality of prognostic studies [23] (Appendix D). This tool assesses biases in 6 different domains (study participation, study attrition, prognostic factor

measurement, outcome measurement, study confounding, statistical analysis and reporting), each evaluated by several items. The study is then rated as having low, medium or high level of bias in each domain. According to Bruls et al. [24], we decided to attribute an overall evaluation to each study. A study was rated at low overall risk of bias when all or most of the domains (4–6) were rated "low" or "moderate", indicating a high-quality study. A study was considered low quality when at least one domain was rated "high". One author (AL) assessed the methodologic quality.

3. Results

3.1. Study selection

A flow chart detailing the search strategy is provided in the figure (Fig. 1). Among 517 studies identified by keyword search, 28 studies, conducted in 15 countries, were included.

3.2. Outcomes used in studies

Pain was assessed in 2 ways : pain NRS and OMPSQ pain sub-score. Tools used for functional assessment were heterogeneous: Oswestry Disability Index (ODI), Roland Morris Disability Questionnaire (RMDQ), OMPSQ function sub-score, Quebec Back Pain Disability Questionnaire (QBPDQ), Spine Functional Index (SFI), and Graded Chronic Pain Scale function sub-score (GCPS). Work-related outcomes were assessed by absenteeism > X days, OMPSQ absenteeism sub-score, return to work at X months post-treatment, and sickness presenteeism (presenteeism despite pain). Global recovery was assessed by a dichotomized scale ("recovered" or "not recovered"), a 7-point Likert Patient-rated Global Recovery Scale, and a "Global Status" Numerical Rating Scale.

3.3. Prognostic power

Results can be found in Table 1. Table 2 summarizes the predictive power of the questionnaires for each outcome by using

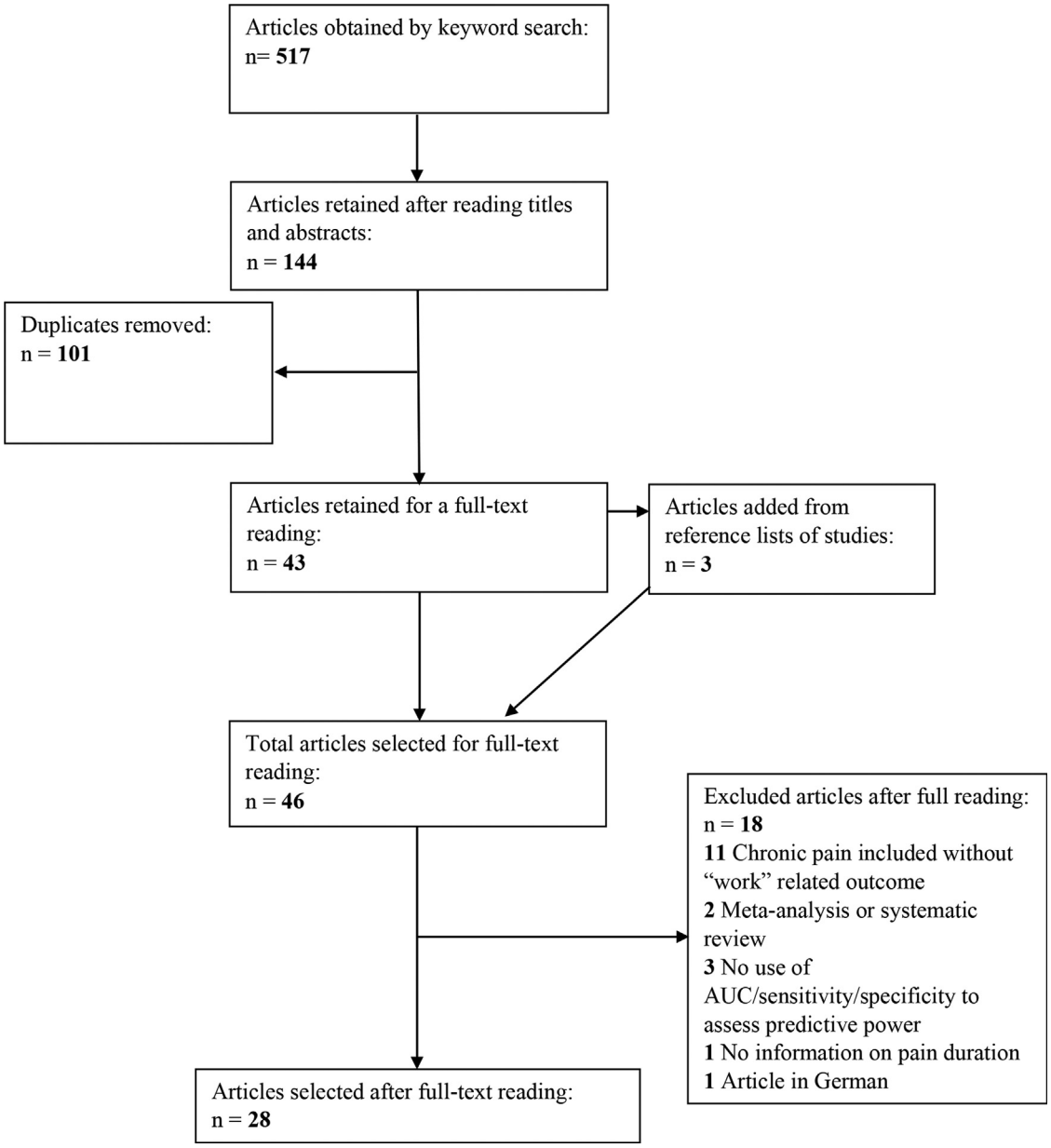

Fig. 1. Diagram of articles in the study.

Table 1
The predictive value of the questionnaires according to the different outcomes.

Study/Country	Questionnaire	Design	Patients (*n*), site, duration	Outcomes	Cut-off scores	Sensitivity (Sn)/specificity (Sp)/AUC (95% confidence interval)
Hill 2008 [17][a] UK	SBST	Cohort	177 LBP Acute & subacute	Pain NRS score ≥ 3 at 6 mo RMDQ ≥ 7 at 6 mo	Classic SBST	AUC = 0.70 (0.62–0.88) AUC = 0.81 (0.75–0.88)
Field & Newell. 2012 [25][a] UK	SBST	Cohort	151 LBP Acute & subacute	Pain NRS score ≥ 3 at 90 days	Classic SBST	AUC = 0.597 (0.49–0.69)
Beneciuk 2013 [29][a] USA	SBST	Cohort	55 LBP Acute & subacute	Pain NRS score ≥ 3 at 6 mo ODI score ≥ 30% at 6 mo	Classic SBST	AUC = 0.61 (0.45–0.76) AUC = 0.75 (0.60–0.90)
Mehling 2015 [40] USA	Modified SBST	Cohort	443 LBP Acute	RMDQ ≥ 7 at 6 mo RMDQ ≥ 7 at 2 yr GCPS[b] ≥ Grade 2 at 2 yr Likert Perceived Recovery Scale < "strong improved" & Pain NRS ≥ 3 at 6 mo[c] Likert Perceived Recovery Scale < "strong improved" & Pain NRS ≥ 3 at 2 yr[c]	Classic SBST ≥ 4 psychosocial. sub-score	Sn = 32%; Sp = 80% Sn = 38%; Sp = 78% Sn = 21%; Sp = 81% Sn = 27%; Sp = 82% Sn = 26%; Sp = 83%
Newell 2015 [26][a] UK	SBST	Cohort	192 LBP Acute & subacute	Pain NRS score ≥ 3 at 90 days	Classic SBST	AUC = 0.59 (0.48–.69)
Kongsted 2015 [27][a] Denmark	SBST	Cohort	604 LBP Acute & subacute	Pain NRS score ≥ 3 at 3 mo RMDQ ≥ 7 at 3 mo	Classic SBST	AUC = 0.56 (0.49–0.60) AUC = 0.67 (0.62–0.73)
Hill 2010 [34] UK	SBST & OMPSQ	Cohort	130 LBP All durations, chronic included	SBST: Time off work ≥ 30 days at 6 mo OMPSQ: Time off work ≥ 30 days at 6 mo	Classic SBST OMPSQ ≥ 112	AUC = 0.89 (0.82–0.95) AUC = 0.88 (0.81–0.96)
Linton & Halldén 1997 [14] Sweden	OMPSQ	Cohort	137 LBP &/or NP Acute & subacute	OMPSQ pain[d] > 16 at 6 mo OMPSQ function[e] < 45 at 6 mo	> 105	Sn = 75%; Sp = 71% Sn = 71%; Sp = 77%
Linton 1998 [16] Sweden	OMPSQ	Cohort (same cohort as Linton 1997 [16])	137 LBP &/or NP Acute & subacute	Absenteeism (≥ 1 day) caused by back pain at 6 mo	> 105	Sn = 85%; Sp = 75% AUC = 0.82 (0.74–0.89)[f]
Hurley 2000 [56] North Ireland	OMPSQ	Cohort	118 LBP All durations, 44% chronic patients	Return to work: "no" at 3 mo posttreatment	> 112	Sn = 59%; Sp = 80%
Hurley 2001 [57] North Ireland	OMPSQ	Cohort (same cohort as Hurley 2000 [38])	118 LBP All durations, 44% chronic patients	Work loss at 1 year posttreatment	> 112	Sn = 100%; Sp = 62%
Linton & Boersma 2003 [15] Sweden	OMPSQ	Cohort	107 LBP &/or NP Acute & subacute			Absenteeism ≥ 1 day because of pain at 6 mo Function: non-recovered if < 45 the OMPSQ function sub-score[e] at 6 mo Pain: non-recovered if > 16 to the OMPSQ pain sub-score[d] at 6 mo
> 100 > 90 > 90	Sn = 74%; Sp = 76% AUC = 0.74 (0.64–0.84)[f] Sn = 79%; Sp = 74% AUC = 0.83 (0.75–0.91)[f] Sn = 70%; Sp = 76% AUC = 0.75 (0.66–0.85)[f]¶					
Grotle 2006 [33] Norway	OMPSQ	Cohort	112 LBP Acute	Pain NRS > 2 at 6 mo Pain NRS > 2 at 12 mo Absenteeism > 30 days at 6 mo Absenteeism > 30 days at 12 mo RMDQ > 4 at 6 mo RMDQ > 4 at 12 mo	1–5) > 90 6) > 105	1) AUC = 0.62 (0.51–0.73) 2) AUC = 0.70 (0.60–0.80) 3) AUC = 0.80 (0.66–0.93) 4) AUC = 0.72 (0.57–0.86) 5) AUC = 0.68 (0.56–0.80) 6) AUC = 0.72 (0.60–0.84)

Table 1 (*Continued*)

Study/Country	Questionnaire	Design	Patients (*n*), site, duration	Outcomes	Cut-off scores	Sensitivity (Sn)/specificity (Sp)/AUC (95% confidence interval)
Heneweer 2007 [28] Netherlands	OMPSQ	Cohort	56 LBP Acute & subacute	Global Recovery = "nonrecovered"[g] at 3 mo Pain NRS score ≥ 3[h] at 3 mo Disability QBPDQ ≥ 30%[h] at 3 mo	Unspecified	AUC = 0.64 (0.50–0.79) AUC = 0.64 (0.50–0.78) AUC = 0.67 (0.54–0.80)
Jellema 2007 [46] Netherlands	OMPSQ	Cohort	296 LBP Acute & subacute	Nonrecovered: defined as a "slightly improved" score or less for ≥ 2 of the following follow-up times: 6,13,26 or 52 weeks[c]	> 99	Sn = 35%; Sp = 81% AUC = 0.61 (0.54–0.67)
Margison & French 2007 [53] Canada	OMPSQ	Cohort	211 LBP,NP, upper limb, lower limb Subacute	"Not able to return to work" at 6 weeks posttreatment	≥ 147	Sn = 51%; Sp = 89%
Westman 2008 [54] Sweden	OMPSQ	Cohort	147 BP, NP, shoulders, lower limb and others. All durations, 84,7% chronic patients	"Failure to reduce absenteeism" at 3 yr posttreatment	≥ 117 ≥ 139	Sn = 78%; Sp = 49% Sn = 44%; Sp = 89%
Gabel 2011 [31] Australia	OMPSQ & OMSQ[i]	Cohort	58 LBP Acute & subacute	SFI ≥ 10% at 6 mo Problem severity: "global status" NRS[j] > 1/10 at 6 mo Absenteeism 0–28 days at 6 mo Long-term absenteeism (> 28 days) at 6 mo Pain NRS score ≥ 3 at 6 mo[h] SFI ≥ 30% at 6 mo[h]	OMPSQ: ≥ 113 ≥ 113 ≥ 115 ≥ 120 OMSQ: ≥ 112 ≥ 112 ≥ 116 ≥ 120 ? ?	OMPSQ: AUC = 0.88 (0.77–0.99) AUC = 0.84 (0.71–0.97) AUC = 0.86 (0.77–0.93) AUC = 0.85 (0.73–0.97) OMSQ: AUC = 0.88 (0.78–0.99) AUC = 0.85 (0.72–0.97) AUC = 0.86 (0.76–0.96) AUC = 0.85 (0.73–0.96) AUC = 0.84 (0.71–0.97) AUC = 0.80 (0.67–0.92)
Gabel 2012 [37] Australia	OMSQ[i]	Cohort	143 LBP, NP, upper limb, lower limb Acute	Absenteeism 0–27 days at 6 mo Absenteeism ≥ 28 days at 6 mo SFI > 10 at 6 mo Problem severity: "global status" NRS[j] > 1/10 at 6 mo Costs ≥ $10000 at 6 mo	≥ 114	Sn = 61%; Sp = 92% Sn = 78%; Sp = 80% Sn = 79%; Sp = 69% Sn = 79%; Sp = 67% Sn = 85%; Sp = 74%
Nonclercq & Berquin 2012 [30] Belgium	OMPSQ	Cohort	73 LBP &/or NP Acute & subacute	OMPSQ pain > 16[d] at 6 mo OMPSQ function < 45[e] at 6 mo OMPSQ absenteeism > 6[k] at 6 mo ODI >20% at 6 mo Pain NRS score ≥ 3 at 6 mo[h] Disability ≥ 30% ODI at 6 mo[h]	≥ 97 ≥ 86 ≥ 106 ≥ 106 5)?	AUC = 0.73 AUC = 0.79 AUC = 0.83 AUC = 0.75 AUC = 0.70 AUC = 0.72
Law 2013 [39] China	OMPSQ	Cohort	220 LBP Acute & subacute	Return-to-work: "no"[l] at 12 mo post-treatment Absenteeism > 30 days at 12 mo posttreatment	≥ 130 ≥ 105	Sn = 82%; Sp = 63% AUC = 0.69 (0.62–0.76) Sn = 76%; Sp = 42% AUC = 0.71 (0.64–0.78)

Table 1 (*Continued*)

Study/Country	Questionnaire	Design	Patients (*n*), site, duration	Outcomes	Cut-off scores	Sensitivity (Sn)/specificity (Sp)/AUC (95% confidence interval)
Bergström 2014 [38] Sweden	OMPSQ	Cohort	173 LBP &/or NP All durations, 95% chronic patients	Absenteeism ≥ 30 days at 6 mo Absenteeism ≥ 30 days at 12 mo Absenteeism ≥ 30 days from 13 mo post-episode until 24 mo Self-reported sickness absenteeism: "yes" at 2 yr[m] Sickness presenteeism due to neck/back pain: "yes" ≥2 times at 2 yr[n] Full-time disability pension at 2 yr	≥105 ≥105 ≥105 ≥80 ≥95 ≥130	Sn = 80%; Sp = 69% AUC = 0.81 (0.71–0.91) Sn = 69%; Sp = 72% AUC = 0.75 (0.67–0.84) Sn = 63%; Sp = 72% AUC = 0.69 (0.59–0.78) AUC = 0.77 (0.69–0.84) AUC = 0.67 (0.58–0.76) AUC = 0.93 (0.88–0.99)
Öncü 2016 [35] Turkey	OMPSQ	Cohort	110 LBP Acute & subacute	Absenteeism > 15 days at 6 mo	>112	Sn = 54%; Sp = 97% AUC = 0.66 (0.52–0.81)
Riewe 2016 [32] Germany	OMPSQ	Cohort	133 LBP &/or NP Acute & subacute	Absenteeism ≥ 1 day at 6 mo OMPSQ function <45[e] at 6 mo OMPSQ pain >16[d] at 6 mo	≥92 ≥71 ≥84	Sn = 63%; Sp = 85% AUC = 0.74 (0.63–0.84) Sn = 97%; Sp = 57% AUC = 0.82 (0.74–0.89) Sn = 72%; Sp = 75% AUC = 0.79 (0.71–0.87)
Chung 2016 [58] Hong Kong	OMPSQ	Cohort	90 BP 54 NP Acute & subacute	Absenteeism > 60 days at 1 year Return to part-time or full-time work at least 4 consecutive weeks at 1 year	BP: >108 ≤115 NP: >108 ≤108	BP: Sn = 66%; Sp = 65% AUC = 0.71 (0.64–0.77) Sn = 67%; Sp = 67% AUC = 0.71 (0.64–0.77) NP: Sn = 65%; Sp = 63% AUC = 0.65 (0.55–0.74) Sn = 55%; Sp = 64% AUC = 0.59 (0.49–0.68)
Linton 2011 [18] Sweden	OMPSQ & OMPSQ-short	2 cohorts: RCT RCT	324 LBP Acute & subacute 183 LBP &/or NP All durations, including chronic patients	1–2) Absenteeism > 14 days at 6 mo	a) OMPSQ: >90 b) OMPSQ-short: >50	1) a) OMPSQ: AUC = 0.72 (0.67–0.77) b) OMPSQ-short: AUC = 0.70 (0.65–0.75) 2) a) OMPSQ: AUC = 0.84 (0.78–0.89) b) OMPSQ-short: AUC = 0.81 (0.74–0.86)
Opsommer 2017 [36] Switzerland	OMPSQ & OMPSQ-short	Cohort	98 LBP Chronic	Return-to-work at 3 mo post-treatment: OMPSQ OMPSQ-short OMPSQ item #15[o] OMPSQ item #16[o] Sum of items #15 & #16[o]	>105 2–5)?	OMPSQ: AUC = 0.82 (0.73–0.90) OMPSQ–short: AUC = 0.79 (0.70–0.88) Item (#15): AUC = 0.67 (0.57–0.78) Item (#16): AUC = 0.76 (0.66–0.85) Sum of items #15 & #16: AUC = 0.77 (0.68–0.86)
Schmidt 2016 [42] Germany	OMPSQ-short	RCT	112 LBP Acute & subacute	Disability ≥4/11 (dichotomized mean response to 3 GCPS "disability" items[b]) at 6 mo	ÖMSPQ scale sum score: >16	OMPSQ scale sum score: Sn = 65%; Sp = 87% AUC = 0.79 (0.67–0.90) OMPSQ item sum score: AUC = 0.77 (0.66–0.87)

RMDQ: Rolland Morris Disability Questionnaire; ODI: Oswestry Disability Index; NRS: numerical rating scale; LBP: low back pain; BP: back pain; NP: neck pain. QBPDQ: Quebec Back Pain Disability Questionnaire; GCPS: Graded Chronic Pain Scale; SFI: Spinal Functional Index; mo: months; yr: years; AUC: area under the receiver operating characteristic curve. For cut-off scores used for the OMPSQ, scores indicating ">" or "≥" correspond to cut-off scores used to define "high risk" people with poor prognosis. Conversely, those with "<" or "≤" correspond to cut-off scores to define "low risk" people with poor prognosis.

[a] Studies involving chronic patients who would normally not been included in this study but whose figures for the acute and subacute population were obtained and/or calculated by Karran et al. [20] in their systematic review and meta-analysis and therefore reproduced here.

[b] GCPS is a measure of 4 grades of risk combining the intensity of the pain and the disability it causes. For the study by Schmidt (2016) [42], only the 3 questions concerning disability caused by pain are considered.

[c] Patient-rated Global Recovery on a 7-point Likert scale for personal recovery feeling: very strong improved/strong improved/slightly improved/no change/slightly degraded/strong degraded/very strong degraded.

[d] Index obtained by multiplying the score of items 10 and 11 of the OMPSQ, of 10 points each, to obtain a score out of 100: "Average intensity of pain during the last X months" and "frequency of pain during the last X months".

[e] Sub-score of 50 points composed of questions 21-25 of the OMPSQ on daily life, each out of 10 points: "I can do light work for an hour", "I can walk for an hour", "I can do ordinary household chores", "I can do the weekly shopping" and "I can sleep at night".

[f] AUC not provided by this study but calculated by Hocking (2008) [59] in their systematic review.

[g] Dichotomized scale of overall recovery feeling: "recovered" or "not recovered".
[h] Figures obtained after analysis of Karran et al. [20], not available in the original study.
[i] Örebro Musculoskeletal Screening Questionnaire (OMSQ). OMPSQ modified to increase its understanding and broaden its applications [34].
[j] Indicated in appendix 2 of the article.
[k] Relative to item 6 of the OMPSQ, a score > 6 corresponds to > 30 days of absenteeism during the last 6 months.
[l] Return to work (Law, 2013. p.365-366) [39] considered "no" if positive answer to one of the last 2 questions: "Willingness to return to work but job is not available/early retirement" or "Cannot go back to work because of back pain".
[m] Present or past absenteeism within 2 years if the patient answers "yes" to at least one of these questions: "Are you considered ill because of your neck/lower back pain?"And/or "Did you have at least one episode of sickness due to neck/low back pain in the previous year?"
[n] Presenteeism at work if "yes" to the question "Has it happened in the previous 12 months that you went to work despite the feeling that you had to take a sick leave because of your health?" With only neck/low back pain and at least in 2 occasions in the last 12 months.
[o] OMPSQ: Item 15: "In your view, how large is the risk that your current pain may become persistent?" and Item 16: "In your estimation, what are the chances that you will be able to work in six months?"

the categories defined for the AUC values [21]. As a reminder, outcomes were arbitrarily divided into the 4 main themes described in the Methods section. Some data from several studies [17,25–31] were obtained from Karran et al. (2017) [20]. See Table 1 and footnotes for more details.

3.3.1. Pain

A numerical rating scale (NRS) score ≥ 3 for pain at 3 months was studied for both the SBST [25–27] and OMPSQ [28], with an AUC between 0.56 (0.49–0.60) [27] and 0.59 (0.49–0.69) [25] for the SBST and 0.64 (0.50–0.78) [28] for the OMPSQ. The same score was studied at 6 months, with an AUC between 0.61 (0.45–0.76) [29] and 0.70 (0.62–0.88) [17] for the SBST and 0.70 (confidence interval missing) [30] to 0.84 (0.71–0.97) [31] for the OMPSQ. Thus, both comparisons gave an advantage to the OMPSQ to predict a pain NRS score ≥ 3 at 3 months ("low" predictive power) and 6 months ("low" to "excellent").

For the OMPSQ, several studies [14,15,30,32] used the OMPSQ pain sub-score as an outcome at 6 months (see Table 1), with an AUC between 0.73 (confidence interval missing) [30] and 0.79 (0.71-0.87) [32]. No studies concerning the OMPSQ-short were found for a pain-related outcome.

3.3.2. Function

The ODI ≥ 30% at 6 months was the only outcome parameter studied for both the SBST and the OMPSQ, with an AUC of 0.75 (0.60–0.90) [29] for the SBST and 0.72 (confidence interval missing) [30] for the OMPSQ. Therefore, we cannot give an advantage to either questionnaire to predict an ODI ≥ 30% at 6 months (both "acceptable" predictive power).

The RMDQ score was used as an outcome for both questionnaires but with different scores. For the SBST, an RMDQ score ≥ 7 was used as outcome at 3 months [27] (AUC = 0.67 (0.62–0.73)) and at 6 months [17] (AUC = 0.81 (0.75–0.88)). For the

Table 2
Summary table of the predictive value of the questionnaires according to the outcomes.

Outcome	SBST	OMPSQ	OMPSQ-short
Pain NRS ≥ 3			
At 3 months	Non-informative	Low	/
At 6 months	Low to acceptable	Low to excellent	/
At 12 months	/	Acceptable	/
OMPSQ pain: > 16 at 6 months	/	Acceptable	/
ODI			
>20% at 6 months	/	Acceptable	/
≥30% at 6 months	Acceptable	Acceptable	/
RMDQ ≥ 7			
At 3 months	Low	/	/
At 6 months	Excellent	/	/
RMDQ > 4			
At 6 months	/	Low	/
At 12 months	/	Acceptable	/
OMPSQ function: < 45 at 6 months	/	Acceptable to excellent	/
QBPDQ: ≥ 30% at 3 months	/	Low	/
SFI			
≥ 10% at 6 months	/	Excellent	/
≥ 30% at 6 months	/	Excellent	/
Disability: ≥ 4/11 (dichotomized mean response to 3 GCPS disability items) at 6 months	/	/	Acceptable
Absenteeism			
≥ 1 day at 6 months	/	Acceptable to excellent	/
> 15 days at 6 months	/	Low to acceptable	Acceptable
≥ 30 days at 6 months	Excellent	Excellent	/
≥ 30 days at 12 months	/	Acceptable	/
≥ 30 days at 24 months	/	Low	/
> 60 days at 12 months	/	Low to acceptable	/
OMPSQ"absenteeism": > 6 days at 6 months	/	Excellent	/
Absenteeism: > 30 days at 12 months post-treatment	/	Acceptable	/
Return-to-work:"no"at 12 months post-treatment	/	Low	/
Return-to-work: at 3 months post-treatment	/	Excellent	Acceptable
Sickness presenteeism due to neck/back pain:"yes" ≥ 2 times at 2 years	/	Low	/
Return to part-time or full-time work: ≥ 4 consecutive weeks at 1 year	/	Non informative to acceptable	/
"Global recovery"	/	Low	/

Explanation of the outcomes and acronyms are in the footnote for Table 1. The categories given ("non-informative","low", etc.) for the area under the receiver operating characteristic curve values are described in the results.

OMPSQ, an RMDQ score > 4 was used at 6 months [33] [AUC = 0.68 (0.56–0.80)) and 12 months [33] (AUC = 0.72 (0.60–0.84)]. Several studies [14,30,32] used the OMPSQ function sub-score at 6 months (see legend Table 1), with an AUC ranging from 0.79 (confidence interval missing) [30] to 0.83 (0.75–0.91) [15]. Other outcomes are listed in Table 1.

3.3.3. Work absenteeism

Only absenteeism at work ≥ 30 days at 6 months was used in a single study [34] as an outcome for both the SBST [AUC = 0.89 (0.82–0.95)] and OMPSQ [AUC = 0.88 (0.81–0.96)]. This study is the only one that studied absenteeism at work for the SBST. The OMPSQ and OMPSQ-short can be compared on 2 outcomes for LBP. The first one was absenteeism > 15 days at 6 months, with an AUC between 0.66 (0.52–0.82) [35] and 0.72 (0.67–0.77) [18] for the OMPSQ [18,35] and 0.70 (0.65–0.75) [18] for the OMPSQ-short. The second was "return to work at 3 months posttreatment", with an AUC of 0.82 (0.73–0.90) [36] for the OMPSQ and 0.79 (0.70–0.88) [36] for the OMPSQ-short.

From these results, we could not conclude that the OMPSQ was superior to the SBST to predict absenteeism at work ≥ 30 days at 6 months (both "excellent" predictive power). The OMPSQ and its short version were comparable in predicting absenteeism > 15 days at 6 months ("low" to "acceptable" for the OMPSQ and "acceptable" for the OMPSQ-short), but the OMPSQ was superior to the short version in predicting a return to work at 3 months posttreatment ("excellent" predictive power).

For the OMPSQ, many other work-related outcomes have been studied (Table 1). For absenteeism ≥ 1 day at 6 months [15,31,32,37], the AUC was between 0.74 (0.64–0.84) [15] and 0.86 (0.76–0.96) [31]. For absenteeism ≥ 30 days at 6 months [31–34,37], the AUC was between 0.80 (0.66–0.93) [33] and 0.88 (0.81–0.96) [34]. The longest follow-up periods were also studied, with an AUC between 0.72 (0.57–0.86) [33] and 0.75 (0.67–0.84) [38] for absenteeism ≥ 30 days at 12 months [33,38] and an AUC of 0.69 (0.59–0.78) for absenteeism ≥ 30 days at 24 months [38]. For non-return to work at 12 months posttreatment [39], an AUC of 0.69 (0.62–0.76) was noted.

3.3.4. Global recovery

No identical global recovery outcome was studied for both SBST and OMPSQ. Therefore, they cannot be compared. Some results are given in Table 1 [28,37,38,40].

3.4. Methodologic quality

QUIPS analysis results are shown in Table 3. Globally, the risk of bias was low for 19 studies and high for 9. Among these 9 studies, 8 had a high risk of bias in the "study attrition" domain.

4. Discussion

4.1. Predictive properties of the questionnaires

Our findings revealed that different outcomes and cut-off scores were used in the selected studies and so they cannot be perfectly compared. Regardless, some observations can be made.

The OMPSQ had a slightly better ability to predict a pain NRS score ≥3 at 6 months for patients with acute or sub-acute spinal pain, with a "low" to "excellent" predictive power as compared with the SBST, which had a "low" to "acceptable" predictive power for this outcome. Both questionnaires seemed to be less effective to predict this score at 3 months ("non-informative" for the SBST and "weak" for the OMPSQ). Other pain outcomes were studied for both questionnaires, with similar results, which supports their usefulness for predicting persistent pain.

For function outcomes, the SBST seemed equivalent to the OMPSQ to predict an ODI ≥ 30% at 6 months with the same "acceptable" predictive power for patients with acute or sub-acute

Table 3
Methodologic assessment of the studies using the QUIPS tool [22].

Study	Study participation	Study attrition	Prognostic factor measurement	Outcome measurement	Study confounding	Statistical analysis and reporting	Overall risk of bias
Hill 2008 [17]	M	H	L	L	L	L	H
Field & Newell 2012 [25]	M	H	L	L	L	L	H
Beneciuk 2013 [29]	L	M	M	L	L	L	L
Mehling 2015 [40]	M	M	L	L	L	L	L
Newell 2015 [26]	M	H	M	L	L	L	H
Kongsted 2015 [27]	L	L	L	L	L	L	L
Hill 2010 [34]	M	M	L	L	L	L	L
Linton & Halldén. 1997 [14]	H	H	L	L	H	L	H
Linton 1998 [16]	H	H	L	L	H	L	H
Hurley 2000 [56]	M	L	L	L	L	L	L
Hurley 2001 [57]	L	M	L	L	M	L	L
Linton & Boersma 2003 [15]	M	H	L	L	M	L	H
Grotle 2006 [33]	M	L	M	L	L	M	L
Heneweer 2007 [28]	M	L	L	L	L	L	L
Jellema 2007 [46]	L	L	L	M	L	L	L
Margison & French 2007 [53]	M	H	L	L	L	L	H
Westman 2008 [54]	L	M	L	L	L	L	L
Gabel 2011 [31]	M	L	M	L	L	L	L
Gabel 2012 [37]	L	L	L	L	L	L	L
Nonclercq & Berquin 2012 [30]	M	L	L	L	L	L	L
Law 2013 [39]	L	M	L	L	M	L	L
Bergström 2014 [38]	M	L	L	M	L	L	L
Öncü 2016 [35]	L	L	L	L	H	L	H
Riewe 2016 [32]	L	M	L	L	L	L	L
Chung 2016 [58]	L	M	M	M	L	L	L
Linton 2011 [18]	L	L	L	L	L	L	L
Opsommer 2017 [36]	L	H	L	L	L	L	H
Schmidt 2016 [42]	L	M	L	L	L	L	L

L: low risk of bias; M: medium risk of bias; H: high risk of bias.

spinal pain. Several studies used the RMDQ as an outcome but with different scores. In particular, the SBST had a predictive power considered "excellent" for an RMDQ score ≥ 7 at 6 months. The predictive power seemed "low" for an RMDQ score > 4 at 6 months and "acceptable" at 12 months for the OMPSQ. According to Epping-Jordan et al. [41], functional outcomes were better predictors of long-term issues than the intensity of pain. Therefore, the SBST would seem to be better for predicting an RMDQ score and thus to predict "function" outcomes, but no conclusions can be drawn from our results.

Work absenteeism was widely studied for the OMPSQ but much less for the SBST. Only one study [34] compared the SBST and OMPSQ for absenteeism ≥ 30 days at 6 months. The findings suggested that the SBST had an "excellent" predictive power, equivalent to the OMPSQ. More studies are needed to confirm this observation. The original OMPSQ was studied for a large number of different outcomes and follow-ups, with AUC values always in the "acceptable" or "excellent" categories. The OMPSQ-short was studied for "work" outcomes and seemed equivalent to the original OMPSQ. Hence, the relatively long original OMPSQ could be replaced by its short version, which seems more appropriate in routine clinical practice. Given these observations, we recommend using the OMPSQ-short if the goal is for a prognosis related to "work" outcomes.

"Global recovery" outcomes were not widely studied for the OMPSQ or the SBST. Moreover, because the 2 questionnaires were not studied for the same outcome, a direct comparison is not possible. This concept is nevertheless interesting for having a more global outcome to be followed over time in addition to more precise outcomes. Indeed, outcomes related to return to work appear to be imprecise indicators of overall patient recovery, with patients returning to work despite persistent pain and functional limitations. In this perspective, we suggest that future studies should add "global recovery" outcomes, in a bio-psycho-social perspective for managing LBP.

Hill et al. (2010) [34], the authors of the SBST, compared the SBST and the original OMPSQ and found comparable predictive properties. They stressed that the shorter SBST had the easiest use. This is why the OMPSQ-short was created [18]. Schmidt et al. (2016) [42] showed that the OMPSQ-short was better accepted by patients than the original OMPSQ. Fuhro et al. (2015) [43] and Forsbrand et al. (2017) [44] found good correlation and moderate agreement between the SBST and OMPSQ-short in their studies of acute or subacute spinal pain.

In conclusion, despite small differences mainly depending on the outcome chosen, the SBST and the original OMPSQ seem to have comparable predictive properties. This observation was confirmed by a meta-analysis [20].

4.2. Clinical usefulness of the questionnaires

The clinical usefulness of the questionnaires is challenged by observations showing that their predictive power is not better than the intuition of the clinician (chiropractors [27], physiotherapists [45], general practitioners [46,47]), although another study demonstrated the opposite [48]. Moreover, most authors recommend some caution in the use of questionnaires. Indeed, their results must be integrated with the patient's history, expectations, preferences and context [48], which may also have an impact on the prognosis [18,28,48,49].

Another question relates to the time frame in which these questionnaires should be used. The utility of the SBST in patients with hyperacute [50] and acute [40] pain is debated. Newell et al. (2015) [26] suggested that the SBST should not be used during the first few days after the initiation of treatment because nearly one third of patients would change risk groups during that period. It would be interesting to carry out a similar study for the OMPSQ.

In clinical settings, determining a prognosis might be interesting but has little value if not coupled with a treatment decision. In this sense, it is important to remember and emphasize that these questionnaires were not created for the same purpose. The OMPSQ was created with questions from other questionnaires widely used and studied in the literature. It was designed to specifically determine which patient is at risk for poor prognosis, mainly defined in terms of work absenteeism [16]. Therefore, it is a prognostic tool not related to treatment recommendations. However, the main objective of the SBST is to find prognostic indicators in the primary care setting that can be modified by a treatment specific to each risk group (low, medium or high) with a limited number of questions; therefore, it is a treatment-allocating tool [17]. It distinguishes a psychosocial sub-score and a physical sub-score, which is not the case for the OMPSQ. This approach likely creates more homogenous groups of patients: high-risk patients scoring high on the psychosocial sub-scale and medium-risk patients having more physical risk factors. This homogeneity allows for more easily offering adequate treatment. Furthermore, studies suggested that this stratified treatment is effective in improving outcomes without costing more [51]. This difference in purpose between these tools is important and must affect the choice of a questionnaire. Considering our results, the OMPSQ is a better prognostic tool, and the SBST a better treatment-allocating tool. Thus, the choice of one questionnaire or another will depend essentially on whether the goal is predicting risks of chronicization or quickly determining which treatment would be appropriate for a given patient. However, this distinction might be somewhat abusive because both questionnaires have been validated for applications extended to other fields: the OMPSQ is predictive of risks other than work absenteeism and the SBST is a correct predictive questionnaire in addition to proposing a treatment.

4.3. Limitations and strengths

Limitations of this study are inherent to the heterogeneity discussed above and also stressed by Sattelmayer et al. [52]: studies varied in characteristics of patient populations, outcomes, follow-up durations, treatments during follow-up and sample size, which influenced results. Studies [37,53,54] involving patients with non-spinal pain associated with spinal pain were included, which implies risk of bias. Regardless, we found satisfactory predictive power, which suggests that these questionnaires can be used for determining prognosis for patients with non-spinal musculoskeletal pain such as arm or leg pain. Indeed, we included studies exploring this application of the questionnaires and that seemed to demonstrate that these questionnaires could be used for other pain sites with some modifications [37,53–55]. This avenue should be the subject of further research. Nevertheless, more studies examining identical outcomes for the same pain sites are needed for a future systematic review/meta-analysis on the subject.

One limitation concerns the few studies that could be used for evaluating the SBST according to our inclusion criteria, so comparison between the SBST and OMPSQ was relatively limited. More studies on the SBST including patients with acute and subacute pain only as well as studies examining the SBST for "work" outcomes are needed.

Our study differs from the meta-analysis of Karran et al. [20] and offers valuable and concrete additional information. First, we focused on only the OMPSQ and SBST, which are the most-used questionnaires. This selection allowed for a more precise analysis of the differences between them, both in terms of prognostic capacity and aims. Second, more studies were included in our

research because our inclusion criteria were broader: adding patients with chronic pain for "work" outcomes, more and different outcomes included in 4 major themes (pain, function, work and overall recovery), and different follow-up times. Therefore, our study is the broadest review on the subject to our knowledge. The final strength of our study is that we looked at the aims and clinical usefulness of the 2 questionnaires, which was not investigated in Karran et al. [20] but is probably the most important thing to consider when deciding which tool to use. This broad perspective allowed us to propose recommendations for clinicians.

5. Conclusion

The choice of a questionnaire depends on its aims. For predictive purposes, the OMPSQ has benefit for the outcome "long-term pain"; the SBST may be the most predictive for the outcome "function" and the OMPSQ may be the best for all "work" outcomes. However, given their brevity, the SBST and the OMPSQ-short seem more appropriate than the original OMPSQ for use in everyday practice. For treatment-allocation purposes, the SBST is clearly a better tool, allowing to allocate patients to homogenous groups with specific treatment protocols. Of note, these questionnaires must be used thoughtfully and their results should be integrated in a broader patient context.

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Disclosure of interest

The authors declare that they have no competing interest.

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Appendix A. Supplementary data

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