

LITERATURE REVIEW

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Generic Preference-based Measures for Low Back Pain

*Which of Them Should Be Used?*Aureliano Paolo Finch, MSc,* Melina Dritsaki, PhD,[†] and Claudio Jommi, MSc*[‡]**Study Design.** Systematic review.**Objective.** This systematic review examines validity and responsiveness of three generic preference-based measures in patients with low back pain (LBP).**Summary of Background Data.** LBP is a very common incapacitating disease with a significant impact on health-related quality of life (HRQoL). Health state utility values can be derived from various preference-based HRQoL instruments, and among them the most widely ones are EuroQol 5 dimensions (EQ-5D), Short Form 6 Dimensions (SF-6D), and Health Utilities Index 3 (HUI III). The ability of these instruments to reflect HRQoL has been tested in various contexts, but never for LBP populations.**Methods.** A systematic search on electronic literature databases was undertaken to identify studies of patients with LBP where health state utility values were reported. Records were screened using a set of predefined eligibility criteria. Data on validity (correlations and known group methods) and responsiveness (effect sizes, standardized response means, tests of statistical significance) of instruments were extracted using a customized extraction template, and assessed using predefined criteria.**Results.** There were substantial variations in the 37 included papers identified in relation to study design and outcome

measures used. EQ-5D demonstrated good convergent validity, as it was able to distinguish between known groups. EQ-5D was also able to capture changes of health states as results of different interventions. Evidence for SF-6D and HUI III was limited to allow an appropriate evaluation.

Conclusion. EQ-5D performs well in LBP population and its scores seem to be suitable for economic evaluation of LBP interventions. However, the paucity of information on the other instruments makes it impossible to determine its relative validity and responsiveness compared with them.**Key words:** EQ-5D, health economics, health policy, HUI III, low back pain, preference-based measures, psychometric characteristics, responsiveness, SF-6D, validity.**Level of Evidence:** 2**Spine 2016;41:E364–E374**

Low back pain (LBP) is a common health problem. A review of studies published between 1966 and 1998 reported that LBP lifetime prevalence reaches an 84% peak, whereas point prevalence and 1-year prevalence ranges from 12% to 33% and from 22% to 65%, respectively.¹

As an incapacitating disease LBP has an important impact on health-related quality of life (HRQoL), making cost-utility analysis (CUA) the preferred economic evaluation for LBP interventions. In CUA, life years gained are weighted for health state utility values (HSUVs), which are commonly derived from three generic preference-based measures: EuroQol Five Dimensions (EQ-5D), Short Form Six Dimensions (SF-6D), and Health Utility Index Three (HUI III). Preference-based HRQoL instruments typically comprise a descriptive system covering core dimensions of health (*e.g.*, mobility, self-care, usual activities, pain, and anxieties) and an attached value set, which is obtained on the basis of population's relative desire for dimensions of health. These generic measures are claimed to be applicable across all disease areas, therefore representing an important clinical outcome as well as a common currency for health technology assessment.²

These instruments psychometric performance in terms of validity (*i.e.*, reaching the objectives it has been developed for) and responsiveness (*i.e.*, ability to detect changes over time and across participants) has been already tested in

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different decision contexts, and more precisely in patients with visual disorders,³ cardiovascular diseases,⁴ cancer,⁵ rheumatoid arthritis,⁶ musculoskeletal diseases,⁷ and multiple sclerosis,⁸ but not in LBP populations.⁹ This systematic review aims at covering this gap and establishing whether these instruments use is appropriate in LBP populations. As it is common in similar studies, included articles will not be required to have conducted an assessment of validity and responsiveness themselves, but will contain information from which the instruments performance can be analyzed.

MATERIALS AND METHODS

The study design is a systematic literature review.

Literature Search

Medline, Embase, and Web of Science were investigated using a strategy developed around the four main constructs of the research question: EQ-5D, SF-6D, HUI-III, LBP. Terms searched were derived from Brazier *et al*,¹⁰ Brooks,¹¹ Dolan,¹² Fenny *et al*,¹³ Hayden *et al*,¹⁴ and Lin *et al*.¹⁵ The searching strategy included synonyms and spelling variations and was refined using truncation, wildcards, phrase search and proximity operators, and adjusted for differences in databases. Related terms such as “validity” or “psychometric characteristics” were not used because of this systematic review objective (this would have been useful in a systematic review of studies assessing the validity of preference-based instruments). No publication date limit was set. All studies published in English or for which a translator was available were considered. As an example, the complete search strategy for MEDLINE (Ovid) is provided in Appendix I, <http://links.lww.com/BRS/B57>.

Study Selection

Relevant records were imported on Refworks and duplicates were removed. Studies were included in the systematic review if they met all the eligibility criteria presented in Table 1.

Data Extraction

A customized extraction template model was used for the collection of relevant data, including study characteristics (*e.g.*, study design), patients characteristics (*e.g.*, age), type and method of validity assessment (*e.g.*, convergent, correlations), method of responsiveness assessment (*e.g.*, standardize response mean), validity and responsiveness data.

Quality Assessment

Quality was assessed using the CONsensus-based Standards for the selection of health Measurement INstrument (COSMIN) checklist,¹⁶ a rating tool to evaluate the methodological quality of studies on measurement properties of health status instruments. For the four psychometric characteristics relevant to the current systematic review (“measurement error,” “hypothesis testing,” “cross cultural validity,” and “responsiveness”) 11 to 18 items per characteristic were analyzed. Each item was assigned one of the four possible

TABLE 1. Eligibility Criteria

Inclusion criteria	
The study population had LBP	
The study examined at least one of the three general preference based instrument (EQ5D, SF6D, HUI3)	
The study reported an estimate of mean score for the preference based instrument/s examined and for a comparator (<i>e.g.</i> , disease specific)	
Exclusion criteria	
The study focused on a condition other than LBP	
The study examined LBP with comorbidities	
Pharmacodynamic and pharmacokinetic studies	
Presentation at conferences and poster presentation	

scores: “excellent,” “good,” “fair,” or “poor.” The item with the lowest score determined the overall score for the property under investigation.

Assessment of Validity and Responsiveness

Construct validity has been defined as the extent to which an instrument measures what it is intended to measure. Construct validity was analyzed when papers reported on convergent validity (correlation between instruments) and known groups differences detected by instruments.

Responsiveness has been defined as the extent to which an instrument is sensitive to statistically significant changes in health over time or between treatment arms.¹⁷ Responsiveness was analyzed when papers reported on tests of statistical significance (TSS), effect sizes (ES), and/or standardize response mean (SRM).

Instruments validity and responsiveness was assessed against a set of hypotheses derived from the literature^{18–22} (Table 2).

Monotonic correlations were considered very weak between 0 and 0.19; weak between 0.2 and 0.39; moderate between 0.4 and 0.59; strong between 0.6 and 0.79; and very strong between 0.8 and 1.²³ Changes in SRM and ES were considered very weak between 0 and 0.19; weak between 0.2 and 0.49; moderate between 0.5 and 0.79; and strong between 0.8 and 1.²⁴

RESULTS

Characteristics of the Included Studies

A total of 739 potentially relevant articles were found. Title and abstract screening excluded 223 and 432 records respectively. After reviewing the articles full text, 37 reports referred to 35 studies were included. The process is described in Figure 1.

The design feature of included studies varied significantly. The majority of them were randomized controlled trials (RCT),^{25–41} followed by cross-sectional studies,^{42–47} observational longitudinal^{48–58} and cohort studies.^{59–61}

Quality of the Included Papers

Quality scores for the three mostly investigated psychometric characteristics (“measurement error,” “hypothesis

TABLE 2. Validity and Responsiveness Hypothesis

Convergent validity
Hypothesis 1. A positive and moderate-to-very strong correlation (>0.4) between generic instruments and disease-specific instruments (for those disease-specific instruments measuring improvements through a reduction in the scores a negative correlation is expected)
Hypothesis 2. A positive and strong-to-very strong correlation between generic instruments (>0.6)
Hypothesis 3. Stronger correlations between generic preference-based instruments and disease-specific instruments than generic preference-based instruments and disease construct-specific instruments
Known groups
Hypothesis 1. Generic instruments to distinguish between different grades of disability (lower scores at increasing level of disability)
Hypothesis 2. Generic instruments to distinguish between groups with disability and groups without disability (lower scores in the presence of disability)
Hypothesis 3. Generic instruments to distinguish between men and women (lower scores for women than for men)
Hypothesis 4. Generic instruments to distinguish between acute and recurrent LBP (lower scores for acute cases)
Test of statistical significance
Hypothesis 1. Generic instruments to be able to detect changes because of treatments
Hypothesis 2. Generic instruments to be able to detect differences between interventions
Hypothesis 3. Generic instruments to be able to detect changes coherent with those reported by other generic or disease-specific measures
Standardized response mean and effect sizes
Hypothesis 1. SRM and ES to be moderate to strong (>0.5)

testing,” “responsiveness”) varied substantially between studies, with at least one study per characteristic receiving a score of excellent, good, fair, and poor quality. Substantially different scores were seen for different characteristics within the same study. For example, Rivero-Arrias *et al*⁴⁰ reported excellent properties for “measurement error,” fair properties for “hypothesis testing” and poor properties for “responsiveness.” In addition to Rivero-Arrias *et al*,⁴⁰ only one other study received an assessment of excellent on some of the aspects of methodological quality investigated (Hellum *et al*)³⁶ and this was for “hypothesis testing” and “responsiveness.” The only two studies for which it was relevant to assess cross-cultural validity received a score of fair (Klemenc-Ketis *et al*)⁵³ and good (Genevay *et al*).⁵¹ Table 3 provides an overview of the quality assessment results for the included studies.

HRQoL Measures Used

The most frequently used descriptive systems are shown in Table 4. As it can be seen, EQ-5D has been used in all the included studies, whereas SF-6D and HUI III have been found only in two.^{47,58} Other common measures used were Oswestry Disability Questionnaire (ODI), Roland Morris Disability Questionnaire (RMDQ), Aberdeen Back Pain Scale (ABPS), and Lumbar Spine Outcome Assessment Instrument (LSOA).

Validity

Convergent Validity Method

Correlations between the outcome measures were reported in 12 studies.^{26,42-44,47,50-55,58}

Hypothesis 1

Correlation between EQ-5D and disease-specific instruments was assessed in 10 studies.^{26,43,44,50-53,55,58}

Five of them analyzed EQ-5D and ODI correlations^{44,52,53,55,58} and results were generally moderate to strong (in absolute terms). Correlation coefficients were between 0.510 and 0.739 in three studies,^{44,52,53} 0.48 in one,⁵⁸ and between 0.232 and 0.206 in one.⁵⁵ In one study data were too sparse to assess correlations.⁴³ Rather strangely, the direction of the correlation changed across studies.

Three of them assessed convergent validity between EQ-5D and RMDQ.^{50,54,55} Correlations were moderate to strong (ρ between -0.422 to -0.815) in all of them.

EQ-5D was also found to moderately correlate with ABPS ($r = -0.44$) in one study⁵⁰ and with Specific Sexual Function Questions ($r = -0.51$)²⁶ and Core Outcome Measure Index (COMI) ($r = -0.54$)⁵¹ in two others.

One study⁵⁸ presented results for both EQ-5D and HUI III correlations with ODI and found moderate correlations at 3 and 6 months for both instruments. Correlations between HUI III and ODI were stronger than those between EQ-5D and ODI at 3 months but weaker at 6 months.

Overall, given that only one study⁵⁵ did not reflect our prior expectations of moderate-to-very strong correlations, findings support the first hypothesis of convergent validity for the EQ-5D, and the small evidence found sustains the first hypothesis for the HUI III.

Hypothesis 2

EQ-5D correlation with other HRQoL instruments was assessed in five studies.^{42,43,47,54,55}

EQ-5D and visual analogue scale (VAS) agreement was examined by three studies.^{42,54,55} Burstrom *et al*⁴² reported strong correlations between the two instruments ($r = 0.67$). Similarly, in the two papers of Kovacs *et al*^{54,55} correlations between EQ-5D and VAS were strong at both 15 and 60 days follow-up. More precisely, the correlation coefficients

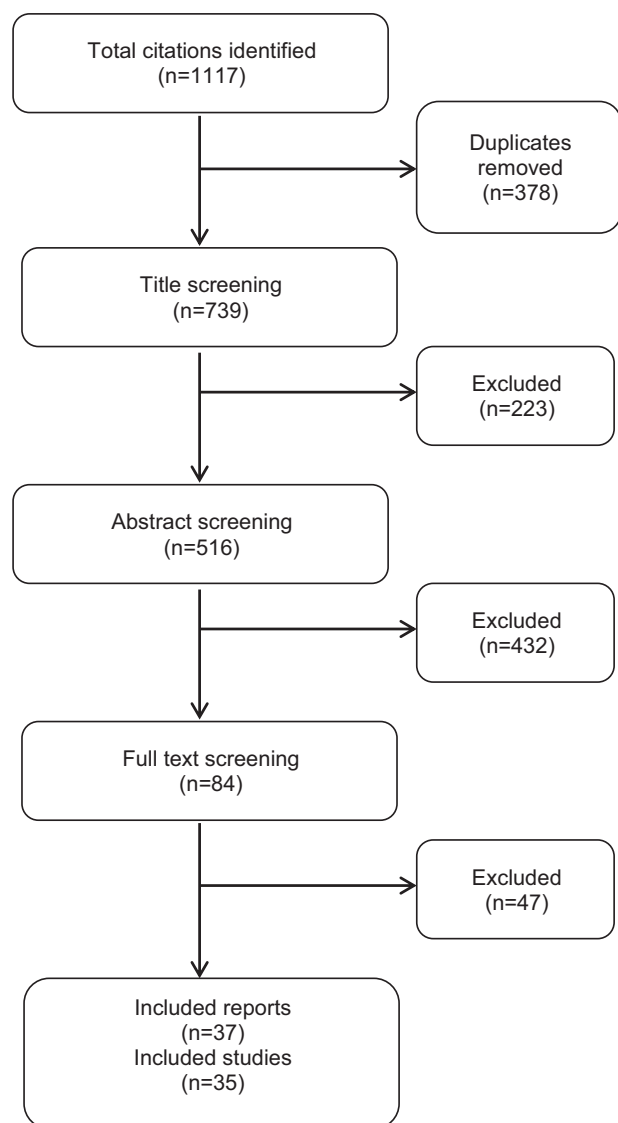


Figure 1. Flow diagram. It represents the screening of the potentially relevant records retrieved with the database search. Thirty-five studies referred to 37 reports were included.

were 0.70 at 15 days investigation point and 0.76 at 60 days investigation time points⁵⁴ and 0.67 at 15 days investigation time point in all of the cases.⁵⁵ Differently from what we expected, correlations were only moderate at baseline ($r = 0.52$ ⁵³ and $r = 0.42$).⁵⁴

In one study⁴⁷ EQ-5D and SF-6D correlation was moderate ($r = 0.553$). Similarly, one study found moderate correlations between EQ-5D and SF36 ($r = 0.49$).⁴³

Although some papers present data that sustain our prior expectations of positive and strong-to-very strong correlations for the second hypothesis, results are not conclusive given that moderate correlations were also frequently reported.

Hypothesis 3

Only one study presented results for correlation between a generic and a disease construct-specific instrument. In

detail, Genevay *et al*⁵¹ found that EQ-5D was weakly associated with COMI symptom specific ($r = -0.36$).

This study supports the third hypothesis of convergent validity of weak correlations between generic preference-based instruments and disease construct-specific instruments.

Known Group Method

Ten studies allowed an assessment of known groups for EQ-5D.^{42,43,45,46,53,56,58-61}

Hypothesis 1

Five studies (six reports) permitted an assessment of EQ-5D validity after the first hypothesis.^{45,46,49,56,58,61}

Two reports referred to the same study^{45,46} showed that EQ-5D was able to detect variations in groups with different severity grades of lumbar spondylitis. Differences were statistically significant. One study⁴⁹ showed that EQ-5D is able to distinguish between women with non-lumbar-pelvic pain, women with lumbar pain, women with pregnancy-related pelvic girdle pain, and women with combined pain. Differences between groups were statistically significant between women without lumbar-pelvic pain and all the other groups, and between women with lumbar pain and women with combined pain. Differences between lumbar pain and pregnancy-related pelvic girdle pain were not statistically significant. One study⁵⁸ reported EQ-5D to differentiate between the group of patients for which the treatment was successful and the group of patients who did not respond to it ($P = 0.003$). Parker *et al*⁵⁶ presented similar results between patients categorized according to three severity grades: stable; worst and best clinical situation ($P \leq 0.005$). EQ-5D presented the highest values for the best clinical situation and the lowest values for the worst situation. Van der Roer *et al*⁶¹ reported similar results for the same severity groups, although it did not provide results for statistical significance.

Overall, EQ-5D responds well when tested on different severity known groups distinguishing between different grades of disability and therefore sustaining the first hypothesis for known group methods.

Hypothesis 2

Only one study permitted an assessment of the second hypothesis for known groups.^{45,46}

The two reports of Muraki *et al*^{45,46} registered a higher mean score ($P < 0.05$) for those patients who declared not to have LBP if compared with those with the symptom.

This sustains the second hypothesis of known group methods, which is the ability of generic preference measure to distinguish between patients and general population.

Hypothesis 3

The third hypothesis of known group method has been tested in four studies.^{42-44,60}

All of them reported women to have significantly lower EQ-5D utility scores than men^{42-44,60} maintaining constant

TABLE 3. Quality of the Included Papers

Name of the First Author and Year of Publication	Measurement Error	Hypothesis Testing	Cross Cultural Validity	Responsiveness
RCTs				
Bastiaenen <i>et al</i> , 2008 ²⁵	Good	Poor	n/r	Poor
Berg <i>et al</i> , 2009 ²⁶	Fair	Poor	n/r	Fair
Berg <i>et al</i> , 2009 ²⁷	Fair	Poor	n/r	Fair
Carr <i>et al</i> , 2005 ²⁸	Fair	Poor	n/r	Fair
Casserley-Feeney <i>et al</i> , 2012 ²⁹	Fair	Poor	n/r	Fair
Chown <i>et al</i> , 2008 ³⁰	Fair	Poor	n/r	Fair
Cox <i>et al</i> , 2010 ³¹	Fair	Poor	n/r	Fair
Del Pozo-Cruz <i>et al</i> , 2011 ³²	Good	Good	n/r	Good
Djais <i>et al</i> , 2005 ³³	Fair	Poor	n/r	Fair
Gilbert <i>et al</i> , 2004 ³⁴	Good	Good	n/r	Good
Gilbert <i>et al</i> , 2004 ³⁵	Fair	Good	n/r	Fair
Hellum <i>et al</i> , 2011 ³⁶	Good	Excellent	n/r	Excellent
Hurley <i>et al</i> , 2001 ³⁷	Fair	Fair	n/r	Fair
Kendrick <i>et al</i> , 2001 ³⁸	Fair	Fair	n/r	Fair
Miller <i>et al</i> , 2002 ³⁹	Good	Good	n/r	Fair
Rivero-Arrias <i>et al</i> , 2006 ⁴⁰	Excellent	Fair	n/r	Poor
Wilkens <i>et al</i> , 2010 ⁴¹	Good	Good	n/r	Good
Cross-sectional				
Burstrom <i>et al</i> , 2001 ⁴²	Poor	Good	n/r	Poor
Eker <i>et al</i> , 2007 ⁴³	Good	Good	n/r	Poor
Klemenc-Ketis, 2011 ⁴⁴	Poor	Fair	n/r	Poor
Muraki <i>et al</i> , 2011 ⁴⁵	Poor	Fair	n/r	Poor
Muraki <i>et al</i> , 2012 ⁴⁶	Poor	Fair	n/r	Poor
Sogaard <i>et al</i> , 2009 ⁴⁷	Poor	Good	n/r	Poor
Observational longitudinal				
Aghayev <i>et al</i> , 2010 ⁴⁸	Fair	Poor	n/r	Poor
Cheshire <i>et al</i> , 2011 ⁴⁹	Fair	Poor	n/r	Poor
Garratt <i>et al</i> , 2001 ⁵⁰	Fair	Good	n/r	Good
Genevay <i>et al</i> , 2012 ⁵¹	Good	Good	Good	Good
Gutke <i>et al</i> , 2011 ⁵²	Good	Good	n/r	Good
Klemenc-Ketis, 2011 ⁵³	Poor	Fair	Fair	Poor
Kovacs <i>et al</i> , 2005 ⁵⁴	Good	Good	n/r	Good
Kovacs <i>et al</i> , 2004 ⁵⁵	Good	Good	n/r	Good
Parker <i>et al</i> ⁵⁶	Good	Good	n/r	Good
Schlusmann ⁵⁷	Fair	Fair	n/r	Fair
Suarez-Almazor <i>et al</i> , 2000 ⁵⁸	Fair	Fair	n/r	Fair
Cohort studies				
Gutke <i>et al</i> , 2006 ⁵⁹	Poor	Good	n/r	Poor
Jansson <i>et al</i> , 2009 ⁶⁰	Fair	Good	n/r	Fair
Van der Roer <i>et al</i> , 2006 ⁶¹	Fair	Fair	n/r	Good

n/r indicates not relevant.

the clinical condition, and this was always statistically significant.

Results support the third hypothesis of known groups assessment (distinguishing between male and female).

Hypothesis 4

Only one study⁶¹ permitted to evaluate the fourth hypothesis of known group.

This study showed EQ-5D to perform well in differentiating patients with acute or recurrent LBP, presenting higher pain and dysfunction for the acute group.

This confirms the fourth hypothesis of the study, namely the ability of distinguishing between acute and recurrent LBP.

Responsiveness

Twenty-four studies allowed for an assessment of responsiveness.^{25,27-30,32-41,49,50,53,54,56-58,60,61}

Twenty-one of them reported TSS,^{25,27-30,33-41,48,49,54,56,57,60,61} three of them ES,^{32,53,58} and one of them SRM.⁵⁰

Test of Statistical Significance Method

Hypothesis 1

Eighteen studies (19 reports) permitted an assessment of the first hypothesis of responsiveness.^{25,27-30,33-37,40,41,48,49,54,56,57,60,61}

Hellum *et al*³⁶ managed to detect statistically significant improvements in patients treated with surgery with disc prosthesis and patients treated with rehabilitation therapy.

TABLE 4. Main Outcome Measures Reported by the Included

Author, Year	Descriptive System			Rating Scale	Other Instruments Used (Generic non Preference Based, Clinical, Condition specific)				
	EQ-5D	SF-6D	HUI III	VAS	SF12 or SF-36	ODI	RDQ	NASS	ABPS
Aghayev et al, 2010 ⁴⁹	✓							✓	
Bastiaenen et al, 2008 ²⁴	✓			✓	✓		✓		
Berg et al, 2009 ²⁵	✓			✓	✓	✓			
Berg et al, 2009 ²⁶	✓			✓	✓	✓			
Burstrom et al, 2001 ⁴¹	✓								
Carr et al, 2005 ²⁷	✓				✓		✓		
Casserley-Feeney et al, 2012 ²⁸	✓				✓		✓		
Cheshire et al, 2011 ⁵⁰	✓								
Chown et al, 2008 ²⁹	✓								
Cox et al, 2010 ³⁰	✓						✓		✓
Del Pozo-Cruz et al, 2011 ³¹	✓					✓	✓		
Djais et al, 2005 ³²	✓			✓			✓		
Eker et al, 2007 ⁵¹	✓				✓				
Garratt et al, 2001 ⁵²	✓						✓		✓
Genevay et al, 2012 ⁵³	✓						✓		
Gilbert et al, 2004 ³³	✓				✓				✓
Gilbert et al, 2004 ³⁴	✓				✓				✓
Gutke et al, 2011 ⁵⁴	✓			✓		✓			
Gutke et al, 2006 ⁵⁵	✓			✓		✓			
Hellum et al, 2011 ³⁵	✓				✓	✓			
Hurley et al, 2001 ³⁶	✓				✓	✓			
Jansson et al, 2009 ⁵⁶	✓								
Kendrick et al, 2001 ³⁷	✓			✓			✓		
Klemenc-Ketis, 2011 ⁴²	✓			✓		✓			
Klemenc-Ketis, 2011 ⁵⁷	✓					✓			
Kovacs et al, 2005 ⁵⁸	✓			✓			✓		
Kovacs et al, 2004 ⁵⁹	✓			✓			✓		
Miller et al, 2002 ³⁸	✓						✓		
Muraki et al, 2011 ⁴³	✓				✓				
Muraki et al, 2010 ⁴⁴	✓				✓				
Parker et al, 2012 ⁴⁵	✓			✓	✓				
Rivero-Arrias et al, 2006 ³⁹	✓				✓	✓	✓		
Schluessman et al, 2009 ⁴⁶	✓			✓				✓	
Sogaard et al, 2009 ⁴⁷	✓	✓			✓				
Suarez-Almazor et al, 2000 ⁴⁸	✓		✓		✓	✓			
Van der Roer et al, 2006 ⁶⁰	✓								
Wilkens et al, 2010 ⁴⁰	✓						✓		

ABPS indicates Aberdeen Back Pain Scale; EQ-5D, EuroQol 5 Dimensions; HUI 3, Health Utility Index Mark 3; NASS, Lumbar Spine Outcome Assessment Instrument; ODI, Oswestry Disability Index; RDQ, Roland Morris Disability Questionnaire; SF-12, Short Form 12 Dimensions; SF-36, Short Form 36 Dimensions; SF-6D, Short Form 6 Dimensions; VAS, Visual Analogue Scale.

Schluessmann et al⁵⁷ presented significant changes in patients receiving total disc arthroplasty, with an EQ-5D mean score of 0.32 at baseline, and improvements to 0.72 at 3 months and 0.73 at 1 year. Parker et al⁵⁶ registered significant improvement of EQ-5D after patients had undertaken lumbar fusion, which were statistically significant. Also Berg et al,²⁷ Chown et al,³⁰ Aghayev et al,⁴⁸ and Cheshire et al⁴⁹ reported similar results, which were statistically significant.

In studies conducted by Bastiaenen et al,²⁵ Carr et al,²⁸ Casserley-Feeney et al,²⁹ Djais and Kalim,³³ Gilbert et al,^{34,35} Hurley et al³⁷ Jansson et al,⁶⁰ and Wilkens et al⁴¹ EQ-5D values appeared responsive to improvements because of the treatment of LBP, although these were not statistically significant.

According to Kovacs et al,⁵⁴ Rivero-Arrias et al,⁴⁰ and Van der Roer et al,⁶¹ the EQ-5D is responsive to variations in the health status because of treatment.

Overall, the first hypothesis for TSS holds given that preference-based measures are able to detect changes because of treatment.

Hypothesis 2

Twelve studies permitted to test for the second hypothesis of responsiveness.^{25,27-31,33-35,41,48,60}

In Chown *et al*³⁰ all patients assigned to the exercise, physiotherapy, or osteopathy groups improved, but patients in the osteopathy group reported significantly higher EQ-5D values if compared with patients in the group exercise ($P < 0.01$). Similarly, Berg *et al*²⁷ registered a different increase in mean EQ-5D values from baseline to 1 year for patients assigned to the total disc replacement group compared with patients assigned to the fusion group, with the total disc replacement being more effective ($P < 0.05$). Aghayev *et al*⁴⁸ found that EQ-5D was able to distinguish between patients receiving Dynardi total disc arthroplasty and patients receiving total disc replacement, with the differences between the two groups being statistically significant at $P < 0.001$. Gilbert *et al*^{34,35} found that EQ-5D differentiated between magnetic resonance imaging and delayed magnetic resonance imaging at 8 and 24 months, and that differences were statistically significant in this latter follow-up.

Other seven studies presented data that supported the second hypothesis, although results were not statistically significant.^{25,28,29,31,33,36,41} Carr *et al*,²⁸ for instance, registered an increase in EQ-5D mean values from baseline to 3 months of 0.028 and from baseline to 12 months of 0.045 for the individual physiotherapy group, whereas improvements for the group exercise were milder. Similarly, Casserley-Feeney *et al*²⁹ reported EQ-5D to differ between public physiotherapy and private physiotherapy patients, Djas and Kalim³³ for the instrument to be sensitive to differences between patients undergoing radiography and patients not undergoing radiography and Wilkens *et al*⁴¹ for the measurement to recognize patients administered with glucosamine and patients administered with placebo. Bastiaenen *et al*,²⁵ Hellum *et al*,³⁶ and Cox *et al*³¹ reported similar results.

One study⁶⁰ managed to differentiate between patients treated with macrodecompression, microscopic decompression, decompression and fusion, and fusion alone.

These results confirm the ability of the EQ-5D to distinguish between different interventions outcomes.

Hypothesis 3

Fifteen studies (16 reports) permitted an assessment of the third hypothesis of responsiveness.^{25,27-30,33-39,41,54,56,61}

Twelve of them reported an EQ-5D behavior that was coherent with the scores registered by other measures.^{27-30,33-37,41,54,56} For example, Berg *et al*²⁷ registered an increase in EQ-5D values for the total disc replacement group at 1 year, and a reduction of the mean value at 2 years, and similar trends were reported for ODI and VAS. Also Parker *et al*⁵⁶ results of EQ-5D and ODI were coherent. Similarly, Carr *et al*,²⁸ Chown *et al*,³⁰ Djas and Kalim,³³

Hurley *et al*,³⁷ and Kovacs *et al*⁵⁴ presented improvements that were well detected by both EQ-5D and RMDQ, Van der Roer *et al*⁶¹ by EQ-5D and Quebec Pain Disability Scale and Gilbert,^{34,35} and Hellum *et al*³⁶ by EQ-5D and ABPS.

Although also for Casserley-Feeney *et al*²⁹ EQ-5D and RMDQ presented similar results, this latter study evidenced that RMDQ is more sensitive than EQ-5D to small differences at low levels of disability. This lack of sensitivity to change in health states seems confirmed also by other studies. For example, in Miller *et al*³⁹ RMDQ is able to detect a small change in patients' status at 3 months that passed undetected by EQ-5D and in Bastiaenen *et al*²⁵ a similar problem occurs with EQ-5D and RMDQ at 6 months. In Kendrick *et al*,³⁸ median EQ-5D scores remained stable from baseline to 9 months, whereas RMDQ scores detected a small improvement in patients. Also, Wilkens *et al*⁴¹ found an extremely small improvement registered by RMDQ at 1 year follow-up not registered by the EQ-5D.

Overall, the evidence collected supports the third hypothesis of responsiveness which is the ability of reporting changes coherent to those reported by other generic or diseases-specific measures.

Effect Size and Standardize Response Mean

Hypothesis 1

Three studies permitted to test ES^{32,53,58} and one study SRM.⁵⁰

EQ-5D ES were moderate and statistically significant in two studies.^{32,53} The third study⁵⁸ reported ES for both EQ-5D and HUI III, and found HUI III to be more discriminative than EQ-5D at 3 months, with effect sizes similar to ODI ones. At 6 months, both EQ-5D and HUI III were highly discriminative.

One study presented EQ-5D SRM and found a moderate responsiveness of the instrument.⁵⁰

ES and SRM were moderate to strong, therefore supporting the hypothesis of responsiveness.

EQ-5D validity and responsiveness results are summarized in Table 5.

DISCUSSION

The 35 studies (37 reports) included in this systematic review show that LBP decreases HRQoL and that EQ-5D is generally able to detect improvements and deteriorations in health states because of health interventions or disease progression.

Comparing our results with those of similar researches it emerges that EQ-5D performs well in LBP populations. In a review of Tosh *et al*³ EQ-5D correlation with visual acuity, a disease-specific instrument for visual disorders, was often poor or nonsignificant for patients with age-related macular degeneration and cataracts. Similarly, a review of Papaioannou *et al*⁶² found generally modest and mostly weak correlations between EQ-5D and disease-specific instruments such as brief psychiatry rating scale and quality-of-life scale,

TABLE 5. EQ-5D Summary of Results

Author, Year	Convergent Validity			Validity—Known Groups				Responsiveness TSS			Responsiveness ES
	H1	H2	H3	H1	H2	H3	H4	H1	H2	H3	H1
Aghayev <i>et al</i> , 2010 ⁴⁹				✓				✓	✓		
Bastiaenen <i>et al</i> , 2008 ²⁴								±	±	X	
Berg <i>et al</i> , 2009 ²⁵	✓										
Berg <i>et al</i> , 2009 ²⁶								✓	✓	✓	
Burstrom <i>et al</i> , 2001 ⁴¹		✓				✓					
Carr <i>et al</i> , 2005 ²⁷								±	±	✓	
Casserley-Feeney <i>et al</i> , 2012 ²⁸								±	±	✓	
Cheshire <i>et al</i> , 2011 ⁵⁰								✓			
Chown <i>et al</i> , 2008 ²⁹								✓	✓	✓	
Cox <i>et al</i> , 2010 ³⁰									±		
Del Pozo-Cruz <i>et al</i> , 2011 ³¹											✓
Djais <i>et al</i> , 2005 ³²								±	±	✓	
Eker <i>et al</i> , 2007 ⁵¹	?	X				✓					
Garratt <i>et al</i> , 2001 ⁵²	✓										✓
Genevay <i>et al</i> , 2012 ⁵³	✓		✓								
Gilbert <i>et al</i> , 2004 ³³								±	✓	✓	
Gilbert <i>et al</i> , 2004 ³⁴								±	✓	✓	
Gutke <i>et al</i> , 2011 ⁵⁴	✓										
Gutke <i>et al</i> , 2006 ⁵⁵				✓							
Hellum <i>et al</i> , 2011 ³⁵								✓	±	✓	
Hurley <i>et al</i> , 2001 ³⁶								±		✓	
Jansson <i>et al</i> , 2009 ⁵⁶						✓		±	-		
Kendrick <i>et al</i> , 2001 ³⁷										X	
Klemenc-Ketis, 2011 ⁴²	✓					✓					
Klemenc-Ketis, 2011 ⁵⁷	✓										✓
Kovacs <i>et al</i> , 2005 ⁵⁸	✓	✓ X						-		✓	
Kovacs <i>et al</i> , 2004 ⁵⁹	✓	✓ X									
Miller <i>et al</i> , 2002 ³⁸										X	
Muraki <i>et al</i> , 2011 ⁴³				✓	✓						
Muraki <i>et al</i> , 2010 ⁴⁴				✓	✓						
Parker <i>et al</i> , 2012 ⁴⁵				✓				✓		✓	
Rivero-Arrias <i>et al</i> , 2006 ³⁹								-			
Schluessman <i>et al</i> , 2009 ⁴⁶								✓			
Sogaard <i>et al</i> , 2009 ⁴⁷		X									
Suarez-Almazor <i>et al</i> , 2000 ⁴⁸	✓			✓							✓
Van der Roer <i>et al</i> , 2006 ⁶⁰				✓			✓	-			
Wilkens <i>et al</i> , 2010 ⁴⁰								±	±	✓ X	

Keys: ✓ Meeting prior expectations; ± trend meeting prior expectation but not statistically significant; - trend meeting prior expectation but no test of statistical significance performed; X trend nonmeeting prior expectations; ? mixed/not possible to assess.

When two keys for the same item are used, it is because more than one result was found.

ES indicates effect size; H1, hypothesis 1; H2, hypothesis 2; H3, hypothesis 3; H4, hypothesis 4; TSS, test of statistical significance.

two-schizophrenia HRQoL measures. In light of this, the commonly moderate-to-strong correlations between EQ-5D and disease-specific instruments found in our study show a good performance of the instrument.

Differently from what it was hypothesized, EQ-5D correlation with other generic instruments was strong at follow-ups, but only moderate at baseline. Weaker correlations for baseline data might be because of EQ-5D being more sensitive to the lower end of the utility scale,⁶³ EQ-5D having more distributed frequencies among spine patients

compared with other generic instruments⁶⁴ (the effect of which is lower mean values for patients in worst health states), or EQ-5D measuring constructs that are relevant for greater disability levels than other generic instruments. Nevertheless, moderate correlations between general preference-based instruments have already been seen in other studies (e.g., Dyer *et al*),⁴ thus this behavior cannot be considered proper evidence against the instrument validity.

EQ-5D known group assessment showed statistically significant differences between different disease severities,

patients with/without LBP and respondents/nonrespondents to treatments. There was also strong and statistically significant evidence that EQ-5D can distinguish between women and men perception of health, with the HRQoL values for the former being lower than the latter. These results sustain our prior hypothesis and are in line with those of other systematic reviews on EQ-5D validity in other population (e.g., Peasgood *et al*⁶⁵).

EQ-5D appears to be a responsive instrument, although it seems to be less responsive than disease-specific ones. This is not surprising. Disease-specific and general preference-based instruments are not perfect substitutes. Disease-specific instruments only contain items or health dimensions that are relevant for the specific condition examined, whereas generic instruments assess all domains of HRQoL. By contrast, general preference-based instruments are meant to be perfect substitutes, at least in theory. The current systematic review presents paucity of data as regards between generic instruments comparison. One study found HUI III to be more responsive than EQ-5D at 3 months and equally responsive at 6 months. Another study presented only moderate correlation between EQ-5D and SF-6D. These results seem to suggest that the three preference-based instruments are not equivalent measures of HRQoL and that they assess different domains. However, results cannot be considered conclusive and a study estimating direct correlations between generic instruments might be useful.

This systematic review has some limitations. First, some of the included studies present small sample sizes. This might be one of the reasons for the lack of statistical significance registered in some reports. Second, there is not enough reference to missing data caused by nonrespondents and how these have been accounted for. Finally, some of the included studies did not control for age, sex, social status, and other variables that can influence LBP evaluation.

Nevertheless, our systematic review represents an important effort. It suggests that EQ-5D performs well in LBP population and that its scores are suitable for economic evaluation of LBP interventions, whereas it recommends the use of EQ-5D in combination with disease-specific instruments for clinical evaluation, given its lack of sensitivity to change in health state compared with them. Results for SF-6D and HUI III are too scarce to draw any conclusion.

➤ Key Points

- ❑ EQ-5D showed good validity and responsiveness in patients with low back pain.
- ❑ EQ-5D can be used for economic evaluation of interventions targeting low back pain.
- ❑ EQ-5D appears unable to detect changes in health status at lower levels of severity.
- ❑ Assessment for SF-6D and HUI III was not possible because of lack of evidence.

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