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Rasch analysis and impact factor methods both yield valid and comparable measures of health status in interstitial lung disease

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Abstract

Objectives: Rasch analysis has largely replaced impact factor methodology for developing health status measures. The aim of this study was to develop a health status questionnaire for patients with interstitial lung disease (ILD) using impact factor methodology and to compare its validity with that of another version developed using Rasch analysis.

Study Design and Setting: A preliminary 71-item questionnaire was developed and evaluated in 173 patients with ILD. Items were reduced by the impact factor method (King's Brief ILD questionnaire, KBILD-I) and Rasch analysis (KBILD-R). Both questionnaires were validated by assessing their relationship with forced vital capacity (FVC) and St Georges Respiratory Questionnaire (SGRQ) and by evaluating internal reliability, repeatability, and longitudinal responsiveness.

Results: The KBILD-R and KBILD-I comprised 15 items each. The content of eight items differed between the KBILD-R and KBILD-I. Internal and test–retest reliability was good for total scores of both questionnaires. There was a good relationship with SGRQ and moderate relationship with FVC for both questionnaires. Effect sizes were comparable. Both questionnaires discriminated patients with differing disease severity.

Conclusion: Despite considerable differences in the content of retained items, both KBILD-R and KBILD-I questionnaires demonstrated acceptable measurement properties and performed comparably in a clinical setting.

Keywords: Interstitial lung disease; Health status; Rasch analysis; Impact factor; King's Brief Interstitial Lung Disease questionnaire; KBILD; Quality of life

1. Introduction

Health status questionnaires can be developed by impact factor or Rasch analysis methodology. Impact factor selects items according to their frequency and importance to patients [1]. The items are then grouped into health domains by clinical sensibility and scored on a Likert response scale. Rasch analysis is more complex and selects items that assess a unidimensional health construct with interval scaling properties [2,3]. Items are scored on a Rasch scaling model. A strength of Rasch analysis is that it can be used to develop brief scales by removing the redundant items and ensuring the retained items measure as close to the true value of health status as possible [2,4]. The similarities and differences in the construct and clinical properties of health status questionnaires developed by these two methods have not been fully evaluated.

Interstitial lung diseases (ILDs) are a group of inflammatory and fibrotic disorders associated with significant morbidity and mortality [5]. We have recently reported the

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What is new?

Key findings

- Health status questionnaires are widely used in both research and clinical settings to evaluate the impact of disease on patients. Impact factor methodology used to develop questionnaires has largely been replaced by methods such as Rasch analysis. This is the first study to compare the clinical properties of a health status questionnaire developed by these methods.
- Despite significant differences in the wording and content of some items, both questionnaires performed similarly well in a clinical setting. The internal reliability, concurrent validity, repeatability, and responsiveness were similar.

What this adds to what was known?

- Both impact factor and Rasch analysis methodology for developing health status questionnaires seem valid.

What is the implication and what should change now?

- Impact factor methodology has the advantage over Rasch analysis in that it is less complex and more patient focused. Further studies are, however, needed to investigate whether Rasch analysis performs better in specific situations such as severe disease category patients.

development and validation of a health status questionnaire using Rasch analysis for patients with ILD, the King's Brief Interstitial Lung Disease questionnaire (KBILD-R) [5]. The optimal method to develop health status questionnaires for patients with ILD is not known. The aim of this study was to develop, validate, and evaluate a health status questionnaire for patients with ILD with impact factor methodology (KBILD-I) and to compare this with another questionnaire developed using Rasch analysis, the KBILD-R.

2. Methods

2.1. Subjects

Subjects recruited for a previous study that reported the development of the KBILD-R completed an additional impact factor rating scale to develop the KBILD-I [5]. Briefly, subjects were recruited prospectively from secondary care (King's College Hospital) and tertiary care (Royal Brompton Hospital) specialist clinics from January−December 2010. Patients self-completed health status questionnaires independently when attending clinic. Patients were excluded from the study if they could not read the questionnaire or completed less than 85% of the questionnaire. The classification of ILD was determined by a multidisciplinary team and consistent with international guidelines [6,7]. Patients with both idiopathic ILD and that secondary to connective tissue disorders (CTD) were recruited. Patients with cough were identified from those responding to the question "In the last 2 weeks, I have experienced coughing bouts." Patients without cough were identified from those that responded "hardly or none of the time."

2.2. Development of KBILD impact factor version (KBILD-I)

2.2.1. Item generation—preliminary questionnaire

A preliminary questionnaire was developed as described previously for the KBILD-R, consisting of 71 items relevant to patients with ILD [5]. Briefly, items were generated following: (1) review of relevant ILD literature, (2) review of available health status questionnaires, (3) face-to-face semistructured interviews with 10 patients with a range of ILDs, (4) multidisciplinary team meeting consisting of respiratory, palliative care, rheumatology, and general physicians and academics, nurse, pharmacist, social worker, and physiotherapist. The questionnaire was worded to assess health status during the past 2 weeks and patients responded on a seven-point Likert scale. Health status was considered to be a patient's perception of their health.

2.2.2. Impact factor ratings

Patients were asked to rate the importance of each item on a five-point scale (1 = not important and 5 = extremely important). The impact factor score for each item was calculated as the product of the proportion of population affected (0.0−1.0) and the mean importance rating of that item [8,9].

2.2.3. Item reduction and allocation to domains

The 20 items with the highest impact factor score were selected for further development. This threshold was comparable to that used in previous health status questionnaire development [8,9]. Items demonstrating a minimum (floor effect) or maximum response (ceiling effect) of $\geq$60% were removed [8]. Items demonstrating high inter-item correlations ($r > 0.8$) were examined, and the item with a lower impact factor score was removed. Items with similar wording were evaluated, and weaker items determined by lower impact factor score were removed. The questionnaire was also evaluated by the multidisciplinary team for further refinement. Items were added or removed, when justified according to face validity. Items were allocated to domains by the multidisciplinary team on the basis of clinical sensibility. Domain and total scores were transformed to a range of 0−100 [(actual score−lowest possible score/range) × 100]; 100 = best health status.