



SHORT COMMUNICATION

# Equipercentile linking of the Brief Psychiatric Rating Scale and the Clinical Global Impression Scale in a catchment area

Stefan Leucht<sup>a,\*</sup>, Rolf R. Engel<sup>b</sup>, John M. Davis<sup>c</sup>, Werner Kissling<sup>a</sup>,  
Katrin Meyer zur Capellen<sup>e</sup>, Max Schmauß<sup>d</sup>, Thomas Messer<sup>e</sup>

<sup>a</sup> Department of Psychiatry and Psychotherapy, Technische Universität München, Klinikum rechts der Isar, Ismaningerstr. 22, 81675 München, Germany

<sup>b</sup> Department of Psychiatry, University of Munich, Nussbaumstrasse 7, 80336 München, Germany

<sup>c</sup> Psychiatric Institute, University of Illinois at Chicago, USA

<sup>d</sup> District Hospital of Augsburg, Augsburg, Germany

<sup>e</sup> Danuvius Klinik GmbH, Pfaffenhofen, Germany

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## Abstract

Recent analyses tried to explain the meaning of the Brief Psychiatric Rating Scale total score (BPRS) and its percentage change from baseline by equipercentile linking with the Clinical Global Impression Scale (CGI). A major limitation was that they were conducted in clinical trial populations limiting generalisability to 'real-world' patients. We therefore replicated the findings in a large sample covering patients admitted to a state hospital with a catchment area. BPRS and CGI ratings at admission ( $n=1772$ ) and at discharge from all patients with schizophrenic disorders (ICD-10 F20.0–F20.9) admitted between 2005 and 2008 were compared using equipercentile linking. Being considered "mildly ill" according to the CGI severity score approximately corresponded to a BPRS total score of 25, "moderately ill" to a BPRS of 33–35, "markedly ill" to a BPRS of 50 and severely ill to a BPRS of 70. To be "minimally improved" according to the CGI change score was associated with a mean BPRS reduction of 13%; and "much improved" with 50% BPRS reduction. The linking functions were not identical, but overall comparable to those in previous randomised trial samples. The suggestion that a 50% BPRS reduction from baseline is a clinically meaningful definition of response in acutely ill patients was reinforced.

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\* Corresponding author. Tel.: +49 89 4140 4249; fax: +49 89 4140 4888.  
E-mail address: [Stefan.Leucht@lrz.tum.de](mailto:Stefan.Leucht@lrz.tum.de) (S. Leucht).

## 1. Introduction

There are no uniformly accepted definitions of “response to treatment” in schizophrenia. Different cutoffs to define response (e.g. at least 20%, 30%, 40% or 50% reduction of the Positive or Negative Syndrome Scale (PANSS; Kay et al., 1987)) or the Brief Psychiatric Rating Scale (BPRS; Overall and Gorham, 1962) are used which makes it impossible to compare the results of different trials. Compared to schizophrenia other psychiatric areas such as major depressive disorder are ahead in this regard because uniformly accepted definitions are available (Nierenberg and DeCecco, 2002). For those patients who are not frequently rated on the PANSS or the BPRS, a given score of 60 or 36, for example, may not mean much intuitively. In an attempt to show in a rough sense what PANSS/BPRS scores mean, we compared the equipercentiles of patients who had BPRS/PANSS scores with the Clinical Global Impression Scale (CGI; Guy, 1976) in several reports. These provided relatively consistent anchor points for BPRS/PANSS total scores in terms of CGI-severity, and that “minimally better” on the CGI corresponded to 20%–25% BPRS/PANSS total score reduction from baseline; and “much better” to 50% BPRS/PANSS reduction (Leucht et al., 2005a; 2005b; 2006; Levine et al., 2008). These analyses were, however, all based on participants from randomised antipsychotic drug trials that resulted in two major limitations:

- 1.) It has been demonstrated that only approximately 10% of patients admitted to a hospital enter clinical trials limiting the generalisability of the results to routine settings (Riedel et al., 2005; Hofer et al., 2000). E.g. participants with somatic or psychiatric comorbidity, especially with drug abuse or suicidality, are frequently excluded from RCTs. Indeed, a recent publication that linked the PANSS with the CGI in a prospective trial found different functions and the authors speculated that their more naturalistic setting accounted for the difference (Schennach-Wolff et al., 2010).
- 2.) As these studies require a minimum severity at baseline, the scores may sometimes be artificially inflated to include a patient which may bias the linking functions. We, therefore, tried to replicate the linking functions in a large sample of all patients with schizophrenia admitted to a state hospital with a defined catchment area.

## 2. Experimental procedures

### 2.1. The database

We included all patients with a diagnosis of schizophrenia or schizophrenia-like disorders (ICD-10 codes F20.0–F20.9) that were admitted between 2005 and 2008 to the psychiatric Augsburg district hospital, southern Germany, a hospital responsible for the psychiatric inpatients of a catchment area of approximately 390,000 people. All schizophrenia patients admitted are routinely rated with the CGI (1–7 rating system) and with the BPRS (18 items, 1–7 scale) at admission and discharge. The CGI is filled in before the BPRS. These ratings have been made routinely since 2004 for the purpose of quality management. There were no formal rater trainings and interrater variability was not examined, but there are biweekly trainings in psychopathology for the medical staff. Moreover, since 1998 the hospital has regularly

participated in clinical trials on various disorders, among them five phase II–IV schizophrenia trials. Of 17,398 patients, 1904 (11%) had a diagnosis of schizophrenia (F20), and 1741 (91%) of these had a BPRS and a CGI rating at baseline and discharge.

There were 1017 (58%) men and 724 (42%) women, mean age 42 years, mean duration of stay 54 days. The mean BPRS total score at baseline was  $60.2 \pm 15.94$  and the mean CGI-severity scale was  $5.5 \pm 0.73$  reflecting a markedly ill population on the average. As there was no experimental intervention, informed consent was not necessary.

### 2.2. Statistical analysis

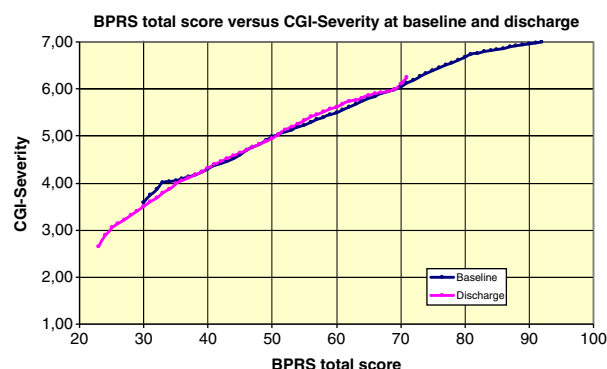
As in the previous analyses (Leucht et al., 2005a; 2005b; 2006) we applied the “equipercentile linking method” by Kolen and Brennan (1995) to compare the BPRS total score with the CGI-severity score, and the percentage BPRS change from baseline with the CGI-change score. The 18 minimum BPRS points meaning “no symptoms” were taken into account by the formula: % BPRS change =  $(\text{BPRS change} \times 100) / (\text{BPRS total score at baseline} - 18)$ , (Obermeier et al., 2010). In brief, percentile rank functions are calculated for both variables. Using the percentile rank function of one variable and the inverse percentile rank function of the other, one then finds for every score of one variable a score on the other variable that has the same percentile rank. Detailed descriptions can be found in previous publications (Leucht et al., 2005a; 2005b; 2006; Levine et al., 2008; Linn, 1993 and in chapter 2 of Kolen and Brennan, 1995). We used Excel 2003 for these calculations.

## 3. Results

Spearman correlation coefficients between CGI-severity ratings and the BPRS total score were 0.45 at baseline and 0.52 at discharge, and 0.54 for the correlation between CGI-improvement score and percentage improvement of BPRS total score from baseline.

### 3.1. Linking of the CGI-severity score and the BPRS total score

Fig. 1 shows the result of the linking between the CGI-Severity scale and the BPRS total score at baseline, and at discharge. On admission most patients fell between a CGI of 7 and 4, and



**Figure 1** Linking of CGI-severity with the BPRS total score. CGI-severity = Clinical Global Impression Severity Scale. Scores: 1 = normal, not at all ill, 2 = borderline mentally ill, 3 = mildly ill, 4 = moderately ill, 5 = markedly ill, 6 = severely ill, and 7 = among the most extremely ill patients; BPRS = Brief Psychiatric Rating Scale.

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