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# Factors influencing subjective quality of life in patients with schizophrenia and other mental disorders: A pooled analysis

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ABSTRACT

Subjective quality of life (SQOL) is an important outcome in the treatment of patients with schizophrenia. However, there is only limited evidence on factors influencing SQOL, and little is known about whether the same factors influence SQOL in patients with schizophrenia and other mental disorders. This study aimed to identify the factors associated with SQOL and test whether these factors are equally important in schizophrenia and other disorders. For this we used a pooled data set obtained from 16 studies that had used either the Lancashire Quality of Life Profile or the Manchester Short Assessment of Quality of Life for assessing SQOL. The sample comprised 3936 patients with schizophrenia, mood disorders, and neurotic disorders. After controlling for confounding factors, within-subject clustering, and heterogeneity of findings across studies in linear mixed models, patients with schizophrenia had more favourable SQOL scores than those with mood and neurotic disorders. In all diagnostic groups, older patients, those in employment, and those with lower symptom scores had higher SQOL scores. Whilst the strength of the association between age and SQOL did not differ across diagnostic groups, symptom levels were more strongly associated with SQOL in neurotic than in mood disorders and schizophrenia. The association of employment and SQOL was stronger in mood and neurotic disorders than in schizophrenia. The findings may inform the use and interpretation of SQOL data for patients with schizophrenia.



## 1. Introduction

Subjective quality of life (SQOL) is an established patient-reported outcome in schizophrenia (Priebe and Fakhoury, 2008). Whilst there is no consensus on its precise definition, several scales are based on Lehman's (Lehman, 1996) approach of measuring SQOL as satisfaction with life in general and major life domains.

In research studies and evaluation of routine care, socio-demographic and clinical factors that may influence scores must be considered (Priebe and Fakhoury, 2008). Socio-demographic factors frequently studied are age (e.g. Sullivan et al., 1991; Sullivan et al., 1992), gender (e.g. Lehman et al., 1995; Roeder-Wanner et al., 1997), marital status (e.g. Mares

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et al., 2002; Marwaha et al., 2008), level of education (e.g. Caron et al., 2005; Swanson et al., 1998), and employment status (e.g. Marwaha and Johnson, 2004; Priebe et al., 1998). Significant associations are reported for some of these variables with SQOL, mostly indicating that older age, better education, and employment are linked with more favourable SQOL (e.g. Evans et al., 2000; Gaite et al., 2002; Marwaha et al., 2008). A recent meta-analysis (Vatne and Bjorkly, 2008), however, failed to find robust evidence that socio-demographic factors influenced SQOL. More consistent evidence associates higher symptom levels with poorer SQOL (e.g. Huppert et al., 2001; Kasckow et al., 2001; Marwaha et al., 2008; Priebe et al., 2000). A meta-analysis (Eack and Newhill, 2007) found weak correlations between symptom levels and SQOL with a substantial heterogeneity.

Initially, SQOL measures were used in psychiatry predominantly in samples with severe mental illnesses, mainly schizophrenia, but interest has increased in other diagnostic groups (d'Ardenne et al., 2005; Rakib et al., 2005; Rudolf and Priebe, 1999). Differences in SQOL between patients with schizophrenia and those with mood disorders are inconsistent (Atkinson et al., 1997; Ruggeri et al., 2002; Vatne and Bjorkly, 2008). Similar socio-demographic and clinical factors were suggested as influencing SQOL in patients with schizophrenia and other diagnostic groups. However, the question as to whether the same factors influence SQOL in different diagnostic groups has not been systematically investigated.

Using a pooled analysis with data from several studies, we aimed to identify the factors influencing SQOL and test whether they differed between patients with schizophrenia and those with other mental disorders. A pooled analysis considers both studies and individual patients as the unit of analysis and has several advantages as compared to a conventional meta-analysis: it enables a more precise estimate of effects of an influential factor; allows for controlling of confounding factors including within-subject clustering and heterogeneity across studies at the patient level; reduces effects of heterogeneity from aggregation of methodologically diverse studies by using the same statistical model; and permits testing main effects as well as interactions essential for exploring whether factors have similar influences in patients with schizophrenia and other diagnostic groups (Blettner et al., 1999; Reininghaus and Priebe, 2007).

## 2. Materials and methods

In a pooled analysis, linear mixed models were applied to individual patient-level data from samples of patients with schizophrenia, mood disorders, and neurotic disorders, with SQOL as the dependent variable.

### 2.1. Sample

The pooled data set was collected specifically for the current study. Given the heterogeneity of measurement methods (Vatne and Bjorkly, 2008), only data sets using the Lancashire Quality of Life Profile (LQOLP) (Oliver et al., 1997) or its short version, the Manchester Short Assessment of Quality of Life (MANSA) (Priebe et al., 1999) were included . To identify relevant data sets we contacted experts in the field and conducted a literature search of academic databases.

We aimed to use diagnostic categories with sufficient sample sizes of each category in the complex analysis. We therefore included only patients with documented diagnoses of schizophrenia, schizotypal, or delusional disorders (F2), mood disorders (F3), or neurotic, stress-related, and somatoform disorders (F4) according to ICD-10 (World Health Organization, 1993). Patients with less frequent and unclear diagnoses were excluded. If available, another SQOL assessment, obtained for the same patients at a later point of time, was included. These increased the precision of estimates of effects by increasing the number of observations, whilst controlling for confounding by within-subject clustering. For studies with more than two time points the first and last one were used to achieve longest and similar times between measurements.

### 2.2. Measures

Included studies used either the LQOLP or MANSA for measuring SQOL, both of which use the Lehman's approach (Lehman, 1996). LQOLP and MANSA contain items on satisfaction with life in general and different life domains rated from 1 (couldn't be worse) to 7 (couldn't be better). They have been shown to yield practically identical SQOL scores with a correlation between LQOLP and MANSA mean scores of $r = .94$ (Priebe et al., 1999) and are widely used in mental health service research in Europe. Their reliability and validity have been demonstrated in several studies (Gaite et al., 2000; Kaiser et al., 1997; Kaiser and Priebe, 1998; Van Nieuwenhuizen et al., 2001; Priebe et al., 1999; Ruggeri et al., 2001). Limiting to these two measures ensures consistent data and fully utilises the advantages of a pooled analysis.

Consistent information was available for the following socio-demographic and clinical characteristics hypothesized to influence SQOL: age, gender, marital status (married/partnership and other), level of education (school level, further education, and higher education; the exact definitions varied according to national education systems; school level usually means completion of 10 years of school education, equivalent to 2 years of high school in the US), employment status (unemployed and other), current treatment (inpatient and outpatient), clinical diagnosis, and level of psychiatric symptoms. In the majority of studies ($n = 13$), symptoms were assessed on the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987) or Brief Psychiatric Rating Scale (BPRS) (Overall and Gorham, 1988). This allowed for computing BPRS-18 total scores and scores of five BPRS-18 subscales: anxiety/depression, anergia, thought disorder, activity, and hostility.

### 2.3. Statistical analysis

Stata 10 for Windows was used for all data analyses (Stata, 2007). Linear mixed models were used to identify the factors associated with subjective quality of life in different diagnostic groups whilst controlling for confounding factors, within-subject clustering of paired measurements and heterogeneity across studies using *xtmixed* and *gllamm* in Stata 10 (Rabe-Hesketh et al., 2002; Stata, 2007). In this three-level model,

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**Table 1**
Study characteristics of the 16 included studies and samples.

| Study | Country | Sample size [a] (ICD-10: F2/F3/F4) | Research design | SQOL measure [b] | SQOL (baseline) |
|---|---|---|---|---|---|
| | | *n* | | | Mean (SD) |
| Roeder-Wanner and Priebe (1998) | Germany | 89 (89/0/0) | Prospective-observational | LQOLP | 4.52 (.75) |
| Burns et al. (1999) | UK | 676 (627/49/0) | RCT | LQOLP | 4.25 (.74) |
| Hansson et al. (1999) | Sweden, Denmark, Finland, Norway, Iceland | 341 (341/0/0) | Cross-sectional | LQOLP | 4.69 (.75) |
| Eklund et al. (2001) | Sweden | 74 (74/0/0) | Cross-sectional | LQOLP | 4.23 (.72) |
| Priebe et al. (2002a) | Croatia, Serbia, Bosnia | 440 (0/0/440) | Prospective-observational | MANSA | 3.44 (.81) |
| Ruggeri et al. (2002) | Italy | 300 (103/108/89) | Prospective-observational | LQOLP | 4.57 (.90) |
| Priebe et al. (2002b) | Germany | 100 (100/0/0) | Prospective-observational | LQOLP | 4.65 (.79) |
| McCabe and Priebe (2004) | UK | 124 (124/0/0) | Cross-sectional | MANSA | 4.43 (.85) |
| d'Ardenne et al. (2005) | UK | 105 (0/21/84) | Cross-sectional | MANSA | 3.13 (.85) |
| Rakib et al. (2005) | UK | 69 (0/0/69) | Cross-sectional | MANSA | 4.11 (.69) |
| Slade et al.(2006) | UK | 97 (51/46/0) | RCT | MANSA | 4.25 (1.00) |
| Priebe et al. (2007) | UK, Spain, Netherlands, Sweden, Germany, Switzerland | 447 (447/0/0) | RCT | MANSA | 4.70 (.88) |
| Hansson et al. (2007) | Sweden | 92 (60/20/12) | Prospective-observational | LQOLP | 4.33 (.77) |
| McGuire-Snieckus et al. (2007) | UK | 106 (62/43/1) | Cross-sectional | MANSA | 5.12 (1.39) |
| Kallert et al. (2007) | Germany, UK, Poland, Slovakia, Czech Republic | 780 (237/350/193) | RCT | MANSA | 3.96 (.92) |
| Junghan (unpublished data) | Switzerland | 96 (78/14/4) | Prospective-observational | LQOLP | 4.72 (1.11) |

[a] Sample size refers to included patients with an ICD-10 clinical diagnosis of schizophrenia, schizotypal, or delusional disorders, mood disorders, or neurotic, stress-related and somatoform disorders for which single SQOL mean scores were available.
[b] LQOLP, Lancashire Quality of Life Profile; MANSA, Manchester Short Assessment of Quality of Life.

paired measurements (level-1) were treated as nested within patients (level-2), and patients nested within studies (level-3). Observations at level-1 were assumed to be missing at random. The modelling for identifying the factors influencing SQOL proceeded through three stages. (1) Mixed models were fitted with SQOL scores as dependent variable and fixed effects adjusted for the time of measurement for the following set of independent variables: age, gender, marital status, level of education, employment status, type of current treatment, ICD-10 clinical diagnosis, and symptom level. (2) All fixed effects identified as statistically significant in stage (1) were entered into a multivariate mixed model adjusted for time point, country of residence, and time to follow-up as a priori confounders. (3) Two-way interaction terms for significant fixed effects × diagnosis were added one by one to the multivariate mixed model to establish whether the effects of factors influencing SQOL identified in stage 2 differed across diagnostic groups. Statistical significance of interaction terms was assessed using likelihood ratio tests to evaluate improvement of model fit. In all stages, heterogeneity of findings across the included study samples was controlled for using likelihood ratios to assess whether adding a random slope for average/proportional patient characteristics (mean age per study, proportion female per study, proportion educated to school level per study, proportion married/partnership per study, proportion unemployed per study, proportion in outpatient care per study, proportion with schizophrenia, and mean BPRS-18 symptom level) and study characteristics, i.e. study design (cross-sectional design, prospective-observational design vs. RCTs) and sample size (small vs. large sample sizes (i.e. ≤ 100) (Higgins and Green, 2008)).

**Table 2**
Patient characteristics by diagnostic group.

| | ICD-10 clinical diagnosis (*n* (%)) | | | Total sample (*n* = 3936) |
|---|---|---|---|---|
| | Schizophrenia (*n* = 2393) | Mood disorders (*n* = 651) | Neurotic disorders (*n* = 892) | |
| Age, mean (SD) | 39.4 (11.4) | 43.6 (12.7) | 42.1 (11.6) | 40.7 (11.8) |
| Female, *n*(%) | 993 (41.5) | 425 (65.3) | 366 (41.0) | 1784 (45.3) |
| Educated to school level, *n*(%) | 806 (33.7) | 244 (37.5) | 146 (16.4) | 1196 (30.4) |
| Married/partnership, *n*(%) | 292 (12.2) | 270 (41.5) | 479 (53.7) | 1041 (26.5) |
| Unemployed, *n*(%) | 1388 (58.0) | 207 (31.8) | 257 (28.8) | 1852 (47.1) |
| Outpatient care, *n*(%) | 1632 (68.2) | 259 (41.3) | 695 (77.9) | 2596 (66.0) |
| BPRS-18 total score, mean (SD) | 37.6 (11.3) | 35.0 (8.7) | 33.0 (7.5) | 36.5 (10.5) |
| Depression/anxiety subscale, mean (SD) | 9.9 (3.9) | 13.9 (4.2) | 13.2 (3.7) | 10.8 (4.4) |
| Anergia subscale, mean (SD) | 8.6 (3.6) | 7.0 (2.8) | 5.6 (2.2) | 7.7 (3.5) |
| Thought disorder subscale, mean (SD) | 8.6 (4.1) | 5.2 (2.3) | 4.6 (1.4) | 7.3 (3.9) |
| Activation subscale, mean (SD) | 5.7 (2.5) | 4.7 (1.7) | 4.8 (1.7) | 5.2 (2.3) |
| Hostility subscale, mean (SD) | 6.0 (2.8) | 4.9 (2.2) | 4.8 (2.0) | 5.5 (2.6) |

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**Table 3**
Univariate mixed models analysis[a] of potential influential factors and SQOL as dependent variable.

| Influential factor | Total studies | *n* | Fixed part | | | Random part | | | | Heterogeneity (average patient characteristics)[b] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Standardized beta | Unstandardized beta (95% CI) | *P* | Level-1 residual variance | Level-2 random intercept variance | Level-3 random intercept variance | Level-3 random slope variance | |
| Age | 15 | 3806 | .04 | **.003 (.001 to .006)** | **.004** | .331 | .400 | .195 | – | $\chi^2 = .26$, $P = .876$[c] |
| Female vs. male | 16 | 3928 | .02 | **.02 (−.03 to .07)** | **.436** | .334 | .422 | .222 | – | $\chi^2 = 4.36$, $P = .113$[d] |
| Level of education | 10 | 2303 | | | **.606** | .353 | .387 | .060 | – | $\chi^2 = .97$, $P = .614$[e] |
| To school vs. further level | | | .04 | **.04 (−.04 to .12)** | **.322** | | | | | |
| To school vs. higher level | | | .03 | **.03 (−.08 to .13)** | **.611** | | | | | |
| Married/partnership vs. other | 12 | 3493 | −.18 | **.06 (.03 to .09)** | **<.001** | .350 | .411 | .145 | .051 | $\chi^2 = 11.71$, $P = .003$[f] |
| Unemployed vs. other | 15 | 3771 | −.32 | **−.32 (−.38 to −.25)** | **<.001** | .334 | .402 | .278 | – | $\chi^2 = 4.58$, $P = .101$[g] |
| Outpatient vs. inpatient care | 16 | 3936 | .05 | **.05 (−.07 to .17)** | **.441** | .334 | .236 | .422 | – | $\chi^2 = .86$, $P = .650$[h] |
| ICD-10 clinical diagnosis | 16 | 3936 | | | **<.001** | .334 | .419 | .198 | – | |
| Mood disorders vs. schizophrenia | | | −.22 | **−.21 (−.30 to −.12)** | **<.001** | | | | | $\chi^2 = 1.55$, $P < .462$[i] |
| Neurotic disorders vs. schizophrenia | | | −.16 | **−.15 (−.27 to −.04)** | **.008** | | | | | |
| BPRS-18 total score | 11 | 2397 | −.28 | **−.027 (−.030 to −.023)** | **<.001** | .359 | .414 | .088 | – | $\chi^2 = .30$, $P = .863$[j] |
| Depression/anxiety subscale | 11 | 2397 | −.371 | **−.083 (−.091 to −.075)** | **<.001** | .358 | .381 | .046 | – | $\chi^2 = .80$, $P = .671$[j] |
| Anergia subscale | 11 | 2397 | −.07 | **−.02 (−.03 to −.01)** | **<.001** | .361 | .472 | .142 | – | $\chi^2 = 4.74$, $P = .094$[j] |
| Thought disorder subscale | 11 | 2397 | −.11 | **−.03 (−.04 to −.02)** | **<.001** | .361 | .467 | .010 | – | $\chi^2 = 3.99$, $P = .136$[j] |
| Activation subscale | 11 | 2397 | −.08 | **−.03 (−.05 to −.02)** | **<.001** | .361 | .472 | .085 | – | $\chi^2 = 1.82$, $P = .403$[j] |
| Hostility subscale | 11 | 2397 | −.21 | **−.08 (−.09 to −.07)** | **<.001** | .360 | .440 | .093 | – | $\chi^2 = 1.86$, $P = .394$[j] |

[a]Three-level random intercept and random coefficient models were used, treating measurement occasions (level-1) as nested within patients (level-2), and patients nested within studies (level-3); estimates are adjusted for time point.

[b]Heterogeneity of findings across studies was tested using likelihood ratio tests to assess whether inclusion of random slopes for respective average patient characteristics at the study level (i.e. mean age per study[c], proportion female per study[d], proportion educated to school level per study[e], proportion married/partnership per study[f], proportion unemployed per study[g], proportion in outpatient care per study[h], proportion with schizophrenia[i], mean BPRS-18 symptom level[j]) improved model fit. Inclusion of random slopes for study characteristics (study design, $\chi^2 = 3.93$, $P = .140$; sample size, $\chi^2 = 7.82$, $P = .020$) was also tested. Random slopes were not included when likelihood ratio tests were not significant.

## 3. Results

### 3.1. Included studies and samples

Sixteen studies (Burns et al., 1999; d'Ardenne et al., 2005; Eklund et al., 2001; Hansson et al., 1999; Hansson et al., 2007; Kallert et al., 2007; McCabe and Priebe, 2004; McGuire-Snieckus et al., 2007; Priebe et al., 2002a, b; Priebe et al., 2007; Rakib et al., 2005; Roeder-Wanner and Priebe, 1998; Ruggeri et al., 2002; Slade et al., 2006), including one unpublished study (Junghan et al. 2009, unpublished data), were included (see Table 1). Twelve were observational, six each cross-sectional and longitudinal, and four randomized controlled trials (RCTs).

From these 16 studies, single SQOL mean scores were available for a total of 3936 patients with schizophrenia, schizotypal, or delusional disorders (*F2*, $n=2393$), mood disorders (*F3*, $n=651$), or neurotic, stress-related and somatoform disorders (*F4*, $n=892$). Paired assessments with SQOL at two time points were available from 2196 patients in 10 studies, the mean duration between measurements being 17.5 months (SD = 8.1).

### 3.2. Patient characteristics

Patient characteristics for the three diagnostic groups are shown in Table 2.

The mean age of patients was 40.7 years with a roughly equal gender distribution. About half of the patients were unemployed. Most patients were unmarried or not living in partnership, being treated as outpatients, and had been diagnosed with schizophrenia. Mean symptom levels were mild to moderate.

### 3.3. Factors associated with SQOL

Associations of potentially influential factors and SQOL as a dependent variable controlling for time point, within-subject clustering and heterogeneity of findings across studies are shown in Table 3.

Almost all variables were significantly associated with SQOL apart from gender, level of education, and service setting. There was a significant heterogeneity across studies for marital status and sample size.

Table 4 shows multivariate mixed models analysis for potential influential factors and SQOL as dependent variable.

In this step of the analysis, age, employment status, diagnosis, and BPRS total and subscale scores were significantly and independently associated with SQOL. Older patients, those in employment, with schizophrenia and with lower symptom levels had significantly higher SQOL scores. All BPRS subscales were significantly associated with SQOL scores. No significant heterogeneity of findings across studies was found.

### 3.4. Factors influencing SQOL in patients with schizophrenia and other disorders

Interaction effects of diagnosis and factors identified as significantly associated with SQOL in the previous multivariate mixed model are summarised in Table 5.

A likelihood ratio test showed an equally strong association of age with SQOL in all diagnostic groups ($\chi^2=1.98$, $P=.371$). There was a significant interaction for diagnosis by employment status ($\chi^2=11.1$, $P=.004$), with unemployment effects being significantly weaker in schizophrenia patients than in mood disorders and neurotic disorders.

**Table 4**
Multivariate mixed models analysis of potential influential factors and SQOL as dependent variable (8 studies, 2063 patients)[a].

| Influential factor | Fixed part | | | Random part[b] | | | Heterogeneity (average patient characteristics)[b] |
|---|---|---|---|---|---|---|---|
| | Standardized beta | Unstandardized beta (95% CI) | P | Level-1 residual variance | Level-2 random intercept variance | Level-3 random intercept variance | |
| | | | | .597 | .421 | .423 | |
| Age | .067 | .006 (.003 to .009) | <.001 | | | | – |
| Married/partnership vs. other | .07 | .07 (−.02 to .15) | .129 | | | | $\chi^2=0.00$, P = 1.00[c] |
| Unemployed vs. other | −.18 | −.18 (−.26 to −.10) | <.001 | | | | – |
| ICD-10 clinical diagnosis | | | | | | | |
| Mood disorders vs. schizophrenia | −.49 | −.47 (−.58 to −.37) | <.001 | | | | – |
| Neurotic disorders vs. schizophrenia | −.43 | −.42 (−.54 to −.30) | <.001 | | | | |
| BPRS-18 total score | −.250 | −.024 (−.027 to −.020) | <.001 | | | | – |
| Depression/anxiety subscale | −.35 | −.08 (−.09 to −.07) | <.001 | .597 | .401 | .403 | – |
| Anergia subscale | −.06 | −.02 (−.03 to −.01) | .003 | .598 | .448 | .447 | – |
| Thought disorder subscale | −.10 | −.03 (−.04 to −.02) | <.001 | .598 | .444 | .445 | – |
| Activation subscale | −.05 | −.02 (−.04 to −.01) | .007 | .598 | .447 | .448 | – |
| Hostility subscale | −.19 | −.07 (−.09 to −.06) | <.001 | .598 | .431 | .431 | – |

[a]Estimates are adjusted for time point, country of residence, and time to follow-up.
[b] Heterogeneity of findings across studies was tested using likelihood ratio tests to assess whether inclusion of random slopes for respective average patient characteristics at the study level (i.e. proportion married/partnership per study[c] improved model fit if there was evidence of heterogeneity in univariate mixed models analysis (see Table 2). Inclusion of random slopes for study characteristics (sample size, $\chi^2=.00$, $P=1.00$) was also tested. Random slopes were not included into the model when likelihood ratio tests were not significant.

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**Table 5**
Multivariate mixed models analysis of factors influencing SQOL in schizophrenia, mood disorders, and neurotic disorders (8 studies, 2063 patients)[a].

| Influential factor | Fixed part | | | Random part[b] | | |
|---|---|---|---|---|---|---|
| | Standardized beta | Unstandardized beta (95% CI) | *P* | Level-1 residual variance | Level-2 random intercept variance | Level-3 random intercept variance |
| ICD-10 clinical diagnosis × employment status | | | | .597 | .420 | .421 |
| Unemployed vs. other | | | | | | |
| Schizophrenia | −.11 | −.10 (−.20 to −.01) | .028 | | | |
| Mood disorders | −.83 | −.80 (−.97 to −.63) | <.001 | | | |
| Neurotic disorders | −.66 | −.65 (−.85 to −.44) | <.001 | | | |
| ICD-10 clinical diagnosis × BPRS-18 total score | | | | .597 | .420 | .422 |
| Schizophrenia | −.24 | −.022 (−.026 to −.018) | <.001 | | | |
| Mood disorders | −.25 | −.024 (−.033 to −.015) | <.001 | | | |
| Neurotic disorders | −.43 | −.041 (−.054 to −.028) | <.001 | | | |

[a]Interaction terms were added to the previous adjusted multivariate mixed model using a likelihood ratio test for assessing their statistical significance (diagnosis × employment status, $\chi^2 = 11.1$, $P = .004$; diagnosis × BPRS-18 total score, $\chi^2 = 6.86$, $P = .032$). Interaction terms did not significantly improve model fit for diagnosis × age ($\chi^2 = 1.98$, $P = .371$), BPRS-18 depression/anxiety subscale ($\chi^2 = 4.56$, $P = .102$), BPRS-18 anergia subscale ($\chi^2 = 2.06$, $P = .357$), BPRS-18 thought disorder subscale ($\chi^2 = 3.30$, $P = .192$), BPRS-18 activation subscale ($\chi^2 = 2.11$, $P = .348$), BPRS-18 hostility subscale ($\chi^2 = .08$, $P = .962$).
[b]Heterogeneity of findings on interaction terms across studies was tested using likelihood ratio tests to assess whether inclusion of random slopes improved model fit if there was evidence of heterogeneity in previous multivariate mixed models analysis (see Table 3). Random slopes were not included into the model when likelihood ratio tests were not significant.

Symptom levels were inversely related to SQOL in patients with schizophrenia, mood disorders, and neurotic disorders. There was a significant interaction effect for diagnosis by symptoms levels ($\chi^2 = 6.86$, $P = .032$). While higher symptom levels were associated with lower SQOL in patients of all diagnostic groups, the influence of symptom levels was significantly stronger in patients with neurotic disorders than in those with schizophrenia and mood disorders. There were no significant interaction effects for diagnosis by BPRS-18 subscales.

## 4. Discussion

### 4.1. Main findings

The pooled analysis found more favourable SQOL scores in patients with schizophrenia than with other diagnoses. It showed higher SQOL scores in older patients, those in employment and those with lower symptom levels. However, the influence of factors other than age varied across diagnostic groups. The association of symptoms with SQOL was significantly stronger in neurotic patients than in schizophrenia and mood disorders. The influence of employment was significantly stronger in mood and neurotic disorders than in schizophrenia.

### 4.2. Strengths and limitations

This is the largest study to date using a pooled data set to analyse factors influencing SQOL in patients with schizophrenia and other mental disorders. The analysis considered both studies and individual patients as units of analysis. Overcoming some of the limitations of conventional meta-analytic techniques, the study therefore complements meta-analytical findings. Further strengths are that the sample size was sufficiently large for this type of complex analysis (although it varied for different analyses in this study), and that for the majority of patients the analysis included two assessments at different time points. This increased the precision of the findings whilst controlling for within-subject clustering. SQOL data and other characteristics were assessed with very similar methods and categories across all included data sets, excluding potential inconsistencies of assessment methods as a source of heterogeneity.

The study has five major limitations: A) We included only studies using the LQOLP and MANSA. B) Study patients were not representative of all patients in the given service. Selection biases might have influenced SQOL levels in diagnostic groups. C) The number of factors in the analysis was limited. Potential factors such as length of illness or details of current treatment (which might have explained the differences found between groups) were not considered. D) Only crude categories of each variable were analysed. E) The diagnostic procedures were not consistently standardized across all studies.

### 4.3. Comparisons with previous research

In this analysis schizophrenia patients had more positive SQOL scores than other diagnoses. This is not accounted for by differences in socio-demographics or symptom levels. Perhaps schizophrenia patients adapt to the experience of living with their disorder in different ways than patients with other disorders (Atkinson et al., 1997; Lehman, 1996). They might have lowered their expectations leading to a higher satisfaction, found more appropriate methods to achieve satisfaction in difficult circumstances, or be less prone to rate items in questionnaires based on negative emotions. The difference may also reflect schizophrenia-specific clinical characteristics. Emotional withdrawal, affective blunting or cognitive deficits may limit the impact of higher symptom levels and disorder-related dysfunction on SQOL (Atkinson et al., 1997), so that SQOL ratings are higher and the influence of overall symptoms are lower than in patients with neurotic disorders.

Despite the differences between diagnostic groups, higher levels of symptoms overall and of symptom subscales were associated with lower SQOL in all groups. This general association of symptom levels and SQOL is in line with previous research (Eack and Newhill, 2007). Based on our findings, an increase of BPRS total scores of 8.1 (i.e. 1 standard

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deviation), corresponds to a decrease in SQOL mean scores of .23 in patients with schizophrenia (i.e. using the standardized coefficient in Table 4 and a standard deviation of .98), .25 in patients with mood disorders, and .42 in patients with neurotic disorders. Hence, the association of overall symptom levels with SQOL appears clinically relevant.

When other factors were adjusted for, marital status did not affect SQOL, which is consistent with Vatne and Bjoerkly's meta-analysis (Vatne and Bjorkly, 2008). It may be possible that positive and negative effects of living with a partner cancel each other out. Younger age and unemployment were associated with lower SQOL, consistent with previous research. The influence of unemployment was weaker in schizophrenia patients, again possibly linked to lower expectations or disorder specific cognitive and emotional processes of appraising an adverse objective situation. It might also be possible that patients with schizophrenia more often have low paying and menial jobs and that such jobs lead to less improvement of SQOL than potentially more attractive jobs of patients in other diagnostic groups.

The pooled analysis reduced the effect of the heterogeneity of findings across studies by using the same statistical model. In the final model significant heterogeneity was identified only for diagnostic group. The sensitivity analysis explained this heterogeneity by the absence of significant differences between diagnostic groups in studies with small sample sizes. Studies with small sample sizes may underestimate differences between diagnostic groups, whilst the study design does not make a difference.

### 4.4. Implications

The factors identified as associated with SQOL explain only small amounts of variance. Whether such variance is important or not, is likely to depend on the type of intervention to be evaluated and the purpose of a study. Small differences in SQOL as an outcome can be very relevant in studies testing inexpensive interventions which can easily be rolled out across services (Priebe et al., 2007), or in evaluations of services in large populations. In such studies, analyses may adjust for the influence of the factors identified in this analysis. The factors may also inform the allocation strategy in experimental studies, e.g. stratifying a random allocation by age, employment status, diagnostic group and/or symptom level. In studies that aim to identify large effect sizes in SQOL, the associations with influential factors reported in this analysis may be less relevant.

The analysis identified the factors influencing SQOL in mostly observational designs. Based on this analysis alone, no firm conclusions can be drawn about possible interventions for improving SQOL. The literature suggests that symptom improvement and employment schemes can lead to improvements of SQOL (Burns et al., 2007; Leucht et al., 2003). Our findings would suggest that such an effect may be smaller in patients with schizophrenia than in neurotic disorders, given the differing influence of symptoms and employment status on SQOL between diagnostic groups. In any case the study can be used to estimate the gains in SQOL that may be expected in case of defined improvements of symptom levels. Moreover, the findings suggest that such estimates should be specific for different diagnostic groups and that not all findings of SQOL research can be generalised from one diagnostic group to others.

Considering the higher SQOL in patients with schizophrenia, further improvements through therapeutic interventions may be more difficult to achieve, and a potential ceiling effect must be considered. Studies of interventions to improve SQOL in schizophrenia patients might more profitably focus on patients with lower SQOL baseline scores, as including patients with relatively positive SQOLs may obscure significant effects.

More specific research including qualitative studies may explore why patients with schizophrenia have more positive SQOL than other diagnostic groups, and why their ratings are less influenced by symptoms and employment status.

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**Contributors**

SP designed the study and had overall responsibility for completion. UR conducted the literature searches and managed the data. SP, RM, TB, ME, LH, UJ, TK, CN, MR, and MS took each responsibility for at least one of the data sets in the analysis. UR, SP, and DW analysed the data. All authors contributed to and have approved the manuscript.

**Conflict of interest**

None of the authors reported potential conflicts of interests.

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