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ORIGINAL ARTICLE

Interview-based assessment of cognition is a strong predictor of quality of life in patients with schizophrenia and severe negative symptoms

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Objective: To analyze the correlation between quality of life, symptoms, and cognition assessed by the interview-based Schizophrenia Cognition Rating Scale (SCoRS).
Methods: Seventy-nine outpatients diagnosed with schizophrenia were evaluated with the Quality of Life Scale – Brazilian version (QLS-BR), the SCoRS, and symptoms scales (Positive and Negative Syndrome Scale [PANSS]). After determining the potential explanatory variables using Spearman's correlation and Student's *t* test results, we ran simple, multivariate, and decision-tree regression analyses to assess the impact of SCoRS and PANSS ratings on mean overall quality of life.
Results: Cognitive deficits and negative symptoms were the best predictors of quality of life. A low degree of negative symptoms (PANSS negative < 11) was a strong predictor of better quality of life (QLS ~ 75), regardless of SCoRS rating. Among participants with more severe negative symptoms, elevated cognitive impairment (interviewer SCoRS ~ 44) was a predictor of worse quality of life (QLS ~ 44).
Conclusions: Cognitive impairment determined by interview-based assessment seems to be a strong predictor of quality of life in subjects with severe negative symptoms. These results support the usefulness of SCoRS for cognitive assessment that is relevant to the everyday life of patients with schizophrenia.

Keywords: Schizophrenia; cognitive neuroscience; outpatient psychiatry; tests/interviews, psychometric; chronic psychiatric illness

Introduction

Cognitive impairment is a core feature of schizophrenia that does not depend on the presence of positive and negative symptoms and is related to functional impairment.[1,2] Thus, the assessment of cognitive deficits in schizophrenia is critical for the study of impact of disease and the development of rehabilitation.

The assessment of quality of life is a useful tool to determine the impact of a disease on daily life. One of the interesting aspects of quality of life is that it introduces a subjective component that covers the perceptions of individuals about themselves and about the damage caused by disease. The inclusion of a subjective feature facilitates more effective interventions from a biopsychosocial perspective, beyond the reduction of symptoms.[3] Therefore, quality of life measures are increasingly being used in the evaluation of functional outcome, drug testing, approval of new drugs, evaluation of rehabilitation, and resource allocation.[4]

Most definitions of quality of life refer to the subjective satisfaction of subjects with various aspects of their life, including physical health, psychological state, social functioning, and general living conditions.[5,6] These are distinct areas that are influenced by the experience, beliefs, expectations, and perceptions of individuals. The World Health Organization (WHO) defines quality of life as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns."[7]

Several studies have examined the associations between quality of life and cognitive deficits in schizophrenia.[8-12] However, probably because a variety of instruments have been used to evaluate quality of life, the results have varied between studies. A higher association between cognitive impairment and quality of life has been obtained with the use of objective quality of life scales rated by researchers than with measures of subjective quality of life in patient-reported

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outcomes.[13,14] Most of these studies have used performance-based neuropsychological tests as a measure of cognitive function.

However, identifying cognitive deficits is not the same as understanding the impact of cognitive deficits on the lives and day-to-day activities of patients. A group of experts has cautioned that neuropsychological test scores alone are insufficient for the regulatory approval of new drugs for improvement of cognitive functioning in schizophrenia.[15-17] Therefore, assessment tools that are sensitive to changes in cognitive functioning and that directly reflect daily functioning are necessary. To address this need, interview-based measures of cognition (as opposed to functional capacity assessments), which may serve as co-primary measures in drug evaluations, have been proposed.[16,17]

One of these interview-based assessments is the Schizophrenia Cognition Rating Scale (SCoRS). Its original version in English has been validated and shown to have good reliability. The SCoRS involves an interview with patients and informants as well as the interviewer's impression of these two sources of information.[16] The inclusion of informants improves the validity of the scale, because studies have shown that scales that rely only on the views of patients and interviewers do not significantly correlate with objective measures of cognitive functioning.[17-21]

To date, there is no study evaluating the relationship between quality of life and cognition assessed by interview-based scales. This study aimed to investigate the correlation between cognition, as measured by SCoRS, and quality of life, taking into consideration the influence of depressive and of positive and negative symptoms on quality of life and SCoRS.

Methods

Participants

Seventy-nine patients with schizophrenia whose diagnosis was confirmed by structured clinical interview using the Mini International Neuropsychiatric Interview (MINI) - Brazilian version were enrolled.[22] All patients were stable, undergoing outpatient psychiatric treatment, and using antipsychotics. Stabilization was defined as the absence of changes in medication doses in the last three months. Exclusion criteria were abuse of alcohol or illicit drugs and history of neurological diseases. The patients were enrolled in the following clinical facilities: Department of Psychiatry of the Instituto de Previdência dos Servidores do Estado de Minas Gerais (IPSEMG), Núcleo de Assistência Psicossocial (NAPS) de Ribeirão das Neves, non-governmental organization LAÇO and Raul Soares Institute, Fundação Hospitalar do Estado de Minas Gerais (FHEMIG).

Severity of symptoms

The Positive and Negative Syndrome Scale (PANSS)[23] and the Calgary Depression Scale for Schizophrenia (CDSS)[24] – Brazilian versions – were used to assess the severity of positive and negative and depressive symptoms respectively. The PANSS score ranges from 7 to 49 for positive and negative symptoms. The CDSS score ranges from 0 to 27. In both scales, the higher the score, the greater the severity of symptoms. The antipsychotic doses of individual patients were converted to chlorpromazine equivalents.

Quality of life

The Quality of Life Scale – Brazilian version (QLS-BR) was used to assess quality of life.[25,26] This scale was specifically developed for schizophrenia, and its development was guided by conceptualizations of the deficit syndrome to evaluate the more insidious aspects of the disease. The Brazilian version of the QLS has a multidimensional structure with three factors, including 21 items. The factors are: social network; occupational level; and intrapsychic functioning/interpersonal relationship. Among the 21 items, two that do not fall into one of the three factors were retained due to their high correlation with the total scale score. These items are motivation and anhedonia. For each item, the rater assigns a score from 0 to 6, with higher scores corresponding to better quality of life. Scores range from 0 to 48 in the social network and intrapsychic functioning/interpersonal relationships factors, and from 0 to 30 in the occupational level factor. The total score ranges from 0 to 126. The QLS-BR has internal consistency greater than 0.85, test-retest correlation of 0.85, and interrater reliability of 0.67 to 1.00.[26] In the present study, the scale was administered by a professional trained by one of the investigators (CSC), who also participated in the validation of the Brazilian version of the QLS.

Cognitive assessment

The SCoRS[16] was used as a measure of cognitive function. This scale was developed as an alternative to neuropsychological tests, making cognitive assessment easier and more relevant to reflect the patient's everyday functioning. The SCoRS is based on interviews with patients and informants, and includes 20 items developed to assess cognitive deficits and how they affect the patient's daily routine. The items assess the cognitive domains of attention, memory, reasoning and problem solving, working memory, language production, and motor skills. Each item is rated on a scale of four points (1 to 4), with higher scores reflecting a greater level of impairment. Thus, the total score ranges from 20 to 80. Full administration of SCoRS includes two separate sources of information and three different scores: an interview with the patient, an interview with an informant about the patient (usually a family member), and a score determined by the interviewer who administered the scale to the patient and informant. The interviewer score reflects observations made by the interviewer regarding both interviews. A global score, which ranges from 0 to 10, is also assigned by the interviewer after having completed the 20 items. The SCoRS was translated and adapted into Brazilian Portuguese by one of the present investigators (FLR). Back translation into English was done by a bilingual individual supervised by the author of the original version (RSK). In

its English version, the items of the SCoRS have interrater reliability ranging between 1.00 and 0.81, internal consistency of 0.79, and validity determined by its high correlation with neuropsychological tests and measures of functional outcome.[16] In the MATRICS Psychometric and Standardization Study, SCoRS global ratings had test-retest reliability of ICC = 0.81.[27]

Procedures

The scales for clinical evaluation and quality of life were administered by the principal clinical investigator (BFC). On the same day, a neuropsychologist administered the cognitive assessment tool. The investigators were blinded to the results of the other assessment. All patients signed an informed consent form, and the study was approved by the Research Ethics Committee at IPSEMG. All procedures were in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Statistical analysis

Spearman's correlation test was used to determine which variables correlated significantly with overall quality of life. The variables of interest were age, total PANSS negative (PANSS-N), total PANSS positive (PANSS-P), total Calgary, and total SCoRS ratings. Student's *t* test was used to evaluate the influence of gender on the mean quality of life (QLS). After determining the potential explanatory variables using the Spearman's correlation and Student's *t* tests, we ran simple, multivariate, and decision-tree regression analyses to assess the power of explanatory variables to predict total quality of life. The software R version 2.15.2 was used for statistical analysis.

Results

Sociodemographic, clinical, and cognitive variables, as well their association with QLS, are presented in Table 1. Gender, age, educational level, dose of medication (in chlorpromazine-equivalent dose), and depressive symptoms (Calgary scale) did not influence overall quality of life. By contrast, high levels of positive and negative symptoms (as measured by PANSS) or cognitive impairment (as measured by SCoRS) were strongly and inversely correlated with QLS.

Table 2 shows the correlation between the three SCoRS scores (patient, informer, and investigator). Because the correlations between these three scores were very high, only interviewer SCoRS data were used for statistical analysis. We chose interviewer SCoRS ratings because these individuals are more qualified to distinguish cognitive impairment from negative symptomatology.[28]

Running simple regression analyses using PANSS-N, PANSS-P, and SCoRS as single explanatory variables of QLS, we found that PANSS-N ($p < 0.001$), PANSS-P ($p = 0.026$), and SCoRS ($p < 0.001$) significantly predicted quality of life at $\alpha = 5\%$. The adjusted R-squared values resulting from these simple regression analyses were 0.171 for negative symptoms, 0.051 for positive symptoms, and 0.194 for cognitive symptoms. A multivariate regression model including negative symptoms, positive symptoms, and cognitive symptoms

Table 1 Impact of variables on quality of life

Variable	Proportion	Mean QLS	p-value (*t* test)
Gender			
Male	52% (n=41)	53.6	
Female	48% (n=38)	59.1	0.098
	Mean (standard deviation)	Correlation with total QLS (Spearman's rho)	p-value
Age (years)	40.8 (11.5)	-0.166	0.169
Education level (years of study)	8.3 (0.38)	0.192	0.096
CPZ eq (mg)	404.5 (29.77)	-0.172	0.133
Calgary	2.9 (3.8)	-0.144	0.166
PANSS-P	11.2 (3.9)	-0.368	< 0.001*
PANSS-N	15.9 (6.2)	-0.531	< 0.001*
SCoRS interviewer	38.8 (10.8)	-0.471	< 0.001*

CPZ eq = chlorpromazine equivalent; PANSS-N = Positive and Negative Syndrome Scale - negative; PANSS-P = Positive and Negative Syndrome Scale - positive; QLS = Quality of Life Scale; SCoRS = Schizophrenia Cognition Rating Scale.
* Significant at $\alpha = 1\%$.

Table 2 Correlations between the sources of information from SCoRS

Variable	Mean (standard deviation)	Correlation with SCoRS interviewer	Correlation with SCoRS informant	Correlation with SCoRS patient	p-value
SCoRS interviewer	38.8 (10.8)		0.805	0.773	< 0.001*
SCoRS informant	38.7 (11.5)	0.805		0.690	< 0.001*
SCoRS patient	38.4 (10.8)	0.773	0.690		< 0.001*

SCoRS = Schizophrenia Cognition Rating Scale.
* Significant at $\alpha = 1\%$.

Table 3 Simple regression trees for PANSS (negative and positive) and SCoRS

Variable	Threshold	Mean QLS variable < threshold	Mean QLS variable ⩾ threshold	Difference between means	p-value (*t* test)
PANSS-P	11	62.6 (n=40)	49.7 (n=39)	12.9	< 0.001*
PANSS-N	12	70.0 (n=23)	50.6 (n=56)	19.4	< 0.001*
SCoRS	44	62.3 (n=50)	44.7 (n=25)	17.6	< 0.001*

PANSS-N = Positive and Negative Syndrome Scale - negative; PANSS-P = Positive and Negative Syndrome Scale - positive; QLS = Quality of Life Scale; SCoRS = Schizophrenia Cognition Rating Scale.
* Significant at α = 1%.

as explanatory variables showed that PANSS-P coefficient (p = 0.383) was not significant, while both PANSS-N (p = 0.012) and SCoRS (p = 0.003) coefficients were significant. A multivariate regression including only PANSS-N and SCoRS had an adjusted R-squared of 0.263 and both coefficients were significant at α = 1%.

We also built regression trees for predicting QLS based on each explanatory variable, allowing only one division per variable. The threshold values found for the variables allowed partitioning of the data into two groups in which the measures of quality of life were as similar as possible; in other words, the sum of variances within groups was minimized. Patient were divided according to each variable into statistically different groups at a level of confidence of 1%, as shown in Table 3. PANSS-N and SCoRS presented similar explanatory power, and divided the patients into two groups with arithmetic difference of 17.6 and 19.4 respectively between QLS means. PANSS-P had lower explanatory power with a difference of 12.9 between QLS means. It is interesting to note that patients with PANSS-N < 12 presented the highest QLS mean (70.0), while patients with SCoRS ⩾ 44 had the lowest QLS mean (44.7). Therefore, based on the simple regression trees, we concluded that patients with low PANSS-N scores had good quality of life, while patients with elevated SCoRS had poor quality of life.

Additionally, we built a multivariate regression tree including PANSS-N, PANSS-P, and SCoRS as explanatory variables, with the constraint that a group needed to have at least 40 patients to get split, in order to avoid model overfitting. As shown in Figure 1, PANSS-P was not found to be a good predictor of QLS when compared to the other variables, and was not entered as a decision variable. The data were initially divided into two groups, considering PANSS-N at a threshold value of 11. The group of patients with PANSS-N ⩾ 11 was subsequently divided into two additional groups, depending on SCoRS at a threshold value of 44. The three groups obtained had statistically different means at a significance level of 1%, according to the one-way analysis of variance (ANOVA) and Tukey's honest significant difference (HSD) tests. Again, PANSS-N score < 11 was a predictor of good quality of life, while a SCoRS ⩾ 44 was a predictor of poor quality of life. The quality of life of patients with PANSS-N ⩾ 11 improved significantly with a low SCoRS.

Finally, we also built regression trees for predicting each QLS factor (1-social network; 2-occupational level; 3-intrapsychic functioning/interpersonal relationship) based on each explanatory variable, allowing only one division. Again, threshold values for the variables were found in a manner that they partitioned the data into two groups in which the measures of quality of life were as similar as possible; in other words, the sum of variances within groups was minimized. Thresholds are shown in Table 4. For factors 1 and 3 (social network and intrapsychic functioning/interpersonal relationship), the patients were divided according to all variables into groups that were statistically different at a level of confidence of 1%, as shown in Table 4. PANSS-N fad the highest explanatory power for both factors, dividing the patients into two groups with a difference of 8.3 between the mean factor 1 QLS scores, and a difference of 6.3 between the mean factor 3 QLS scores. For factor 2, occupational level, only SCoRS divided the patients into statistically different groups at a level of confidence of 1% (mean QLS factor 2 difference of 3.8), as shown in Table 3.

Discussion

We studied a group of individuals with schizophrenia who had a degree of cognitive impairment that is expected for

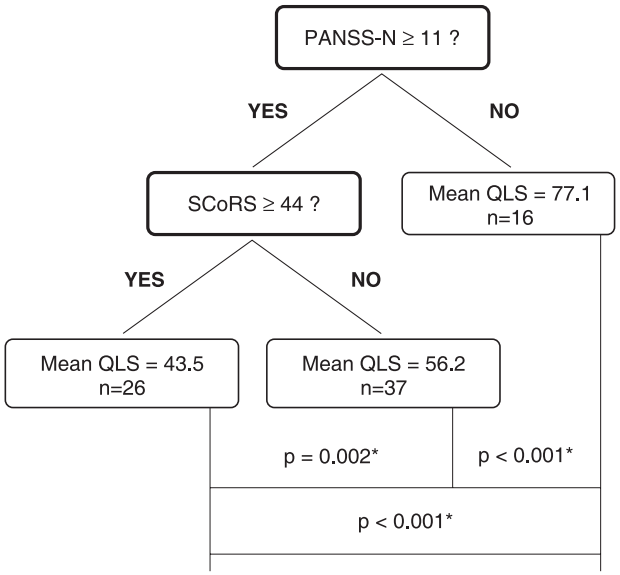

Figure 1 Multivariate regression tree to predict Quality of Life Scale scores (Total). ANOVA = analysis of variance; HSD = honest significant difference; PANSS-N = Positive and Negative Syndrome Scale negative; QLS = Quality of Life Scale; SCoRS = Schizophrenia Cognition Rating Scale.

Table 4 Simple QLS factors regression trees for PANSS (negative and positive) and SCoRS

QLS factor	PANSS-P		PANSS-N		SCoRS	
	Threshold	Difference between means	Threshold	Difference between means	Threshold	Difference between means
1 - Social network	9	7.7*	12	8.3*	44	6.9*
2 - Occupational level	11	2.7	17	1.9	50	3.8*
3 - Intrapsychic functioning/ interpersonal relationship	11	3.2*	16	6.3*	44	5.6*
Total QLS	11	13.4*	12	18.3*	44	17.8*

PANSS-N = Positive and Negative Syndrome Scale - negative; PANSS-P = Positive and Negative Syndrome Scale - positive; QLS = Quality of Life Scale; SCoRS = Schizophrenia Cognition Rating Scale.
* Significant at $\alpha = 1\%$.

the disease. A recent multicentric study[29] including 300 participants with schizophrenia found mean SCoRS ratings and standard deviations that are similar to those reported by us.

The present results indicate that cognitive deficits assessed by SCoRS, and negative symptoms assessed by PANSS are predictors of quality of life in schizophrenia. This supports previous results obtained by our group showing that negative symptoms and interview-assessed cognitive deficits represent independent constructs in patients with schizophrenia.[28] Our findings also corroborate data in the literature, especially data from studies using objective scales, such as the QLS-BR, to assess quality of life in schizophrenia. Most of those studies, however, used neuropsychological tests to assess cognition.[14,30-33] Hence, our results indicate that interview-based instruments are also suitable to detect the impact of cognitive impairment on quality of life. This kind of cognitive assessment has obvious advantages over neuropsychological evaluation, especially in clinical settings, since it is easier, faster and does not require extensive training.

In fact, the correlation between cognition as assessed by SCoRS and quality of life found in our study is stronger than that reported by studies that used neuropsychological tests[30-33] and by a meta-analysis.[14] Other studies have reported similar results, with interview-based assessment of cognition tending to correlate more strongly with quality of life than performance-based measures.[16,27] It is possible that interview-based cognition assessment has greater sensitivity than neuropsychological tests to detect the effects of cognitive deficits on daily life and, consequently, to establish a relationship between cognitive deficits and quality of life. Alternatively, the greater correlation between interview-based measures of cognition and measures of quality of life may result at least in part from methodological aspects. This is because the effect of non-specific factors (e.g., low motivation) on all interview-based measures is more homogeneous than the effect of non-specific factors on neuropsychological tests. In any case, the use of cognitive interview-based measures seems to be more appropriate to compare the effects of cognition and symptoms on quality of life.

Our study also showed that patients with low level of negative symptoms seem to usually have a good quality of life, independently of cognition. Conversely, among patients with high levels of negative symptoms, those with higher cognitive impairment have a significantly worse quality of life than those who are more cognitively preserved. This information may be relevant for clinical practice, since it could help clinicians to identify situations in which special attention must be paid to cognitive impairment (i.e., avoid some medications, indicate rehabilitation strategies). Like in previous studies, quality of life was not related to depressive symptoms, and was moderately related to positive symptoms. It has been shown that depressive symptoms are an important determinant of quality of life in scales that rely on self-assessment, but not in scales completed by an interviewer, as is the case of the QLS-BR.[34,35]

Based on simple regression trees, we concluded that cognitive deficit assessed by SCoRS significantly predicted the three factors of the QLS scale and was the only significant predictor of QLS factor 2, occupational level. Negative symptoms assessed by PANSS presented the highest explanatory power for QLS factors 1 and 3, social network and intrapsychic functioning/interpersonal relationship.

This study has some limitations. The sample was relatively small and included clinically stable individuals, with low levels of positive symptoms. Therefore, the results obtained may not be generalized to a more heterogeneous population. Another limitation is that cognitive impairment and quality of life were assessed only by interview-based instruments. The poor insight often observed in patients, as well as the possibility of inaccuracy in informant reports may have influenced the ratings.

In conclusion, interview-based assessment of cognition and negative symptoms were the best predictors of quality of life in schizophrenia. We found that an elevated level of cognitive impairment (interviewer SCoRS $\geqslant$ 44) was a predictor of poor quality of life, while a low level of negative symptoms (PANSS negative $<$ 11) was a strong predictor of good quality of life. Elevated cognitive impairment was the only predictor of poor occupational level, while severe negative symptoms were the best predictor of poor social network and intrapsychic functioning/interpersonal relationship.

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Disclosure

The authors report no conflicts of interest.

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