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ORIGINAL PAPER

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Prediction of community outcome in schizophrenia 1 year after discharge from inpatient treatment

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Abstract This longitudinal study aimed at identifying predictors of community outcome from a broad range of neuropsychological, clinical psychopathologic, sociodemographic, and treatment related factors. $N = 96$ schizophrenia patients were assessed both at baseline during inpatient treatment and 1 year after discharge from hospital (follow-up). At follow-up functional outcome was measured by the Global Assessment of Functioning Scale (GAF) and the Social Adjustment Scale II (SAS II). Data were analyzed in an explorative way by means of multiple linear regression analyses. Three out of the five functional outcome measures were predicted by the negative syndrome and measures of cognitive functioning. However, the positive syndrome also consistently predicted psychosocial functioning. Altogether, the regression models explained between 20% and 35% of the variance in our outcome measures. The findings not only reemphasize that negative symptoms and cognitive dysfunctions are key determinants of community outcome but also point to a potential predictive relevance of positive symptoms.

Key words Schizophrenia · functional outcome · prediction · neuropsychology · psychopathology

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Introduction

The diagnosis of schizophrenia is often accompanied by a rather poor functional outcome including life skills as occupational and social adjustment, or activities of daily living [40, 46, 61]. This reduced functional outcome is often responsible for the requirement of long-term treatments in institutions and the resulting high costs of care. Functional outcome in schizophrenia can be affected by a number of factors like cognitive dysfunctions, symptoms, age, gender, education, illness duration, and pharmacological and psychosocial treatments.

Both longitudinal and cross-sectional studies suggest that cognitive dysfunctions, particularly memory, limit functional outcome such as psychosocial skills acquisition, occupational functioning, social attainment, and degree of independent living [18, 27]. Cognitive deficits are supposed to be more closely associated with functional outcome than are psychotic symptoms or any other symptom domain [17–20]. The review of Green et al. [18] suggests that between 20% and 60% of the variance in functional outcome can be explained by cognitive functioning. Nonetheless, this review of 37 studies also points up to the enormous heterogeneity with regard to predictor and outcome measures as well as inconsistent findings.

With regard to psychopathology, negative symptoms are most consistently related to functional outcome [19]. Ho et al. [26] found in their 2-year follow-up study that negative symptoms were associated with worse occupational and social adjustment and higher financial dependency. Other studies [1, 12] identified negative symptoms to be associated with social problem solving. Again, negative symptoms were related to worse general social adjustment [62] and a reduced likelihood of living independently [28]. Green and Nuechterlein [19] discuss the degree of overlap between cognitive dysfunctions and negative symptoms. According to their review, the percentage of

variance explained is relatively small, i.e. about 10–15%. Thus, the authors conclude that negative symptoms and cognitive dysfunctions might be placed on different 'pathways'. Concerning our own schizophrenia sample, the negative syndrome only weakly correlated with global cognitive functioning [39]. Only few studies [5, 48, 52] found positive symptoms to be associated with functional outcome. In general, Norman et al. [48] assume that symptoms in later stages of the illness and after an optimized treatment might be better predictors than those in acute phases.

Further, medication related factors like medication side effects [28], and possibly the type (atypical versus conventional) of antipsychotic medication [41] might be associated with functional outcome. Hofer and colleagues for example found that parkinsonism negatively influenced occupational functioning. Finally, compliance with medication was shown to predict functional outcome in first-episode schizophrenia patients [4]. Regarding clinical and sociodemographic factors the literature is relatively sparse. Dickerson et al. [13] for example showed that a younger age and a shorter illness duration related to better social functioning at follow-up. Hofer et al. [27] found age, education and depression to be predictors of a patient's need for care. Female sex negatively influenced occupational functioning in this study. Other studies in turn resulted in better outcomes for female schizophrenia patients concerning occupational and social functioning [43].

Green et al. [18] discuss the relatively narrow selection of predictor measures as a key limitation of existing literature. Further, they point out, that studies were generally underpowered. Twenty-five of the 37 studies under review had sample sizes below 50 and an insufficient statistical power (≤ 0.50).

The goal of the present explorative study is to identify predictors of functional outcome from a broad range of neuropsychological, clinical psychopathologic, and sociodemographic factors within a relatively large schizophrenia sample. We hypothesized that cognitive dysfunctions and negative symptoms were most consistently associated with functional outcome. The statistical power of our prediction analyses will be an additional focus of the paper. The present study further adds a psychosocial intervention to the list of potentially relevant predictor variables. An increasing number of successful clinical trials indicates that such interventions can aid to symptom reduction [34, 51, 53], relapse prevention [3, 6, 21, 24, 30], and improvement of social functioning [7, 50]. The type of functional outcome we focus on is community outcome according to the definition of Green et al. [18]. Community outcome, i.e., occupational functioning, social attainment, and degree of independent living, is from our point of view especially relevant with regard to the aforementioned economical implications.

Method

Study design

Interventions

Between April 1998 and June 2001 169 inpatients who met DSM-IV criteria for schizophrenia or schizoaffective disorder were consecutively recruited as part of a combined large-scale psychotherapy and neuropsychology study at the Tuebingen University Hospital, Department of Psychiatry and Psychotherapy, and the Rottweil State Hospital of Psychiatry and Psychotherapy (Germany). All patients of the catchment areas needing inpatient treatment and fulfilling the below mentioned eligibility criteria had the possibility to take part in the study.

The experimental condition is a structured cognitive-behaviorally oriented group treatment program for relapse prevention (Cognitive-Behaviorally Oriented Service, CBOS). The treatment protocol will be presented in detail elsewhere. Briefly, CBOS was manualized and consisted of inpatient (1–4) and outpatient (5) group components: (1) A psychoeducational group therapy aimed at providing information about the illness and the treatment, establishing a functional subjective illness concept, fostering the patient-therapist cooperation, and improving crisis coping skills. (2) A social-emotional skills training was designed in order to improve emotion perception, emotion expression, and social skills. (3) A social group treatment addressed the patients' living situation, occupation, and leisure time. (4) In addition, relatives received structured group sessions providing information about illness and treatment. (5) After inpatient treatment patients participated in a needs-based outpatient therapy group for 1 year. This outpatient group addressed stress coping skills, crisis management skills, and coping with day-to-day problems. Treatment As Usual (TAU) was chosen as control intervention and reflected the current German treatment standard. TAU consisted of individual supportive treatment, which focused on the well-being, the functional status, and on daily events. In addition, patients participated in a group therapy comprising information, benefits advice, advocacy, and emotional support, and received support for the social situation provided by a social worker, if needed. Patients of both treatment conditions received medication according to their individual needs without restriction by the study protocol. After discharge from inpatient treatment medication was prescribed by psychiatrists independent of the study team.

Functional outcome was one of the secondary endpoints. Further methods and primary objectives (psychopathologic relapse) of our pragmatic randomized clinical trial will be described in detail elsewhere.

Eligibility criteria

Diagnoses were determined by the German version of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; [64]). All patients gave written informed consent to participate in the study, which was approved positively by the local ethics committee. Patients were selected based on the following inclusion criteria: (1) stabilization phase of illness, and (2) age between 18 and 60 years. We considered patients to be in the beginning stabilization phase if they showed a symptom reduction and voluntarily agreed to be treated at an open ward.

Exclusion criteria were as follows: (1) lifetime history of substance dependence or substance abuse (DSM-IV/SCID-I) during the last month before recruitment, (2) neurologic disease or damage, (3) medical illness that may interfere with cognitive function, (4) history of head injury with loss of consciousness greater than 5 min, (5) mental retardation (IQ below 80 according to the MWT-B [42], a German multiple-choice vocabulary test measuring the premorbid intellectual level), (6) admission to long-term inpatient rehabilitation planned, and (7) insufficient German language skills.

Selection analysis

A total of 1,652 patients in the two catchment areas representing all admissions of patients with psychotic syndromes were screened. 391 had no schizophrenic or schizoaffective disorder, 886 fulfilled exclusion criteria, 206 patients refused to participate in the study. The most frequent reason for excluding patients of the state hospital was their need for further treatment in rehabilitation wards (n = 204). As CBOS focuses primarily on relapse prevention and comprises of an outpatient treatment phase these patients had to be excluded. Substance dependence as major clinical problem was observed in 192 patients.

The most frequent reason for refusal of study participation was that patients did not see themselves as suffering from any disorder or requiring any kind of treatment (156/206). Randomisation or the need to fill out questionnaires was the reason for refusal in only 23 of the 206 cases. 27 of the 206 patients had other reasons for refusal, e.g., preference for treatment in other formats (individual treatment) or in other institutions. In order to compare participating and refusing patients with respect to symptom severity we obtained symptom ratings of 155 of the 206 refusers. The remaining 51 refusing patients did not agree to participate in a clinical interview. There was no significant difference between both groups regarding positive or negative symptoms as assessed with the PANSS (PANSS; [35]) standard scales (positive-syndrome scale: participants mean item score = 2.1, SD = 0.7; refusals mean item score = 2.1, SD = 0.8; F = 0.171; P = 0.679. Negative-syndrome scale: participants mean item scores = 2.3, SD = 1.0; refusals mean item score = 2.4, SD = 1.1; F = 0.110; P = 0.746).

Finally, 169 patients fulfilling eligibility criteria and giving written informed consent were allocated randomly to either CBOS or TAU. The diagnosis of two patients had to be changed later to a bipolar affective disorder with psychotic symptoms. These two patients were excluded from the present analysis. Additional 16 patients refused to participate in the neuropsychological examination. Thus, complete inclusion examinations with regard to clinical psychopathologic, sociodemographic, and neuropsychological variables of 151 inpatients are available at baseline (t1). All patients were admitted to the hospital due to an acute episode of their psychosis. After completion of inpatient treatment, 96 (64%) of the 151 patients underwent the 1-year follow-up (t2) including the assessment of functional outcome. These n = 96 patients constitute the study sample of the present paper. The n = 55 patients without follow-up (36%) could not be reassesed primarily due to motivational reasons. One crucial factor could have been that patients got no financial incentives for their follow-up assessments.

Intervals

The study sample showed a mean interval from admission to hospital to baseline assessment of 21 days (SD = 21 days). Thus, baseline assessment took place after an individually optimized pharmacological treatment had been initiated for approximately 3 weeks. The mean interval from baseline assessment to discharge from hospital was 77 days (SD = 39 days). During this interval the CBOS and TAU treatment conditions were administered.

Baseline characteristics

The sociodemographic, clinical psychopathologic, medication related, and neuropsychological characteristics of the study sample (n = 96) are shown in Table 1.

Table 1 Characteristics of the study sample at baseline (n = 96)

Sociodemographic characteristics	
Age M (SD)	33.9 (9.7)
Gender	
Female	47 (49.0%)
Male	49 (51.0%)
Education[a]	
Elementary school	24 (25.0%)
Secondary school	33 (34.4%)
High school	39 (40.6%)
Family status	
Married/with partner	18 (18.8%)
Without partner	78 (81.2%)
Verbal IQ (according to Lehrl [42]) M (SD)	106.6 (16.7)
Clinical psychopathologic characteristics	
Treatment condition	
Treatment As Usual (TAU)	47 (49.0%)
Cognitive Behaviorally Oriented Service (CBOS)	49 (51.0%)
Diagnoses (DSM-IV/SCID-I/II)	
Schizophrenia[b]	
Paranoid type	55 (57.3%)
Undifferentiated type	12 (12.5%)
Disorganized type	7 (7.3%)
Catatonic type	5 (5.2%)
Residual type	6 (6.3%)
Schizoaffective disorder	11 (11.5%)
Personality disorders	32 (33.3%)
Global Assessment of Functioning Scale (GAF) M (SD)	43.5 (10.6)
PANSS standard-scales (according to Kay et al. [35])	
Positive-syndrome, mean item score (SD)/range	2.1 (0.7)/1.0–3.9
Negative-syndrome, mean item score (SD)/range	2.3 (0.9)/1.0–4.1
PANSS factor scores (according to Klingberg et al. [39])	
Positive-syndrome, mean item score (SD)/range	2.4 (1.0)/1.0–5.6
Negative-syndrome, mean item score (SD)/range	2.3 (1.0)/1.0–4.6
Disorganization, mean item score (SD)/range	2.1 (0.8)/1.0–4.0
Impulsiveness, mean item score (SD)/range	1.3 (0.5)/1.0–3.4
Depression, mean item score (SD)/range	2.2 (1.0)/1.0–4.7
First episode of illness	31 (32.3%)
Age at onset of illness (first psychotic symptoms) M (SD)	25.8 (7.7)
Medication related characteristics	
Type of antipsychotic medication	
Atypical antipsychotic medication	38 (39%)
Conventional or combined antipsychotic medication	58 (61%)
Chlorpromazine-equivalents M (SD)	611 (360)
Extrapyramidal symptoms scale, mean sum score (SD)	3.9 (3.3)
Compliance Rating Scale (CRS) M (SD)	5.2 (1.3)
Neuropsychology (z-standardized factor scores; Klingberg et al. [39])	
Attention M (SD)	−1.5 (1.1)
Memory M (SD)	−2.7 (1.2)
Abstraction/executive functioning M (SD)	−0.9 (1.2)
Global cognitive functioning M (SD)	−1.7 (0.9)

M = Mean; SD = Standard deviation; PANSS: Positive and Negative Syndrome Scale

[a] Dichotomized for correlation analyses: Elementary/secondary versus high school

[b] Dichotomized for correlation analyses: Paranoid versus rest

Sociodemographic characteristics

Patients had a mean age of 34 years. Gender was balanced in the study sample. The sample is characterized by a relatively high proportion of well-educated individuals and a slightly above-average verbal IQ according to the MWT-B [42]. In view of later correlation analyses we dichotomized education into elementary/secondary versus high school. As in most schizophrenia samples, only a minority of patients was married or lived close-partnered.

Clinical psychopathologic characteristics

As expected from a random allocation, approximately 50% of the sample was in the CBOS and TAU condition respectively. The most frequent schizophrenia subtype was the paranoid type. Schizophrenia subtype was dichotomized into paranoid versus rest with

respect to later correlation analyses. Personality disorders were diagnosed according to DSM-IV criteria, using the Structured Clinical Interview for DSM-IV Axis II Disorders. Personality disorders also were dichotomized (no versus yes) for further analyses. One third of the patient sample was diagnosed with a personality disorder. The patient sample scored on the Global Assessment of Functioning Scale (GAF; [56] on average of somewhat above 40 points. This score reflects serious impairment in social and occupational functioning, or serious symptoms at baseline.

Psychopathology was assessed by the Positive and Negative Syndrome Scale [PANSS; 35]. The PANSS items are considered to be interval measurements. Good interrater reliability could be confirmed: the Intraclass Correlation Coefficient (ICC) for the positive syndrome was 0.91, for the negative syndrome 0.86. In addition to the PANSS standard scales we previously [39] have conducted a factor analysis over the data of the $n = 169$ complete PANSS interviews (t1) to obtain empirically derived symptom dimensions. Thus, the sample of the present article is entirely included in this factor analysis. We have extracted five components accounting altogether for 55% of the variance. These five factors have been interpreted as representing the following psychopathological dimensions. Factor 1 (18.5% of total variance): negative syndrome (Items N1, N2, N3, N4, N6, G7, and G16); factor 2 (15.4%): impulsiveness (Items P7, G14, S1, S2, and S3); factor 3 (7.6%): positive syndrome (Items P1, P3, P6, G12); factor 4 (6.7%): disorganization (Items P2, N5, N7, G5, G11, and G13); and factor 5 (6.3%): depression (Items G2, G3, and G6). Factor scores were created by averaging raw scores of items within each empirical domain (mean item score). Details of the PCA procedure and the construction of the factor scores have been described elsewhere [39]. The moderate level of the PANSS scores (Table 1) implies that patients were at baseline assessment in the beginning stabilization phase of their illness. Approximately one third of the patients were first episode cases.

Medication related characteristics

Our clinical trial was open regarding medication. At baseline assessment 38 of the 96 patients (39%) received atypical antipsychotics. Conventional antipsychotics were administered to 39 (41%) patients. Nineteen patients (20%) received a combination of both atypical and conventional antipsychotic substances. We further transformed the antipsychotic dosages into chlorpromazine-equivalents (CPE). CPE were calculated according to Davis [11]. Atypical antipsychotics were transformed in line with Mueller [47] and information of the pharmaceutical industry. The following potency factors were applied to the atypical substances: olanzapine 20.0, clozapine 2.0, risperidone 100.0, amisulprid 1.0, and sulpirid 0.5. Patients had a mean of 611 CPE (SD = 360) at baseline. Thirty-five patients (37%) needed an adjunctive anticholinergic (biperiden) medication. Twenty-one (22%) patients received antidepressants. Finally, mood-stabilizers were administered in 10 (10%) cases. Further, extrapyramidal side effects of the antipsychotic medication were assessed with the Extrapyramidal Symptoms Scale (EPS; [59]). The mean EPS sum score of 3.9 (SD = 3.3) reflects extrapyramidal symptoms of only low intensity. Finally, medication compliance was assessed using the seven point observer-rated Compliance Rating Scale (CRS, [36, 37]). This scale measures not only whether medication was taken as prescribed but also takes into account the patient's interest in collaboration with antipsychotic treatment. The mean CRS score of 5.2 (SD = 1.3) stands for "passive acceptance" of medication.

Four medication related variables were selected to be entered in the correlation analyses: (1) the type of antipsychotic medication (dichotomized into atypical versus conventional/combined), (2) the antipsychotic dosage (CPE), (3) the extrapyramidal side effects (EPS sum score), and (4) medication compliance (CRS score).

Neuropsychological functioning

The following comprehensive battery of tests was administered to assess neuropsychological functions that have been found to be impaired in schizophrenia patients: Computerized Wisconsin Card Sorting Test (WCST; [22]); Degraded Stimulus Continuous Performance Test (dsCPT; [49]); Trail Making Test A/B (TMT; [54]); Digit-Symbol and Digit-Span from the German version of the Wechsler Adult Intelligence Scale (WAIS; [60]); Rey Complex Figure Test (RCFT; [45]); Verbal Fluency [31]; and the German version of the Rey Auditory Verbal Learning Test (AVLT; [25]). We have conducted a principal components analysis (PCA) on the complete neuropsychological data sets (t1) in advance to get the composite measures of cognitive functioning [39]. In accordance with Green et al. [18], we favored those neuropsychological factor scores as they can provide an estimate of the total amount of variance in outcome that can be explained by cognition in general. PCA was followed by orthogonal (Varimax) rotation. The PCA has extracted three components, which accounted for 59% of variance. We have interpreted the three factors as representing the following constructs. Factor 1 (39.2% of total variance): memory (RCFT and AVLT variables); factor 2 (10.1%): attention (TMT A/B, Digit-Span, Digit-Symbol, and dsCPT variables); and factor 3 (9.6%): abstraction (WCST variables). To calculate neuropsychological factor scores (function scores) raw test scores of all patients were first transformed to standard equivalents (z-scores) using the means and standard deviations of a healthy matching control group ($n = 40$). All standard scores were computed with higher values indicating better performance. Factor scores were created by averaging z-scores within each empirical domain. Finally, we computed a total score of global cognitive functioning by averaging z-scores of the three factor scores. Details of the PCA procedure, the construction of the factor scores, and the recruitment of the control group have been described previously [39]. Our patient sample was most severely impaired with regard to memory, followed by attention and abstraction/executive functioning. The global cognitive functioning score was approximately one and one half standard deviations lower than the mean for our healthy comparison subjects (Table 1). This profile of cognitive impairment is in line with existing literature [16, 23, 63].

Follow-up assessment

The mean interval from baseline assessment to follow-up was 445 days (SD = 51 days), i.e., approximately 15 months. Outcome measures were rated by trained and experienced clinical psychologists (master's level) who were not involved in the patients' treatment.

Ratings on the Global Assessment of Functioning Scale [GAF; 56] were used as a measure of overall functioning level. The GAF scale is particularly useful in tracking the clinical progress of individuals in global terms, using a single measure. The GAF scale is to be rated with respect only to social, occupational, and psychological functioning. GAF ratings run from 1 to 100 with higher values indicating better functioning. At the 15-month follow-up patients showed a GAF score slightly above 70 (Table 2). This score means that there are some difficulties in social or occupational functioning or some mild symptoms. In general, patients reached a relatively adequate level of overall functioning.

The Social Adjustment Scale II [57] was applied to measure functional outcome in the work, social and leisure, and household domain. This scale has been used in previous studies of cognitive functioning and social outcome in schizophrenia [2, 17]. We chose the SAS II as this scale assesses the functional outcomes, which are targeted by our CBOS treatment condition. The SAS II is a semi-structured interview based more on self-reports than on demonstrations. Nevertheless, ratings can also be based on information obtained from hospital charts or caregivers' reports. The SAS II quintessentially measures what Green et al. [18] refer to as community outcome, i.e., occupational functioning, social attainment, and degree of independent living.

Four global scales of the SAS II were analyzed. These global ratings follow the semi-structured interview and compare a patient's functioning level with the society's standards and exigencies. The global scale 'Work' reflects the evaluation of a patient's sta-

Table 2 Means (M) and standard deviations (SD) of functional outcome measures at follow-up ($n = 96$)

Functional outcome measures	M	SD
Global Assessment of Functioning (GAF)	72.0	13.2
SAS II—Global scales		
Work[a]	4.0	1.4
Household	3.3	0.9
Social leisure	3.6	1.2
General	3.8	1.1

[a] $n = 77$ (Category unratable for 19 patients); SAS II: Social Adjustment Scale II

bility and effectiveness of occupational functioning in consideration of his or her education, earlier vocational training, and professional experience. Due to long-term unemployment, this scale was not ratable for 19 patients. The global scale 'Household' assesses the extent of integration into household with respect to participation and reciprocal assistance. The global scale 'Social Leisure' evaluates the quantity and quality of social and leisure activities as well as the profoundness of interpersonal relationships. Finally, the global scale 'General' assesses overall functioning in all of the relevant social roles (work, household, partnership, and parenthood), quantity and quality of interpersonal relationships, and personal well-being.

The SAS II global scales are rated along a seven point interviewer-rated scale with higher values indicating worse adjustment (1 = excellent adjustment, 2 = very good adjustment, 3 = good adjustment, 4 = moderate adjustment, 5 = poor adjustment, 6 = very poor adjustment, and 7 = extremely poor adjustment). The SAS II global scales are viewed as interval measurements.

Table 2 depicts the means and standard deviations of the five functional outcome measures at 15-month follow-up. Overall, patients reached a moderate level of social adjustment.

Statistical analysis

As described above, existing literature in this field of research is largely atheoretical, and characterized by a lack of homogenous results and methodological heterogeneity. Therefore, an explorative approach in data analyzing seemed to be the most appropriate method. Data analyses were done with SPSS for windows, version 14.0.

To exclude selectivity of our sample, we compared the baseline variables between the $n = 96$ patients with follow-up (64% completers) and the $n = 55$ patients without follow-up (36% non-completers) using *t*-tests for independent samples and chi-square statistics.

In a first step, we then performed bivariate correlation analyses (Pearson product moment correlation with a *P*-value of 0.05) between the sociodemographic, clinical psychopathologic, medication related, and neuropsychological variables (listed in Table 1) on the one hand and the five functional outcome measures (GAF and four SAS-II global scales) on the other hand. With regard to diagnoses, schizophrenia subtypes were dichotomized into paranoid versus others. This dichotomy seemed to be appropriate to us since patients with a paranoid type of schizophrenia have occasionally been found to be less neuropsychologically impaired than non-paranoid patients [55, 58]. Regarding symptom ratings, analyses were restricted to our PANSS factor scores with the aim of limiting the number of dependent variables for later regression analyses. Further, our PANSS factors include not only the positive and negative symptom dimensions, but also disorganization, depression, and impulsiveness. The goal of the bivariate correlation analyses was to identify significant independent variables to be entered in the multiple regression analyses in the next step. This part of the analysis was considered as exploratory and hence no correction for multiple testing was made.

As a second step, we conducted multiple linear regression analyses in order to determine the relative contribution of each variable to functional outcome measures. We adjusted for the patients' study treatment by introducing the treatment condition (TAU versus CBOS) as a forced entry variable in the first block. In the second block we included those variables that showed a significant bivariate association with at least one of the functional outcome variables. The model selection was performed using a stepwise procedure, in which the *P*-value limits to enter and remove variables were 0.05 and 0.10 respectively. Interpretation will be based on the explained variances (corrected R^2) of the regression models and the standardized *beta* coefficients.

Finally, we performed *post-hoc* power calculations on the multiple regression analyses. *Ex-post* effect sizes were computed according to Cohen [8, 9]: $f^2 = R^2/1-R^2$. Thereby, effect sizes are classified as small ($f^2 < 0.15$), medium ($f^2 = 0.15$–0.34), or large ($f^2 \geq 0.35$). The power calculation was done with the computer program GPOWER [14, 15]. *Post-hoc* power calculations with this program require an entry of the effect size, the actual sample size, the alpha-level (0.05, two-tailed), and the number of predictors. A statistical power ≥0.80 is considered to be sufficient. The *post-hoc* power of a multiple regression analysis gives information whether the test was powerful enough to detect significant predictors.

Results

Completer versus non-completer analysis

Except for verbal IQ, no significant differences regarding baseline characteristics (Table 1) resulted between the $n = 55$ patients without follow-up (non-completers) and the $n = 96$ patients with follow-up (completers). Considering verbal IQ [42], completers (mean IQ = 107, SD = 17) were slightly but significantly (t (147) = −2.031, $P = 0.044$) more intelligent than non-completers (mean IQ = 101, SD = 15).

Bivariate correlation analyses

Overall, all neuropsychological and four of the psychopathological (PANSS) factor scores as well as the five functional outcome measures were normally distributed (symmetric, one-peaked distributions within good ranges). Pearson product moment correlation analyses were conducted to assess the relationships between our independent variables (Table 1) on the one hand and functional outcome measures (Table 2) on the other hand. As the GAF score at baseline and the impulsiveness factor score (PANSS) did not meet the assumptions of normal distribution (skewed distributions), we also conducted non-parametrical correlation analyses.

The following 16 independent variables (1–16) showed a significant correlation with at least one of the functional outcome measures (Table 3): the four (1–4) neuropsychological factors, four (5–8) of the PANSS factor scores (positive-syndrome, negative-syndrome, disorganization, and depression), and (9) the overall functioning level (GAF baseline). Fewer symptoms, better cognitive functioning, and better overall functioning at baseline were consistently correlated with better functional outcome at follow-up. Further, (10)

schizophrenia subtype (paranoid versus rest), (11) first episode of illness, (12) personality disorder diagnoses (no versus yes), (13) age, (14) gender, and (15) education showed significant associations with one or more of the outcome measures: a schizophrenia diagnosis of the paranoid type was related to better functional outcome (SAS II—Social Leisure); first episode patients showed better overall functioning (GAF) at follow-up; a personality disorder diagnosis correlated with worse ratings along the SAS II scales Social Leisure, Work, and General; a higher age was associated with worse overall functioning (GAF) and worse ratings along the SAS II scale Work; a female gender correlated with better household functioning and better general adjustment (SAS II); and, higher education was related to better work and household functioning as well as better general adjustment (SAS II). Finally, (16) better medication compliance (CRS score) significantly correlated with better outcome (SAS II—Household, Social Leisure, and General). The significant correlation coefficients varied from relatively low (0.20) to moderate (0.46) absolute values. The impulsiveness factor score (PANSS), verbal IQ, age at onset of illness, family status, and three of the medication related variables (type of antipsychotic medication, chlorpromazine-equivalents, and extrapyramidal symptoms) were not significantly associated with any of the functional outcome measures. The non-significant correlation coefficients showed absolute values below 0.20. Thus, these variables were excluded from further multivariate analyses. A similar pattern of results was found when the relationships were assessed by using Kendall's τ_b rank-order coefficient.

In the next step the aforementioned 16 significant independent variables were entered as predictor variables into the second block of each of the stepwise multiple linear regression analyses. The baseline GAF score (skewed distribution) was also included in the regression analyses on the background of the relative robustness of this statistical method.

Multiple linear regression analyses

Table 4 describes the five final regression models. Analyses are adjusted for the treatment condition (TAU versus CBOS) by introducing it as a forced entry variable in the first block. Therefore, treatment condition is listed for each of the five regression analyses regardless of its significance level.

The Global Assessment of Functioning (follow-up GAF) was best predicted by the cognitive factor memory, followed by the PANSS factor negative-syndrome, and the PANSS factor positive-syndrome. The model explained 20% of the corrected variance in this outcome measure. Better overall functioning at follow-up was associated with better memory performance, and less negative and positive symptoms at baseline. The treatment condition did not explain a significant proportion of variance in this outcome.

Occupational functioning (SAS II—Work) was best predicted by global cognitive functioning at baseline. Further, overall functioning (GAF) at baseline was associated with occupational outcome. The model explained 23% of the corrected variance in this outcome domain. Better occupational functioning at follow-up was correlated with higher global cognitive performance and better overall functioning at baseline. The treatment condition did not explain a significant proportion of variance in this outcome.

Household functioning (SAS II—Household) was best predicted by a female gender. Additionally, a higher GAF score, better abstraction/executive functioning, and less negative symptoms at baseline were associated with better household functioning at follow-up. The model explained 34% of the corrected variance in this outcome measure. Again, the treatment condition did not explain a significant proportion of variance in this outcome.

Social contacts and leisure activities (SAS II—Social Leisure) were primarily predicted by the negative syndrome, followed by the positive syndrome. The less negative and positive symptoms at baseline, the better social and leisure activities at follow-up were. Further, a personality disorder was associated with worse outcome in the social and leisure domain. The CBOS treatment condition tended to result in a significant association ($P < 0.10$) with better social and leisure activities. The model explained 32% of the corrected variance in this outcome.

Finally, general adjustment (SAS II—General) was primarily predicted by the negative syndrome. Further, overall functioning (GAF), the positive syndrome, and global cognitive functioning at baseline were associated with general adjustment at follow-up. The model explained 35% of the corrected variance in this global outcome measure. Less negative and positive symptoms, better overall functioning (GAF), and higher global cognitive functioning at baseline predicted better general adjustment at follow-up. For a second time, the CBOS treatment condition tended to result in a significant association ($P < 0.10$) with better general adjustment.

Effect sizes and power calculations

The resulting *ex-post* effect sizes (f^2) for the five multiple regression analyses ranged from medium to large (Table 5). *Post-hoc* power calculations revealed an excellent overall statistical power of our multiple correlations (Table 5).

Discussion

Methodological strengths

The present study is a descriptive, longitudinal survey of patients with schizophrenia disorders in a natu-

Table 3 Independent variables (1–16) showing significant correlations (Pearson) with functional outcome measures (GAF, SAS II—Global Scales) at follow-up (f/u), $N = 96$

	GAF f/u	SAS II—Global scales at f/u			
		Work[a]	Household	Social leisure	General
Neuropsychology (factor scores)—baseline					
(1) Attention	0.226*	−0.294**	−0.309**	−0.236*	−0.285**
(2) Memory	0.330**	−0.309**	−0.101	−0.097	−0.188
(3) Abstraction/executive functioning	0.120	−0.347**	−0.317**	−0.135	−0.269**
(4) Global cognitive functioning	0.288**	−0.411**	−0.299**	−0.193	−0.309**
Clinical psychopathologic characteristics—baseline					
(5) PANSS factor positive-syndrome	−0.178	0.197	0.246*	0.223*	0.264**
(6) PANSS factor negative-syndrome	−0.284**	0.318**	0.331**	0.459**	0.406**
(7) PANSS factor disorganization	−0.058	0.061	0.182	0.209*	0.175
(8) PANSS factor depression	−0.116	0.228*	0.093	0.204**	0.261**
(9) GAF—baseline	0.177	−0.340**	−0.341**	−0.316**	−0.379**
(10) Schizophrenia subtype (paranoid versus rest)	−0.020	−0.038	0.194	0.198*	0.155
(11) First episode of illness (no versus yes)	0.196*	−0.115	−0.090	−0.112	−0.183
(12) Personality disorder diagnosis (no versus yes)	−0.143	0.313**	0.183	0.317**	0.324**
Sociodemographic characteristics					
(13) Age	−0.279**	0.236*	0.140	0.110	0.133
(14) Gender (female versus male)	−0.115	0.183	0.318**	0.132	0.209*
(15) Education (elementary/secondary versus high school)	0.132	−0.288**	−0.248*	−0.142	−0.209*
Medication related characteristics—baseline					
(16) Compliance Rating Scale (CRS)	0.111	−0.131	−0.233*	−0.258**	−0.233*

[a] $n = 77$ (Category unratable for 19 patients); SAS II: Social Adjustment Scale II; GAF: Global Assessment of Functioning Scale
* $P < 0.05$, ** $P < 0.01$

ralistic setting for a period of 15 months. The study aimed at identifying predictors of functional outcome in schizophrenia. Many of the methodological weaknesses in this field of research discussed by Green et al. [18] were addressed in this study. This included a relatively large and thoroughly characterized patient sample, a comprehensive neuropsychological test battery, symptom assessment with a high interrater reliability, well-defined and naturalistic functional outcome measures, and a longitudinal design with a substantial follow-up interval. A longitudinal design allows a more stringent examination of potentially causal interactions between independent factors and their influence on outcome measures. The predictor variables comprised not only neuropsychological measures but also clinical psychopathologic, medication related, and sociodemographic factors. Further, our prediction analyses have been adjusted for the patients' study treatment (TAU versus CBOS). Finally, the present study is one of the very few, which reported the statistical power of its prediction analyses. Thereby, *post-hoc* power calculations revealed a high overall statistical power (≥0.9) of our multiple correlations. This means that our regression analyses excellently fulfilled the qualifications for the detection of potentially significant predictors. Actually, Green et al.'s [18] review identified only four studies [12, 33, 44, 62], which related to community outcome and featured at least a sufficient *post-hoc* statistical power (≥ 0.8).

Our patient sample was consistently assessed in the beginning stabilization phase of the illness. All patients were admitted to the hospital due to an acute episode of their psychosis. Baseline assessment took place after an individually optimized pharmacological treatment had begun for approximately 3 weeks. There was a relatively high degree of variability regarding duration of the lag between admission and baseline assessment (SD = 21 days). This variability reflects the fact that remission of acute psychotic symptoms varies to a great extend. The PANSS scores at baseline also indicate that patients were still suffering from residual positive and negative symptoms. As outlined above, Norman et al. [48] assume that symptom levels in later stages of the illness and after an optimized treatment might be better predictors than those in acute phases. Thus, the preconditions of the present study were in our opinion the best possible in order to identify valid predictors of community outcome. After discharge from hospital, all study patients were invited to monthly assessments up to the point of 1-year follow-up. Therefore, assessments of functional outcome also seem to be highly valid given that our raters were very familiar with the patients' living conditions. Finally, our follow-up sample of 96 patients proved to be quite representative for the full sample (see section "Completer versus non-completer analysis").

Prediction of functional outcome

Altogether, eight independent variables proved to be significant predictors of the functional outcome measures in our multivariate analyses: the PANSS positive- and negative-syndrome, the cognitive factors memory, abstraction/executive functioning, and global cognitive functioning, gender, a personality

Table 4 Final models of the five stepwise multiple linear regression analyses with treatment condition as forced entry variable ($n = 96$)

Outcome domains and predictors[a]	Model					Coefficients		
	Variance		Analysis			β	Analysis	
	R^2	Corr. R^2	F	df	P		t	P
Global Assessment of Functioning (GAF follow-up)	0.231	0.197	6.833	4	<0.001			
Memory						0.291	3.093	0.003
PANSS factor negative-syndrome						−0.259	−2.754	0.007
PANSS factor positive-syndrome						−0.219	−2.343	0.021
Treatment condition (TAU versus CBOS)						0.147	1.572	0.119
SAS II—Global scales								
Work[b]	0.258	0.227	8.442	3	<0.001			
Global cognitive functioning						−0.364	−3.519	0.001
GAF (baseline)						−0.291	−2.83	0.006
Treatment condition (TAU versus CBOS)						−0.079	−0.775	0.441
Household	0.372	0.334	9.942	5	<0.001			
Gender (female versus male)						0.332	3.566	0.001
GAF (baseline)						−0.290	−3.178	0.002
Abstraction/executive functioning						−0.287	−3.191	0.002
PANSS factor negative-syndrome						0.192	2.093	0.039
Treatment condition (TAU versus CBOS)						−0.022	−0.253	0.801
Social leisure	0.347	0.318	11.700	4	<0.001			
PANSS factor negative-syndrome						0.426	4.712	<0.001
PANSS factor positive-syndrome						0.249	2.846	0.006
Personality disorder (no versus yes)						0.209	2.3150	0.023
Treatment condition (TAU versus CBOS)						−0.145	−1.668	0.099
General	0.385	0.349	10.872	5	<0.001			
PANSS factor negative-syndrome						0.349	3.958	<0.001
GAF (baseline)						−0.223	−2.366	0.02
PANSS factor positive-syndrome						0.211	2.302	0.024
Global cognitive functioning						−0.196	−2.266	0.026
Treatment condition (TAU versus CBOS)						−0.169	−1.962	0.053

[a] Predictors initially entered: first block (forced entry)—Treatment condition (TAU versus CBOS); second block (16 variables)—4 Neuropsychological factors (memory, attention, abstraction, and global cognitive functioning), 4 PANSS factors (positive-/negative-syndrome, disorganization, and depression), GAF Scale baseline, schizophrenia subtype (paranoid versus others), first episode of illness, personality disorder (no versus yes), age, gender, education, and medication compliance
[b] $n = 77$ (category unratable for 19 patients); SAS II: Social Adjustment Scale II. GAF: Global Assessment of Functioning Scale. CBOS: Cognitive Behaviorally Oriented Service; TAU: Treatment As Usual

Table 5 *Ex-post* effect sizes (f^2) and power calculations

Multiple regression analyses ($n = 96$)	f^2	F(17)	Lambda	Power
Global Assessment of Functioning (GAF)	0.30	1.755	28.80	0.90
SAS II—Global scales				
Work[a]	0.35	1.799	26.95	0.85
Household	0.59	1.755	56.64	0.99
Social leisure	0.54	1.755	51.84	0.99
General	0.64	1.755	61.44	0.99

[a] $n = 77$ (Category unratable for 19 patients); SAS II: Social Adjustment Scale II. Effect sizes $f^2 \geq 0.35$ are considered as large (for details see section "Statistical Analysis")

disorder diagnosis, and the overall functioning level (GAF) at baseline. Three out of the five functional outcome measures were predicted by the negative syndrome as well as measures of cognitive functioning. Thus, our hypothesis was supported.

Occupational adjustment was best predicted by global cognitive functioning. This result is in line with Hofer et al. [29], who also found that cognitive symptoms negatively influenced occupational functioning. Social contacts and leisure activities were associated with the negative and positive syndrome and a personality disorder diagnosis at baseline. The negative syndrome showed the absolutely highest standardized *beta* coefficient as regards the prediction of social and leisure functioning. Thus, cognitive functioning might be of minor importance in the prediction of the quantity and quality of social and leisure activities and the profoundness of interpersonal relationships. Both measures of global functional adjustment were predicted by the negative syndrome. All of the associations were in accordance with our expectations: less negative and positive symptoms as well as better cognitive functioning were associated with better functional outcome at follow-up. Among the sociodemographic factors, only the female gender was associated with better household functioning. It is worth mentioning that these associations were independent of the treatment related factors of the present sample. Neither the kind of psychosocial intervention (CBOS versus TAU) nor the type of antipsychotic medication or medication compliance explained a significant proportion of variance in functional outcome.

The present results are compatible with the heuristic model of Green and Nuechterlein [19] insofar as negative symptoms and cognitive functioning

predict community outcome. However, it is somewhat surprising that the negative syndrome was not associated with occupational adjustment in the multivariate analyses. We assume that the amount of variance explained by negative symptoms in this outcome domain is represented by the psychological functioning dimension (e.g., flat affect, social avoidance, impaired communication) of the GAF scale.

Further, the relatively consistent prediction of functional outcome by the positive syndrome is remarkable. This result is not in line with the heuristic model of Green and Nuechterlein [19]. Nevertheless, our finding is compatible with the results of Norman et al. [48] and Breier et al. [5]. In both studies, symptom assessment also was accomplished in a relatively stable state following initial pharmacological treatment. Further, the patients of these studies suffered from some residual positive symptoms too. Thus, the predictive value of positive symptoms might be particularly dependent on the stage of illness. Transient positive symptoms in acute phases of the illness might be less predictive than ones that are more persistent.

Altogether, our regression models explained between 20% and 35% of the corrected variance in our outcome measures. Thus, the predictive value of the regression models is still limited. There seem to be two major reasons for this restricted predictive capability. First, while we covered a wide range of potentially important factors, relevant variables such as family interactions still could be missing in the analysis. Second, the type of functional outcome measured in the present study might be another reason. The Social Adjustment Scale II assesses what Green et al. [18] refer to as community outcome. This is a quite complex and naturalistic outcome measure. The implementation of more narrowly defined outcome measures like laboratory assessments of instrumental skills or social problem solving abilities resulted in considerably higher proportions (above 50%) of explained variances [10, 32]. In contrast, studies with more naturalistic outcome measures as social adjustment [2] or work functioning and independent living [27, 28] resulted in explained variances between 19% and 37%. Those results are comparable with ours.

Age and education showed a significant bivariate correlation with functional outcome. However, in the multivariate approach, these factors were no longer found to be predictive of functional outcome once the influence of the other predictor variables had been accounted for. Thus, age and education seem to be of relatively subordinate relevance for functional outcome in the present patient sample. The same applies for the schizophrenia subtype, first episode of illness, the symptom dimensions disorganization and depression, the cognitive factor attention, and medication compliance (CRS).

Limitations

The present study has several limitations. First, the generalizability is restricted since 55% (205/375) of the eligible patients refused study participation. Further, follow-up data are available of only 64% (96/151) of the baseline sample. Thus, the results of the present study might apply only to the more treatment compliant and more cooperative patients. Moreover, patients with substance dependence or an indication for long-term inpatient rehabilitation were not included in the study. However, our study is one of the very few naturalistic studies, which reports such a detailed selection analysis. Thus, we actually can inform about the applicability of our findings. Finally, the relatively long mean duration of the index hospitalization of approximately 3 months might limit generalizability as other European countries report shorter mean durations of inpatient treatment.

Second, we used an explorative approach as literature is mainly atheoretical, and characterized by inconsistent results and methodological heterogeneity. Further, we could not provide a replication sample. Since multiple regression analysis is a heuristic method selecting the best fit regression from an infinite number of possible models, we cannot rule out the possibility that random effects or sample specific factors have contributed to the outcome. Thus, our results have to be seen as tentative and hypothesis generating.

A final limiting factor might be the relatively short follow-up interval. The fact that the GAF score at baseline predicted three of our outcome measures suggests that even 1 year after discharge from hospital patients still have continuing effects of their index episode. According to Keshavan et al. [38] assessments at later follow-ups may be a more valid measure of outcome independent of the index episode of the illness. These authors found the GAF score to be correlated with functional outcome at 1-year but not at 2-year follow-up.

Conclusion

Our correlation analyses show that community outcome is multifactorially determined with no single predictor variable explaining a sufficient amount of variance in this naturalistic and complex outcome. However, our results suggest that community outcome in the more compliant patients is mainly predicted by psychopathological and cognitive symptoms. The present study is one the very few, which provides a comprehensive prediction analysis based on an excellent statistical power. Our findings not only reemphasize that negative symptoms and cognitive dysfunctions are key determinants of community outcome but also point to a potential predictive relevance of positive symptoms. The present results reemphasize the basic clinical and economical

necessity of developing and implementing both psychosocial and pharmacological treatments focusing specifically on psychopathological symptoms and cognitive dysfunctions in order to positively affect community outcome in patients with schizophrenia.

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