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The Association Between Executive Functioning and Personal Recovery in People With Psychotic Disorders

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Background: **Recovery in psychotic disorder patients is a multidimensional concept that can include personal, symptomatic, societal, and functional recovery. Little is known about the associations between personal recovery (PR) and functional recovery (FR). FR involves a person's ability to recover or compensate for impaired cognition, such as executive functions, and the loss of skills.** ***Method:*** **In this cross-sectional study (the UP'S study), we used measures of executive functioning and personal recovery to assess a cohort of people with a psychotic disorder. PR was measured using the Recovering Quality of Life (ReQOL) and Individual Recovery Outcomes (I.ROC). FR was assessed using two forms of assessment. The Behavioral Rating Inventory of Executive Functioning Adult version (BRIEF-A) was used for self-rated executive functioning, and the Tower of London (TOL) for performance-based executive functioning. Regression models were calculated between executive functioning (BRIEF-A and TOL) and PR (ReQOL and I.ROC). Model selection was based on the Wald test.** ***Results:*** **The study included data on 260 participants. While total scores of BRIEF-A had a small negative association with those of the ReQOL ($\beta = -0.28$, $P > .001$) and the I.ROC ($\beta = -0.41$, $P > .001$), TOL scores were not significantly associated with the ReQOL scores ($\beta = 0.03$, $P = .76$) and the I.ROC scores ($\beta = 0.17$, $P = 0.17$).** ***Conclusion:*** **Self-reported EF, which measures the accomplishment of goal pursuit in real life was associated with PR. However, processing efficiency and cognitive control as measured by performance-based EF were not.**

Key words: personal recovery/executive functioning/performance-based/self-rated

Introduction

Recovery in people with a psychotic disorder is a multidimensional construct that can include personal, symptomatic, and functional recovery.[1,2]

The first of these, personal recovery, has been described as "a deeply personal, unique process of changing one's attitudes, values, feelings, goals, skills and/or roles".[3,4] It is a process that is thought to be dynamic and nonlinear, involving both gains and relapses,[3,5,6] and has been operationalized in the CHIME conceptual framework for recovery,[6] which identifies five processes that constitute the domain: connectedness, hope and optimism, identity, meaning in life, and empowerment.[7]

Several instruments have been developed for the quantitative assessment of the extent of personal recovery.[6,8,9] Some of them, such as the Individual Recovery Outcomes Counter (I.ROC),[10] assess recovery in four subdomains (empowerment, home, people, and opportunity), and define personal recovery more broadly. Others, such as the Recovery Quality of Life (ReQOL),[11–13] are more unidimensional. The difficulty is that there is no golden standard where it comes to measuring personal recovery,[6] nor do we know if there is a difference in personal recovery being measured by the more broad questionnaires or the unidimensional ones.

The other three domains of recovery can briefly be defined as follows. Symptomatic recovery involves a certain degree of positive and negative symptoms, and is usually

assessed using a psychotic symptoms-rating scale.[14,15] Societal recovery is sometimes referred to as social recovery[14]; in an earlier paper describing the protocol and cohort study on which the present study is based, we defined it in terms of a patients' situation with regard to housing, work, education, and social relationships.[1,16] While functional recovery concerns a person's ability "to recover or compensate for the loss of skills and impairments in cognitive functioning".[1,2,16] Earlier definitions viewed it—or aspects of cognitive functioning—as part of symptomatic recovery.[17,18] However, van de Stel[19] proposed that it should be seen as a fourth and separate domain of recovery, apart from personal, symptomatic, and societal recovery—a view we adopted for the purposes of the present study, especially because the study of functional recovery may provide guidance on ways of developing new interventions to improve recovery in functional and other domains.

Research on the associations between the four types of recovery has focused mainly on the associations between symptomatic and personal recovery. One review found weak associations between symptomatic and personal recovery, leading the authors to conclude that it is possible for personal recovery to occur despite the presence of psychotic symptoms.[20] However, few studies have examined the associations with societal and functional recovery,[8] and their heterogeneity has been moderate to high.[8,9]

The focus in our own study lay on the associations between personal and functional recovery, which, as stated above, involves a person's ability to compensate for impairments in cognitive functioning. Cognitive problems, including executive dysfunction, are a core feature of psychotic disorders.[17,18,21,22] By reducing a person's capacity for leading a satisfactory life, their negative impact can impoverish his or her experience of personal recovery.[23]

While a meta-analysis of the determinants of personal recovery found that neurocognition in general had no association with personal recovery,[8] its results were limited by the fact that, in all cases, neurocognition was measured using performance-based tests such as the Raven's matrices, Trail Making Test part B (TMT-B) or Brief Assessment of Cognition in Schizophrenia (BACS).[24–26] However, to be able to capture the broad spectrum of executive functioning, it has long been recommended that executive functioning should also be measured using additional measures, including self-reported executive functioning.[27–29] Self-report measures can provide especially useful insight into patient's experience of executive functioning in everyday life.[30,31] An everyday perspective is important for executive functioning, which by definition includes processes that are involved in active real-time decision making, planning for the future, self-control, and initiating behavior.[32–35]

Therefore, the aim of this study is to investigate whether there is executive functioning can predict personal recovery, and whether any such prediction is influenced by the type of measurement (performance-based or self-report) with which executive function is assessed.

Finally, as personal recovery can be assessed and interpreted in a variety of ways[6] – either as a multidimensional concept, for example, or as a unidimensional one[11–13] – we used two different measures to assess it. We hypothesized that, independently of the assessment strategies, executive functioning would be associated with higher levels of personal recovery.

Methods

This study is part of the ongoing UP'S observational cohort study, which has the aim to investigate recovery processes over time in people with a psychotic disorder.[1,16] These participants will be followed up for a total of 10 years, with assessments every year. Eligibility for this cohort is based on a primary diagnosis of a schizophrenia spectrum disorder according to DSM 5 criteria (ie, schizophrenia, schizophreniform disorder, schizoaffective disorder, brief psychotic disorder, substance-induced psychotic disorder, delusional disorder, schizotypical disorder, or/and psychotic disorder not otherwise specified (psychosis NOS)). At inclusion in the study, patients are aged between 18 and 65. Those with insufficient proficiency in Dutch are excluded.

This cohort study is a collaboration between the Erasmus University Medical Center and ten mental health institutions in the southwestern Netherlands, all of which provide ambulatory teams in which patients are included, interviewed, and followed up by students and/or researchers. To ensure that all patients with a psychotic disorder can be included independent of the severity of the disorder, they are selected randomly through a search in the Electronic Patient Files (EPF) held at the participating Mental Health Care Institutions. After researchers have made an anonymized list of the patients in a participating team, those who are not eligible for inclusion in this study are filtered out. Then, 30 patients from the remaining list are randomly selected. If the inclusion criteria are met by fewer than 30 patients of the team, all eligible patients will be on the list. The patients can be asked to participate by a student researcher of the cohort. However, patients cannot be approached if, in the view of the team, there is a specific reason, such as active psychosis, or ineligibility due to a move. The only patients who can be asked to participate are those who were on the list and can be approached according to the team.

Patients can give informed consent and participate in the study only after they had been given information on the study, have received answers to all their questions, and have been given time to consider. After being asked for a

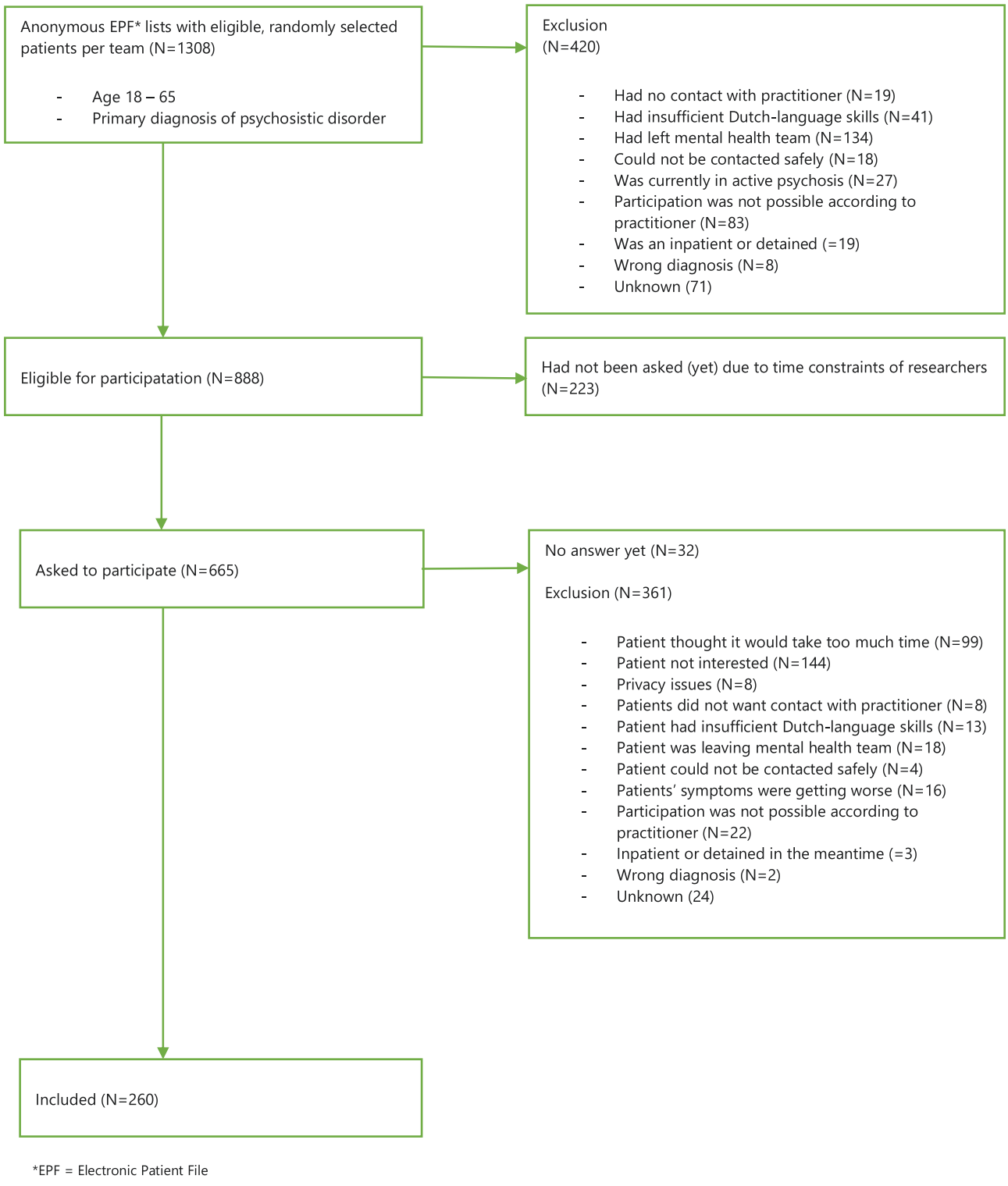

Fig. 1. Inclusion flowchart for the up's study.

reason, those who are not willing to participate are not contacted again.

Unfortunately, as no further demographic or clinical data were available on patients on the list who did not want to participate or who were not included due to ie active psychosis or detention, we cannot compare those who were and were not included in this study. The inclusion flowchart is shown in Figure 1. At the

time of writing this article, the cohort consisted of 260 participants.

Assessments

Personal Recovery

The Recovering of Quality of Life (ReQOL) 10 item version is a questionnaire that measures personal recovery in the last week.[11] All items are scored on a five-level scale ranging from "none of the time" to "most of the time." A sum score can be calculated, with high scores indicating a high degree of recovery.[11] Reliability was shown to be $\alpha = 0.93$ for the UK version[12] and $\alpha = 0.94$ for the Dutch version.[13]

The Individual Recovery Outcomes Counter (I.ROC) is 12-item measurement tool that was created to measure well-being and the recovery process. It is an easy to use and preferred questionnaire for assessing recovery in clinical practice,[36] and consists of four subscales: home, opportunity, people, and empowerment, each of which comprises three questions about how it has been in the last three months; these questions are answered on a six-point scale ranging from "never" (0) to "always" (6). Chronbach's α for the total questionnaire in a sample of people with severe SMI ranges from 0.74 to 0.83.[10] The total score was used for the present study.

Executive Functioning

The Behavior Rating Inventory of Executive Functioning for Adults (BRIEF-A) is a 76-item self-report questionnaire that uses everyday real-world examples to assess executive functioning.[37] Scoring is on a three-point scale ranging from never (1) to always (3). Each item is part of one of nine scales, four comprising the Behavioral Regulation Index and five comprising the Metacognition Index. Between the two, they constitute a Global Executive functioning score. T-scores and percentiles must be calculated for each scale and index. Each has two cutoffs: whereas t-scores between 60 and 65 are considered to be in the subclinical range, t-scores above 65 or percentile scores above 90 indicate a level of clinically impaired executive functioning. To measure whether participants' answers are valid, the BRIEF-A uses three validity scales: negativity, infrequency, and inconsistency. Scoring above cutoff on any of these scales produces a nonvalid score that is excluded from the analyses. The questionnaire has been evaluated for use in a schizophrenia sample.[38] Chronbach's α for the subscales of the questionnaire ranges from 0.93 to 0.96.[39]

The Tower of London (TOL) is a widely used task for scoring planning and executive functioning. This test is part of the Brief Assessment of Cognition in Schizophrenia (BACS), a short but effective test battery to test multiple cognitive skills,[40] which is used in the UP'S study. Furthermore, it is one of the most commonly used tests to assess executive function.[41] Participants are shown two pictures with three sticks. Each picture consists of three beads (red, green, and blue) stacked on the sticks. The goal is to calculate the lowest number of moves to go from the first to the second picture.[42] There are 20 basic items and 2 bonus items, which are shown only when all the basic items have been answered correctly, each within 20 s. The Chronbach's α of the TOL ranging from 0.66 to 0.89 for schizophrenia patients.[40]

Symptom Severity

The Positive And Negative Symptom Scale-Remission (PANSS-R) is used to assess symptom severity, and was originally a 30-item inventory for assessing the severity of psychotic symptoms across three subscales: positive symptoms, negative symptoms, and general symptoms. Each item is scored from absent (1) to extreme (7), and incorporates both a behavioral effect and symptom severity.[43] Eight of the 30 items have been shown to measure remission, three items being positive, three being negative and two being general.[44] This 8-item was used in this study, and has a Chronbach's α of 0.80.[45]

Statistical Analysis

After the patients' demographic characteristics had been described, missing values and influential outliers for all questionnaires were analyzed and dealt with according to questionnaire standards. Correlations between all measures had been calculated and described. First, a generalized linear model (glm) was built for self-reported executive functioning (BRIEF-A) on personal recovery (ReQOL). Then, after a similar model had been made for self-reported executive functioning (BRIEF-A) on the other measure of personal recovery (I.ROC), these steps were repeated to build models for performance-based executive functioning (Tower of London) and personal recovery (ReQOL and I.ROC). Gender, age, and symptoms were controlled for in all glm models. SPSS version 26.0 was used for analysis.

Results

Patient Characteristics

Currently, 260 participants had been included in the UP'S cohort. Age, gender, time in treatment, number of admissions, and diagnoses are shown in table 1.

Scores on the Measures and Correlations

All descriptive statistics, as well as mean sample scores, are shown in table 1. Mean personal recovery scores show high levels of personal recovery on the ReQOL, compared to other psychosis samples.[11] For both measures, however, no norm scores are available. For executive function

Table 1. Descriptive Statistics $N = 260$

			N (%)	Mean (SD)	Range
Age (years)				40.8 (12.2)	18–65
Sex (male)			150 (65.2)		
Time in treatment (years)				12.5 (9.8)	
Number of admissions				3.1 (3.6)	
Involuntary				*1.2 (2.3)*	
Primary diagnosis of psychotic disorder	Schizophrenia		109 (41.2)		
	Psychosis NOS		69 (26.5)		
	Shortlasting psychotic disorder		27 (10.4)		
	Schizoaffective disorder		24 (9.2)		
	Other psychotic disorders		31 (11.9)		
Symptoms	PANSS-R Total			2.0 (0.8)	1–4.5
	PANSS-R Positive			*2.1 (1.0)*	*1–5.3*
	PANSS-R Negative			*2.2 (1.0)*	*1–5.7*
	PANSS-R Generic			*1.7 (0.9)*	*1–6.0*
Personal recovery	ReQOL			25.1 (7.6)	0–40
	I.ROC			49.9 (9.9)	26–72
Executive functioning	BRIEF-A	*Low (>65)*	*55 (24.6)*	56.7 (10.5)	35–83
	TOL	*Low (<15.4)*	*91 (39.6)*	15.3 (5.1)	0–22

Note: PANSS-R, Positive and Negative Symptom Severity-Remission; ReQOL, Recovering Quality of Life; I.ROC, Individual Recovery Outcomes Counter; BRIEF-A, Behavioral Rating Inventory of Executive Functioning-Adults; TOL, Tower of London.

Table 2. Correlation Matrix

	Age	PANSS-R	ReQOL	I.ROC	BRIEF-A	TOL
Age	1					
PANSS-R	−0.077	1				
ReQOL	−0.002	**−0.388****	1			
I.ROC	−0.025	**−0.414****	**0.693****	1		
BRIEF-A	0.030	**0.277****	**−0.509****	**−0.558****	1	
TOL	−0.124	−0.003	0.029	0.118	−0.067	1

Note: PANSS-R, Positive and Negative Symptom Severity-Remission; ReQOL, Recovering Quality of Life; I.ROC, Individual Recovery Outcomes Counter; BRIEF-A, Behavioral Rating Inventory of Executive Functioning-Adults; TOL, Tower of London.
N for each item: Age $N = 259$, PANSS-R $N = 236$, ReQOL $N = 256$, I.ROC $N = 254$, BRIEF-A $N = 224$, TOL $N = 230$.
*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

measures, the mean of the self-reported rating scale is only marginally better than other samples of outpatients with a psychotic disorder, but it is worse than a previously reported normative sample.[46] The mean score on the performance-based measure is shown to be similar to other psychotic populations and well below that of a previously reported normative sample.[40] The mean symptom scores all indicate a low symptomatology at time of assessment. Sensitivity analysis revealed no differences across diagnostic groups.

Table 2 shows the correlations between the various measures. We found a high correlation between the ReQOL and I.ROC ($r = 0.693$, $P < .001$). Although both measures of personal recovery were negatively correlated with the BRIEF-A (ReQOL $r = -0.509$, $P < .0010$; and I.ROC $r = -0.558$, $P < .001$), neither was correlated with the TOL (ReQOL $r = 0.029$, $P = .666$; and I.ROC $r = 0.118$, $P = .074$). Neither was there a correlation between the BRIEF-A and TOL ($r = -0.067$, $P = .349$). Table 2 shows all the correlations between the different measures. Lastly, a positive moderate correlation was found between the BRIEF-A and PANSS-R ($r = 0.277$, $P < .001$), whereas no correlation was found between the TOL and the PANSS-R ($r = -0.003$, $P = .960$).

The Association Between Executive Function and Personal Recovery

The generalized linear model for the ReQOL showed a small but significant negative association with the BRIEF-A ($\beta = -0.28$, $P > .001$). Surprisingly, no association was found between the ReQOL and the TOL

Table 3. Regression Models of Executive Functioning and Symptoms on Personal Recovery

	ReQOL		I.ROC	
Parameter	BRIEF-A	TOL	BRIEF-A	TOL
Intercept	46.35 (2.39)**	31.37 (2.06)**	80.20 (3.12)**	56.97 (2.64)**
Sex (male)	1.85 (0.87)*	1.70 (1.01)	2.74 (1.14)*	3.37 (1.31)**
Age	–	–	–	–
Symptoms	−3.14 (0.56)**	−3.89 (0.62)**	−4.20 (0.75)**	−5.97 (0.80)**
BRIEF-A	−0.28 (0.04)**		−0.41 (0.05)**	
TOL		0.03 (0.10)		0.17 (0.12)

Note: ReQOL, Recovering Quality of Life; I.ROC, Individual Recovery Outcomes Counter; BRIEF-A, Behavioral Rating Inventory of Executive Functioning-Adults; TOL, Tower of London.
*Waldtest $P < .05$.
**$P < .01$.

(β = 0.03, $P = .76$). For the IROC, too, there was an association with the BRIEF-A (β = −0.41, $P > .001$). Again, no association was found with the TOL (β = 0.17, $P = .17$). Further analysis showed that none of the control variables were effect modifiers. Table 3 shows the results for the best-fitting models.

Discussion

The aim of this study was to investigate the associations between executive functioning and personal recovery. We hypothesized that, independently of the assessment strategies, better executive functioning would be associated with better personal recovery. This hypothesis was partly confirmed, but only for self-reported executive functioning. We found no association between performance-based executive functioning and personal recovery.

Our study supports the suggestion made in earlier research on executive functioning that one should not rely solely on one measure.[28] As there was no significant correlation between the two measures, each seems to measure different aspects of executive functioning. It has been suggested that performance-based measures test processing efficiency and cognitive control, unlike self-report measures such as the BRIEF-A used in the present study, which are thought to measure the accomplishment of goal pursuit in real life.[47,48] This might imply that the skills patients need for personal recovery are skills for achieving goal pursuit rather than cognitive control and processing efficiency.

This nonetheless raises the question of which measure should be used to assess executive functioning, and *when* it should be used. Performance-based measures are administered in a test environment that is highly structured, often quiet, and works to a fixed set of rules. But it has often proved difficult to generalize performance in these tests to daily life.[49,50] They have been linked to clinician-rated daily functioning in the past, but not to self-rated daily functioning.[51] This may explain the absence of an association with personal recovery: a person's ability to do well on these tests that are performed in a lab-like environment does not seem to be related to the skills needed to accomplish goal pursuit, or to their well-being or hopes for the future. In other words, the association between the highly subjective concept of personal recovery and the self-report measure of executive functioning may be explained by more positive experiences in daily life.

Although the lack of correlation between the performance-based and self-report measures of executive functioning has been found in other populations as well,[48,52] it remains unclear whether it simply reflects the differences between testing approaches, and the difficulties per approach or whether it reflects a real difference in processes of executive functioning being tested. Both measures may provide a different view of executive functioning. Performance-based measures are thought to tap into processing efficiency and cognitive control, whereas self-report measures, are thought to measure the accomplishment of goal pursuit in real life.[47,48] As far as we know, these measures have not yet been combined in studies assessing the association between executive functioning and personal recovery in the same group of patients with a psychotic disorder. This is important to investigate, since the way the forms of measuring executive functioning are associated to personal recovery seems to be different. To understand the relationship between executive functioning and personal recovery in detail, and to use this understanding to help people during the process of personal recovery, we need to improve our understanding of the differences between the types of executive functioning measures, and also to identify the components of executive functioning that each measure reflects.

Noteworthy features of this study are the average overall scores on personal recovery, symptom severity, and executive functioning. The mean scores we found for personal recovery on the ReQOL were not only higher than those for a patient population and a specific psychotic disorders group as shown in other studies,[11] but

were also similar to those of a previously reported student population,[13] a sample that is actively participating in society. For the I.ROC, unfortunately, no previous literature with comparable groups is available. The scores for symptom severity, which reflected only mild symptoms at time of assessment, were in line with earlier research in patients with a psychotic disorder.[53,54] However, this was not the case for executive functioning measures, where the mean score on the performance-based measure was similar to that in other studies involving people with a psychotic disorder,[55] ie, well below that of the previously reported normative sample.[40] Similarly, while the mean of the self-reported rating scale was only marginally better than in other samples of outpatients with a psychotic disorder, it was still far worse than a previously reported normative sample.[46] By indicating clear impairments in executive functioning in the people in our cohort, our study is therefore in line with the previous literature.

Nevertheless, the rather high personal recovery levels support the notion that personal recovery can occur even in the presence of impairments of executive functioning.[3,4,56,57] While the impact of executive functions on personal recovery may be limited, the cross-sectional nature of this study justifies further investigation. For example, it could also be that the reasonable degree of personal recovery led to better self-reported executive functioning in this cohort than in other samples of outpatient psychosis samples.[46] Further longitudinal research is thus required.

Strengths and Limitations

This study is part of a large cohort of 260 participants with an established diagnosis of a psychotic disorder, all of whom were in mental health care at the time of inclusion. Demographic variables showed this to be a representative sample of those currently in community mental health care in the Netherlands.[58] Age, gender distribution, symptom severity, and diagnostic groups showed to be similar to previous studies in a psychosis sample.[59–61] The study has been set up with the help of a scientific board and a peer expert group, selected measures (such as those for personal recovery) were approved on a scientific level, with regard both to their wording and to the importance of their content for the patient population. Furthermore, both personal recovery and executive functioning were each measured extensively with two measures. The importance of using different forms of testing to measure executive functioning has already been highlighted[28]; our study now shows that is also relevant to a sample of people with psychosis. For personal recovery, no such comparison has previously been made within a single study; given the ongoing discussion on its theoretical framework, and given the number of measures already available,[6] we felt it important that personal recovery, too, should be tested in a more elaborate way.

This study also has several limitations. Firstly, the accuracy of the two measures of assessing executive functioning. It is known that self-report measures are not only affected by psychological factors including depression and anxiety,[62] but are also prone to response bias,[46,63] which could mean that illness insight plays a role in the associations between self-report measures of executive functioning and personal recovery. Patients with good illness insight may therefore report more difficulties in executive functioning, and, as a result, may also report worse personal recovery. Performance-based tests, on the other hand, test multiple general cognitive skills at the same time,[64,65] making it difficult to distill the different elements of executive functions. The results of these tests are also proven difficult to generalize to daily life.[49,50] These issues remain to be investigated in future studies.

Secondly, we cannot in any detail establish the nature of the difference between the two types of executive functioning measures. This difference between them was shown in two ways: by the lack of correlation between them, and by their different associations with personal recovery. However, we do not know whether the differences are due to the difficulties concerning their accuracy and specificity, or whether they reflect the actual differences in executive functioning measured by the two types of test.

Thirdly, as the cross-sectional nature of this study does not enable us to establish causality, we can give no indication of whether personal recovery is influenced by executive functioning, or vice-versa. Given that many patients have impairments of executive functioning even before the onset of their illness,[66,67] it is most likely that executive functioning is predictive of personal recovery and not the reverse. To prove this hypothesis, longitudinal and experimental research should be conducted on the association between personal recovery and executive functioning over time.

Fourthly, no measure of general functioning has been used in this study. Therefore, we do not know the general functioning of the participants in this cohort.

Fifthly, the sample in this study is shown to be heterogeneous. Only 41% of the sample is shown to have a diagnosis of schizophrenia and up to 9 diagnoses (in the psychotic disorder spectrum) are eligible for participation in the study. Although this does reflect the psychosis population in the Dutch mental health care, the heterogeneity might make the results difficult to generalize. It might be ie the personal recovery levels might be higher when looking at just those with a diagnosis of schizophrenia, compared to those with schizoaffective disorders. This should be further investigated.

Finally, although the patients' demographic characteristics indicate a representative sample of the current ambulatory patient population in the Netherlands, some groups of patients were less willing or able to participate. The flowchart shows that these groups included care-avoiding patients, those with severe psychotic symptoms (active

psychosis), and those in inpatient care. While this could have positively skewed this studies' population who were in the process of recovery, it is also the case that those leaving the mental health care team were not willing or able to participate, whether for logistical reasons or from lack of interest or time. Such a lack of participation, especially by those who were leaving mental health care altogether—who may thus have been on the way to recovery—may have negatively skewed this population. For this reason, our cohort may not provide a complete picture of recovery (including personal recovery) in psychotic patients.

In conclusion, this study shows that, as a way of operationalizing functional recovery, executive functioning was associated with measures of personal recovery, dependent on the measure with which it was assessed. Clinically, this means that we should aim to improve personal recovery by helping patients to improve their (self-reported) executive functioning through improving their goal-pursuit skills, especially in daily life. In this case, it is thus recommended to add cognitive remediation training to standard rehabilitation practices, to enhance functional recovery,[68] and thus enhance personal recovery ie patients may be able to better attain personal goals such as having more social contact or finding work when cognitive remediation is added.[68] This may increase their empowerment and give them meaning in life,[7] both of which are aspects of personal recovery.

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