Neurocognition in Schizophrenia:

Measured with the MATRICS Consensus Cognitive Battery in a Young Adult Population

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ABSTRACT

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Background: The concept of recovery from schizophrenia has been reformed and now includes social adaptation, working abilities, and daily functioning, as well as decrease in symptoms. Neurocognitive deficits are often discovered in patients with schizophrenia, and have been connected to the course of illness and functional outcome. Still, heterogeneity characterises patients with schizophrenia and the various paths towards recovery are uncertain at present time. The purpose of this thesis was to examine whether significant differences in neurocognitive functioning between patients with schizophrenia and healthy controls could be detected with the MATRICS Consensus Cognitive Battery (MCCB). An additional aim was to describe the patients in terms of resilience, degree of hope, self-efficacy, and daily functioning.

Methods: Neurocognitive functioning was assessed with the MCCB in a group of 18 young adults with a recent debut of schizophrenia, and a healthy control group. Measures of resilience, hope, and self-efficacy were administered in the patient group. Patients were also interviewed on their daily functioning.

Results: Significant differences in neurocognitive functioning between patients and controls were detected on half of the subtests of the MCCB. Investigation of degree of neurocognitive impairment in the patient group, revealed that 89.9 % show impairment when the mildest criteria are used, while only 22.2 % display impairment according to the strongest criteria. Descriptions of daily functioning revealed diversity in terms of employment or educational status, independent living, and relational functioning in the patient group.

Conclusions: Despite the low number of participants in our study, significant differences between patients with schizophrenia and healthy controls are discovered with the MCCB. Our study demonstrates heterogeneity on neurocognitive functioning and on several aspects of daily functioning in the patient group, which shed light on the importance of focusing on individual differences in order to offer tailored interventions and promote recovery.

ACKNOWLEDGEMENTS

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INTRODUCTION

Schizophrenia is a mental illness, which has traditionally been characterised as a chronic disease. At the beginning of the 20th century Kraepelin introduced the term "dementia praecox", implying inevitable mental deterioration, and ever since, a common perspective about the downward course of the disease has dominated amongst scientists, clinicians, and the public (Kraepelin, 1971). Later Bleuler recognised periods of remission in patients with schizophrenia, though they were described mostly as temporal improvements (Bleuler, 1950). The introduction of antipsychotic treatment in the 1950's made a better prognosis for patients with schizophrenia possible, and consequently the rate of outpatients with this diagnosis increased (Frese, Knight, & Saks, 2009). Patients were given hope of reintegration into society, but for many of them a decrease in positive symptoms appeared not to be sufficient for a successful adaptation to life outside hospitals and recovery as such (Hegarty, Baldessarini, Tohen, Waternaux, & Oepen, 1994; Sharma & Antonova, 2003). Despite its shortcomings in reaching full recovery, antipsychotic medication has continued to be the treatment of choice in medical health care worldwide. Nevertheless, during the last decades an extensive amount of research has contributed to a focus on positive outcome in schizophrenia (Harding, Brooks, Ashikaga, Strauss, & Breier, 1987; Harrison et al., 2001; Harrow, Grossman, Jobe, & Herbener, 2005; Torgalsbøen & Rund, 2002). Focusing on recovery and positive outcome is crucial in adjusting treatment to each individual, and giving hope to both patients and the people surrounding them.

The concept of recovery

Recovery is often characterised by complete absence of symptoms, and the goal of treatment is to cure the patient. This classical medical terminology and clinical approach are challenging when applied to mental illness, because the presence and absence of symptoms are neither as distinct nor absolute as in somatic illness, and symptoms intertwine with normal life experiences (Andreasen et al., 2005; Lieberman et al., 2008). Recently the view of recovery from schizophrenia has changed, and is now a wider concept focusing on social adaptation, working abilities, and daily functioning, as well as a decrease in symptoms (Frese et al., 2009). This new perspective may be seen as a reflection of the World Health Organization's definition of health, which includes not only absence of symptoms and pain, but also the aspect of physical, mental, and social well-being (World Health Organization,

2010). One study demonstrated that as much as 40 % of patients with a diagnosis of schizophrenia experienced a period of recovery lasting one or more years, at one or more points in time (Harrow et al., 2005). Furthermore, full recovery was shown to be possible in patients with schizophrenia in longitudinal studies carried out by Torgalsbøen and Rund (2002), though full recovery was also somewhat rare and an unstable state, with occasions of recurrence of the illness. Jobe and Harrow (2005) examined the heterogeneity in outcome of patients diagnosed with schizophrenia, and found that schizophrenia is a mental illness with a relatively poor outcome. At the same time, the researchers discovered subgroups that experienced extended periods of recovery, supporting diversity to some extent in outcome in this patient group.

Due to the considerable number of patients who experience remission and recovery, many questions have been raised concerning what factors recovery depends upon. Biological, psychological, and social factors have been investigated, including level of neurotransmitter substances, level of expressed emotions in the family environment, social support, and coping skills (Combs & Mueser, 2007). Cognitive functioning has been closely linked to functional outcome in schizophrenia, and is yet another factor generating a lot of interest from both scientists and clinicians (Green, 1996). The failure to reintegrate the patients suffering from this mental illness to a life outside mental health institutions constitutes an enormous cost for society. Researchers are now interested in improving functional outcome through neurocognition, and thereby improve patients' quality of life and reduce societal costs (Sharma & Antonova, 2003). Accordingly, Helldin et al. (2006) demonstrated differences in cognitive abilities in favour of the patients in remission, suggesting cognitive function as a possible predictor of remission. There is also a new interest in neurocognitive deficits as target of treatment in schizophrenia, due to the link to functional outcome and recovery (Gold, 2004; Green & Nuechterlein, 1999). Research on the role of cognition in schizophrenia is important to develop both medical and psychological treatment, as well as generating knowledge concerning prognosis, remission, and recovery (Green, Kern, & Heaton, 2004; Sharma & Harvey, 2000a).

Neurocognition in Schizophrenia

Clarification of terms

Initially, schizophrenia has been considered a disorder of language and thought. The term cognition was introduced to describe the information processing deficits experienced by people suffering from the illness. As neuropsychological tests became common methods within the field of research on cognition and schizophrenia, the deficits were also called neuropsychological. However, many professionals claimed such a phrasing should be reserved for a methodological purpose, resulting in a new term, neurocognitive deficits (Green, 1998; Rund, 2002). The term neurocognition also makes the link between cognitive functions and neural structures more explicit, while at the same time accepting that the specific connections remain uncertain (Green, 1996). In this thesis we will therefore use the term neurocognitive when describing the impairments observed in patients with schizophrenia.

Neurocognitive impairments as core features of schizophrenia

Neurocognitive deficits have been associated with the diagnosis of schizophrenia for many years, but the implications of the deficits and how they covariate with schizophrenia have not yet reached a consensus. A constantly growing amount of research demonstrates that the patient group diagnosed with schizophrenia often has a neurocognitive function characterised by broad impairments (Bilder et al., 2000; Green, 1998; Heinrichs & Zakzanis, 1998; Sharma & Antonova, 2003; Weickert et al., 2000). Studies have shown that patients with schizophrenia score significantly lower on neurocognitive measures in comparison with a healthy control group (Hoff et al., 1999; Mesholam-Gately, Giuliano, Goff, Faraone, & Seidman, 2009). Also when compared to other patient groups, patients with schizophrenia show significantly larger impairments on measures of different neurocognitive domains. Patients with schizophrenia demonstrate greater deficits in executive function when compared to patients with bipolar disorder, suggesting that these deficits are specific to schizophrenia and a core feature of the illness (Wobrock et al., 2009). In addition, general memory impairments were discovered in patients with schizophrenia, related to both verbal and visual measures, while only deficits in measures of visual memory were specific to schizophrenia, when compared to participants with Attention Deficit Hyperactivity Disorder (ADHD) (Øie, Sundet, & Rund, 1999).

Neurocognitive impairments are considered core features and independent variables of schizophrenia (Nuechterlein, Green, & Kern, 2009). Studies have shown that neurocognitive deficits are persistent over time and across the state of symptoms. In the review of several longitudinal studies, Rund (1998) found that neurocognitive deficits were relatively stable over long periods of time after the onset of the illness. Others have found that performance on some neurocognitive measures remains impaired whether the symptoms are active or under control, and even when the patients are in remission (Kurtz, 2005). Censits et al. (1997) found no change in neurocognitive test performance, despite introduction of antipsychotic medication and symptom reduction. The assumption that neurocognitive deficits might occur independently of symptoms and psychopharmacological treatment is therefore supported by empirical evidence. Hence, neurocognitive deficits appear to be, not merely a bi-product of other symptoms or psychopharmacological treatment, but rather independent features.

Scientists have taken an interest in how early one can detect neurocognitive differences between persons at risk of developing schizophrenia and their peers not at risk. By tracking down school records of grades from the first to twelfth grade, Bilder et al. (2006) detected that persons who later developed schizophrenia, performed more poorly than their fellow classmates, as early as the first year of school. This difference was maintained, and even increased, during the twelve years of schooling. Others have also found debilitated neurocognitive functioning from premorbid periods to first episodes of psychosis (Jahshan, Heaton, Golshan, & Cadenhead, 2010; Mesholam-Gately et al., 2009). But early assumptions of a further deterioration in the course of illness have not been supported by empirical evidence. Stability in neurocognitive deficits, rather than decay, has been the trend in longitudinal studies following patients with the diagnosis over periods of time (Hoff et al., 1999; Jobe & Harrow, 2005; Kurtz, 2005; Rund, 1998).

Moreover, researchers have been able to show that certain neurocognitive deficits could predict the onset of schizophrenia spectrum disorders. The genetic contribution to this illness has baffled scientists for several years, and the focus on genetic vulnerabilities of schizophrenia has recently expanded to include phenotypic indicators (Erlenmeyer-Kimling et al., 2000). In the New York High-Risk Study following children born to mothers suffering from schizophrenia, researchers found that some childhood cognitive measures could predict schizophrenia-related psychoses in early adulthood (Erlenmeyer-Kimling et al., 2000). In

addition, studies have demonstrated that neurocognitive deficits may be observed premature to both psychotic symptoms and other characteristics of the illness (Davidson et al., 1999). Research has also suggested possible specific risk markers, such as decline in working memory and speed of processing (Jahshan et al., 2010), as well as verbal memory deficits (Lencz et al., 2006). However, one should be cautious when drawing conclusions, since there are few longitudinal studies at the present that examine and follow high-risk individuals over long periods of time.

Furthermore, findings indicating that neurocognitive deficits are present in an attenuated form amongst non-affected first-degree relatives of patients with schizophrenia emphasise the fundamental role of neurocognition in this mental illness (Asarnow et al., 2002). Meta-analyses have discovered that first-degree relatives of patients with schizophrenia demonstrate neurocognitive deficits on several cognitive measures, corresponding to domains like speed of processing, attention, working memory, verbal and visual memory, as well as executive function (Sitskoorn, Aleman, Ebisch, Appels, & Kahn, 2004; Snitz, MacDonald, & Carter, 2006). Researchers assume that these findings suggest that neurocognitive deficits may represent an important part of genetic vulnerability in developing schizophrenia.

Functional outcome is another factor closely linked to neurocognitive functioning, and findings suggest that neurocognitive deficits could predict functional outcome (Green, 1996; Green et al., 2004a). Moreover, Green et al. (2000) have identified four cognitive domains that covariate with functional outcome (immediate verbal memory, verbal memory, executive functioning, and attention/vigilance). Composite neurocognitive measures, a sum of scores on tests corresponding to different domains, have shown even stronger correlations to daily functioning. The reason for this may be that everyday functioning often requires a combination of several cognitive skills (Green et al., 2004a). The relationship between neurocognition and functional outcome is generally found to be stronger than that of psychotic symptoms and functional outcome (Green, 1996). Indeed, this supports the interest in discovering beneficial treatment of schizophrenia via neurocognition.

Findings indicate that psychopharmacological treatment may improve neurocognition in patients with schizophrenia, such as the improvement observed when comparing the effects of second- versus first-generation antipsychotic medication (Harvey & Keefe, 2001; Sharma

& Harvey, 2000b). However, it is not certain whether the second-generation antipsychotic medication has an actual enhancing effect on cognition, or if the change in neurocognitive functioning in patients with schizophrenia is a result of reduced dosage and fewer impairing side effects (Carpenter & Gold 2002; Harvey & Keefe, 2001). Still, intervention through specific neurotransmitter agents has left scientists optimistic in developing psychopharmacological treatment stimulating neurocognitive functioning in schizophrenia (Stone, Seidman, Wojcik, & Green, 2003). Structural brain abnormalities and neural connectivity problems are also associated with schizophrenia, and will limit the effect of psychopharmacological interventions. Nevertheless, a prospect will be to develop medication that may enhance the efficiency of the neural systems, to improve neurocognitive functioning in patients with schizophrenia (Green et al., 2004b).

Heterogeneity in neurocognitive functioning

Numerous studies have shown that neurocognitive deficits are common in schizophrenia. Palmer et al. (1997) estimated that 90 % of the patients have clinically meaningful deficits in at least one cognitive domain, and as much as 70 % in two domains. The size of the neuropsychologically normal patient group varied from 11 to 30 %, according to the impairment criteria being used. Based on such findings, the amount of patients with schizophrenia demonstrating neurocognitive function within the normal range will fluctuate depending on the strictness of the criteria, but should be expected to be present to some extent. However, it is important to consider that even when a patient does not show significant impairments, their neurocognitive function may still be altered from their premorbid level (Green, 1998). Consonant with this, monozygotic twins diagnosed with schizophrenia demonstrating normal neuropsychological functioning, still performed below their unaffected twin on neurocognitive measures (Goldberg et al., 1990). This research sheds light on the heterogeneity of neurocognitive functioning in patients with schizophrenia. However, since a majority of patients with schizophrenia experience change in neurocognitive functioning, whether impairments are present or not, interventions aimed at enhancing cognition will still probably be beneficial. Together, this supports the necessity to assess cognitive function and discover ways of intervening to enhance cognition and thereby promote recovery (Nuechterlein et al., 2008).

Furthermore, suggestions have been made to implement neurocognitive deficit as a diagnostic criterion in the Diagnostic and Statistic Manual of Mental Disorders, Fifth Edition (DSM-V) (Keefe & Fenton, 2007; Lewis, 2004). The expected consequences of such a proposal would be a more accurate diagnosis, increased awareness amongst clinicians concerning neurocognitive impairments, and a more homogenous patient group. A further consequence of a more precise prognosis could be more efficient treatment and better outcome (Keefe & Fenton, 2007). On the other hand, a substantial part of the patient population will be excluded if such a criterion was to be introduced in DSM-V. Even though a majority of persons suffering from schizophrenia experience neurocognitive deficits, research indicates that up to 30 % of the patient group will not show significant impairments in neurocognitive performance (Green, 1998; Palmer et al., 1997). Given the correlation between neurocognitive function and functional outcome, the possibility of recovery might be underestimated if the subgroup that shows no signs of impairment was to be excluded.

Even though the group of patients with schizophrenia can be characterised as heterogenic, the neurocognitive difficulties experienced by the majority of patients tend to involve certain neurocognitive domains. Attention deficits have been considered an important part of the clinical picture in this illness since the beginning of the 20th century (Rund, 2002). Moreover, these attentional deficits have been discovered in a large scale in individuals with a diagnosis of schizophrenia who experience neurocognitive difficulties (Braff, 1993). Weickert et al. (2000) demonstrated that even the group of patients who displayed average premorbid intellectual levels, with no signs of decline in IQ, and a cognitive profile similar to normal, exhibited impairments on measures of executive function and attention. Working memory and memory and learning are other neurocognitive domains where patients with schizophrenia often struggle (Gur, Moelter, & Ragland, 2000; Keefe, 2000). Gold et al. (1992) discovered impairments in different areas of memory in patients with schizophrenia, despite the degree of attentional demands, suggesting that memory impairments are not necessarily dependent on impairment in other neurocognitive domains. Other leading scientists within the field have also supported this view of independent memory impairments in schizophrenia (Gur et al., 2000).

Social cognition

Patients with schizophrenia often struggle in daily interactions. Relating to other persons and adapting to various social situations, tend to be particularly rigorous. An aspect of information processing associated with these difficulties is social cognition (Nuechterlein et al., 2004). Personal relevance and complexity of stimuli characterise the study of social cognition, as opposed to the stimuli used in studies of non-social cognition, often reduced to numbers and letters (Brekke, Kay, Lee, & Green, 2005). The complexity of stimuli in tests of social cognition may therefore be more ecologically valid and reveal multifaceted information, that is, if the measure has sound psychometric properties. It has also been proposed that the correlation between neurocognition and functional outcome might be mediated by social cognition (Brekke et al., 2005; Sergi, Rassovsky, Nuechterlein, & Green, 2006).

Specific or general deficits?

An ongoing debate within this field of research concerns whether neurocognitive deficits in schizophrenia are specific to the illness or not, and if a specific pattern does exist, which domains are involved. Some studies examining this question have found that neurocognitive deficits in schizophrenia are better accounted for by a common, generalised factor, involving impairments across several neurocognitive domains (Dickinson, Iannone, Wilk, & Gold, 2004; Mohamed, Paulsen, O´Leary, Arndt, & Andreasen, 1999). Other findings supporting non- specific impairments are studies that indicate meaningful individual cognitive differences within this patient group, such as the existence of a neuropsychologically normal subgroup (Palmer et al., 1997). Conversely, scientists have discovered distinct patterns of neurocognitive deficits in schizophrenia that differs significantly from that of other illnesses, such as depression and bipolar disorder, supporting neurocognitive deficits specific to schizophrenia (Green et al., 2004b; Wobrock et al., 2009). Even though a significant amount of research demonstrate areas of neurocognition more often affected than others in patients with schizophrenia, some researchers, such as Rund (2002), stress that this question still remains to be solved. Neurocognition has become an explicit target of treatment, which means that enhancement of cognition could have a significant positive effect and lead to recovery (Friedman, 2000; Sharma & Harvey, 2000b). If specific cognitive deficits and their neurobiological substrates were to be discovered, it would facilitate the development of effective interventions for enhancing cognition in schizophrenia.

The MATRICS initiative

Reaching consensus

Traditionally, a variety of neuropsychological tests have been used to measure neurocognitive functioning in patients suffering from schizophrenia. The lack of a consensus test battery for scientific and clinical use has made it difficult to compare results, and hampered the discovery of an agreement on neurocognitive difficulties specific to this group of patients. Therefore there have been great demands for standardised tests, sensitive to the deficits exhibited by patients with schizophrenia. A group of American scientists and academics from different areas of expertise were given the task to develop such a test battery. The process of developing a consensus cognitive test battery started off with the Food and Drug Administration (FDA) and The National Institute of Mental Health (NIMH) establishing the Measurement And Treatment Research to Improve Cognition in Schizophrenia initiative (MATRICS). The main purpose of the governmental involvement in developing a consensus test battery was to establish a measurement that is able to assess cognitive improvements due to various interventions, first and foremost medical treatment (Green et al., 2004b).

The initial step in the development of the MATRICS Consensus Cognitive Battery (MCCB) was to identify the cognitive domains that should be included in a cognitive test battery. Such domains should represent separable aspects of cognition, providing more specific and detailed information (Nuechterlein et al., 2004). Through carefully conducted factor analyses and expert rankings, seven cognitive dimensions were identified and recommended for inclusion in the MCCB (Green et al., 2004b; Nuechterlein et al., 2008). Moreover, an agreement was reached on what criteria the selection of tests should be made upon, and which subtests that should be included (Kern, Green, Nuechterlein, & Deng, 2004). In 2005 the battery was officially approved by the NIMH for scientific use. In addition the FDA recommended use of the battery in the process of developing potential cognition enhancing drugs for schizophrenia and related disorders. Due to the amount of interest and attention the work with the MATRICS initiative has received in the U.S.A., scientists in other parts of the world have been made aware of the potential this research might have on treatment of schizophrenia.

Norwegian research with the MCCB

The MCCB has been translated into Norwegian, and is now used by a group of researchers with experience and expertise within the field of neurocognition and schizophrenia (Rund, Mohn, & Sundet, 2010). Since the Norwegian edition of the test battery was recently introduced, standardisation is still in progress and only one study using this version of the MCCB has been published so far. The results from this study showed significant differences between patient group and healthy controls on all but one neurocognitive domain (Holmén, Juuhl-Langseth, Thormodsen, Melle, & Rund, 2009). Social cognition, measured with the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT), was the one domain in which no group differences were detected. This was not in line with the researchers' expectations, and the use of the MSCEIT in an adolescent population was therefore questioned.

Data from the Norwegian study using the MCCB also demonstrate general and explicit neurocognitive deficits in the patient group relative to controls. Others support these findings of broad neurocognitive impairment across several domains in an adolescent patient population (Ueland, Øie, Landrø, & Rund, 2004). The pattern of neurocognitive impairment discovered in adolescents with schizophrenia is similar to that found in adults sharing the same diagnosis. Together, these findings have left an interest in administering the MCCB on young Norwegian adults, to examine if the results may be replicated.

Recently there has been an increased interest in first-episode psychosis and early intervention to promote recovery and positive outcome (Marshall & Rathbone, 2009; Simonsen et al., 2007). The possibility of isolating different factors and decreasing their interaction with neurocognition, are advantageous when studying first-episode psychosis in contrast to patients enduring schizophrenia spectrum disorders of longer duration. Patients with several episodes of psychosis often have long histories of treatment and their neurocognitive function is therefore more likely to be influenced by effects of age, clinical symptoms, illness duration, and severity (Mesholam-Gately, Giuliano, Goff, Faraone, & Seidman, 2009). The patients included in the present study had a recent debut of psychosis and were referred to the study within five months after admission to hospital or outpatient clinic, to minimise the interference of other variables.

Measures of resilience, hope, and self-efficacy

The new focus on remission and recovery in schizophrenia sheds light on several possible predictors of positive outcome. The main factor examined in this thesis is neurocognition, but at the same time it is assumed that other factors could be influential in coping with schizophrenia.

Resilience has been demonstrated as an influential factor when coping with stressful life events and achieving a positive outcome after being exposed to threatening life experiences (Rutter, 1985). Masten, Best, and Garmezy (1990) define resilience as consisting of three aspects, a process, a capacity, and an outcome, which all consist of successful adaptation despite challenging and threatening experiences. Others refer to this concept as a measure of successful stress-coping abilities (Connor & Davidson, 2003). Receiving a diagnosis of schizophrenia, traditionally viewed as chronic, as well as experiencing negative and positive symptoms, neurocognitive impairments, and the immense decrease in daily functioning, would be expected to be experienced as major stressors. Given the expected high degree of experienced stress, resilience might play a significant part in coping and in functional outcome in schizophrenia. Researchers have shown that resilience is influenced by health status, demonstrating that individuals with mental illness have lower levels of resilience than others who do not have mental problems (Connor & Davidson, 2003). Moreover, resilience scores were found to be modifiable and to increase as treatment evolved. Could it be that resilience represents an important part of the recovery-puzzle in schizophrenia?

Hope is yet another factor worth investigating in relation to prediction of functional outcome and recovery in schizophrenia. The concept is considered a variable of significance for positive daily functioning, as well as adapting to illness and promoting well-being (Herth, 1992). Hope has been identified as a key condition in the process of restitution by individuals who describe themselves as being in recovery from mental illness (Jacobson & Greenley, 2001). Research on hope in the Norwegian population revealed that the most important health-related variable predicting hope was self-assessed health, and that in fact a subjective perception of health was a stronger predictor of hope than presence of chronic disease (Rustøen et al., 2003).

When investigating patients with schizophrenia and their path towards recovery, self-efficacy might be of informative value. Self-efficacy is a concept reflecting an optimistic self-belief, and a belief that one can manage novel or difficult tasks, as well as handling the adversity of human functioning (Schwarzer, 1992). Suffering from schizophrenia involves a number of stressors, and self-efficacy is related to conscious adaptation to stressful life events and awareness of coping abilities in daily life. This suggests that it would be fruitful to relate the concept of self-efficacy to functional outcome and recovery in schizophrenia.

Daily functioning

Research on schizophrenia and recovery has been occupied with identifying factors, besides decrease in symptoms, contributing to a positive outcome (Green, 1996; Green et al., 2004a; Liberman, Kopelowicz, Ventura, & Gutkind, 2002). Moreover, outcome in schizophrenia has been found to be diverse and some argue that several aspects should be measured, such as educational and employment status, independent living, and relational functioning, in order to achieve sufficient information to evaluate the patients' process of remission and recovery (Andreasen et al., 2005; Liberman et al., 2002). Previous findings have revealed occupational dysfunctions in patients with schizophrenia, documenting employment rates of 10 % and 14.5 % at baseline level (Mueser, Salyers, & Mueser, 2001; Rosenheck et al., 2006). More specifically, only a minor percentage of the patient group is holding competitive jobs, despite expressed desire to work in the majority of the group. The loss of productivity over lifetime in patients with schizophrenia represents the largest indirect cost associated with the illness (Combs & Mueser, 2007). Research on educational status in mental illness, has found that living with a diagnosis is connected to reduced likelihood of achieving high levels of education (Kessler, Foster, Saunders, & Stang, 1995). Independent living and community functioning have also been studied in relation to schizophrenia, and have even been connected to neurocognitive deficits (Rempfer, Hamera, Brown, & Cromwell, 2003). Furthermore, in terms of relational functioning, studies have shown that patients with schizophrenia are less likely to get married and stay married, and that marital status might serve as a useful predictor of outcome (Agerbo, Byrne, Eaton, & Mortensen, 2004; Turner, Dopkeen, & Labreche, 1970). The data available in our study enable us to describe the patient group at baseline level on several variables of daily functioning, and will reveal if heterogeneity is present in the early phase of the illness. Investigation of recovery will not be

possible until follow-up data at a second point in time are complete, and therefore a prediction of outcome will not be at consideration in the present thesis.

The purpose of this study

The present study is part of an ongoing longitudinal study investigating neurocognition and resilience as possible predictors of recovery in the early and late course of schizophrenia, following the patients for ten years. Principal investigator is associate professor Anne-Kari Torgalsbøen, Department of Psychology, University of Oslo. The MCCB is the chosen neuropsychological test battery in this study, as well as consensus based definitions of remission (Andreasen et al., 2005) and full recovery in schizophrenia (Liberman et al., 2002). The collection of data is still in progress and so far 18 patients have been included in the study.

In this thesis the Norwegian version of the MCCB will be used to examine if significant differences in neurocognitive functioning between patients with schizophrenia and healthy controls might be revealed. Based on the research previously accounted for, we expect these differences to take form as neurocognitive impairments in the patient group. Test performances of young adults with a recent schizophrenia diagnosis will therefore be compared with the performance of normal controls.

1. The primary aim of this study is to investigate if significant differences in neurocognitive functioning between young adults with schizophrenia and healthy controls will be discovered with the MATRICS Consensus Cognitive Battery (MCCB).

2. A subordinate purpose is to investigate what characterises young adults with schizophrenia in terms of resilience, hope, and self-efficacy, and to describe our patient group in terms of daily functioning.

METHODS

Subjects

The patients were recruited from mental health service institutions located in the Oslo area, including psychosis units at Asker and Bærum Hospital and Lovisenberg Hospital. Shortly after they were admitted to the institutions with a first-episode psychosis, their treating clinicians referred them to the longitudinal project this study is part of. Inclusion criteria were mental illness within the spectrum of schizophrenia and psychosis of the DSM-IV (schizophrenia [295.00], schizophrenia, residual type [295.60], paranoid schizophrenia [295. 30], disorganised schizophrenia [295.10], schizophreniform disorder [295.40], schizo-affective disorder [295.70], and psychosis unspecified [298.90]), and patients had to be referred within five months of their first contact with the mental health service institutions (APA, 1994). Furthermore, the participants had to be over the age of 18. Exclusion criteria were affective disorders, IQ<70, or head trauma.

The final number of patients included in our study was 18, and the distribution of the different diagnoses was as follows: Schizophrenia *n*=5 (27.8 %), schizophrenia, residual type *n*=2 (11.1 %), paranoid schizophrenia *n*= 2 (11.1 %), disorganised schizophrenia *n*=1 (5.6 %), schizophreniform disorder *n*=3 (16.7 %), schizo-affective disorder *n*=4 (22.2 %), and psychosis unspecified *n*=1 (5.6 %). Of these, 16 (88.9 %) had started antipsychotic treatment before testing, and seven (38.9 %) used a combination of antipsychotic medication and antidepressants. Twelve of the participants in the patient group were hospitalised at the time of testing, and therefore the interview and the tests had to be administered at the hospital. The remaining six were outpatients, received treatment as outpatients, and were tested at their respective clinics. All patients but three had Norwegian as their mother tongue, though everyone was able to complete the interview and tests in Norwegian. Years of education varied from 9 to 16 (*M* 11, *SD* 2).

In the control group, the youngest subjects were recruited from Junior- and Senior High schools in the Oslo metropolitan area. The older part of the group replied to advertisements on a hospital trust internet homepage (Vestre Viken Hospital Trust) and a health information webpage (nettdoktor.no). The control group was tested at Asker and Bærum Hospital or the Department of Psychology at the University of Oslo. They were matched to the patient group

on gender, age and education. In relation to mental health, the participants in the control group were either screened for mental problems using the Mini-International-Neuropsychiatric-Interview (MINI) (Sheehan et al., 1998), or asked a non-standardised set of questions on mental health.

After carefully describing the study and the procedures involved, written informed consent were obtained from participants in both patient and control group. Testers also made sure that the patient group was made fully aware of what their role, as participants in this study, would involve. The study has been approved by the Regional Committee for Medical Research Ethics (REK).

Clinical instruments

The clinical interviews and tests were carried out by experienced clinicians, trained in the use of the different instruments. For establishment of diagnosis, the participants were interviewed with the Structural Clinical Interview for DSM-IV (SCID) (First, Spitzer, Gibbon, & Williams, 1996). SCID was used in order to establish a diagnosis on the first axis, with the modules A-E. The degree of symptoms and psychopathology was measured with the Positive and Negative Syndrome Scale (PANSS) for schizophrenia (Kay, Fiszbein, & Opler, 1987). In some cases, after patients had given their consent, additional information was obtained from therapists and first-degree relatives.

Furthermore, information on resilience, hope, and self-efficacy was obtained from subjects in the patient group, using self-report forms. In order to assess degree of resilience, a Norwegian translated and back-translated version of the Connor-Davidson Resilience Scale (CD-RISC) was chosen (Connor & Davidson, 2003). The scale consists of 25 items each rated on a five-point scale (0-4), with higher scores reflecting a greater degree of resilience. A mean score of 80.4 (*SD* 12.8) was discovered in the general population and 68.0 (*SD* 15.3) in a group of outpatients with mental illness. Our patient group will be compared according to these findings. In developing this scale, Connor and Davidson discovered that Cronbach's α was .89. Test validity was documented by positive correlations to measures of hardiness and social support, and negative correlations to measures of perceived stress, stress vulnerability, and disability.

Measuring the subjects' perceived degree of hope, the Norwegian version of the Herth Hope Index (HHI) was selected (Herth, 1992; Rustøen et al., 2003). This scale comprises 12 items each rated on a four-point Likert scale (from "strongly agree" to "strongly disagree"). A mean score of 36.7 (*SD* 4.1) was detected in the general population and will be the basis for comparison in our study (Rustøen et al., 2003). Herth (1992) demonstrated a Cronbach's α of .97, indicating high degree of internal consistency. Moreover, convergent validity was discovered with measures of existential well-being and hope, and divergent validity was found with measures of hopelessness.

The degree of perceived self-efficacy was assessed using the Norwegian version of The General Perceived Self-Efficacy Scale (GSE) (Røysamb, Schwarzer, & Jerusalem, 1998). The scale is composed of ten items, each rated on a four-point Likert scale (from "completely wrong" to "completely right"). A mean score of 29.6 (*SD* 5.3) was discovered in a total sample from 25 countries and will be used to discuss the level of self-efficacy in our patient group (Scholz, Gutiérrez-Doña, Sud, & Schwarzer, 2002). Reliability was also investigated, and Cronbach's α ranged from .75 to .91. Documenting test validity, positive correlations to favourable emotions, dispositional optimism, and work satisfaction were found. Furthermore, negative correlations to variables such as depression and health complaints, were also discovered. To sum up, the CD-RISC, the HHI, and the GSE all have sound psychometric properties and are able to distinguish between those with greater and lesser degree of resilience, hope, and self-efficacy.

A semi-structured interview was used to assess educational and employment status, independent living (grocery shopping, domestic chores, leisure activity, and housing situation), as well as relational functioning (friends, family, and partner). These aspects of psychosocial functioning are part of the consensus based recovery criteria used in the main study (Liberman et al., 2002).

Neurocognitive instruments

Neurocognitive assessment was carried out by either clinical psychologists, or graduate students of psychology, trained in administering standardised neuropsychological tests. Intellectual abilities were assessed using four subtests of the Wechsler Adult Intelligence Scale Third Edition (WAIS-III) (vocabulary, similarities, block design, and matrix reasoning)

(Wechsler, 2003). The Norwegian version of the MCCB was used to assess neurocognitive function (Nuechterlein & Green, 2009). This test battery consists of ten tests measuring the following seven neurocognitive domains; speed of processing, attention/vigilance, working memory, verbal learning, visual learning, reasoning and problem solving, and social cognition.

Speed of processing

Three tests are used to measure the subjects' speed of processing. The Trail Making Test part A (TMT-A) measures how rapidly participants are able to draw a connection between numbers placed randomly on a piece of paper (*Army Individual Test Battery*, 1944). The faster the task is completed, the higher the score. In the following test, the Brief Assessment of Cognition in Schizophrenia (BACS), the task is to connect unique symbols with corresponding numbers, by referring to an explanation key (Keefe, 1999). The symbols are arranged in lines across a sheet in a random sequence, and participants must find the corresponding number using the explanation key. The final test of speed of processing is the Category Fluency Test in which the participants are to name as many animals as they possibly can in 60 seconds (Spreen & Strauss, 1991).

Attention/vigilance

The chosen test for assessing attention in the MCCB is the Continuous Performance Test Identical Pairs (CPT-IP) (Cornblatt, Risch, Faris, Friedman, & Erlenmeyer-Kimling, 1988). This is the only test administered on a computer. When the participants discover two identical numbers flashing on the screen in a row, they should respond as quickly as possible by pressing the left mouse button. There are three different conditions in the CPT-IP; two, three, and four digit numbers. Monitoring the numbers is the final task in the test battery, lasting for ten minutes.

Working memory

To measure working memory the participants complete two different tests, verbal and visual. The University of Maryland- Letter-Number Span (LNS) is the test assessing the verbal part of working memory (Gold, Carpenter, Randolph, Goldberg, & Weinberger, 1997). Numbers and letters are orally presented to the participants and their task is to organise the information, sorting numbers from letters, and presenting the numbers in an ascending order, and the

letters alphabetically. The visual part of working memory is measured with the Spatial Span (Wechsler Memory Scale III) (Wechsler, 1997). The administrator presents a visual pattern by touching blocks on a board, and the participants have to repeat this pattern by touching the board in the exact same order. There are two conditions, forwards and backwards, either to repeat the tapping in the same order as the administrator, or to reverse the pattern.

Verbal learning and memory
In the Hopkins Verbal Learning Test-Revised (HVLT-R) a list of twelve words are read out loud to the participants and they have to repeat as many words as they are able to remember immediately after the words have been presented (Brandt & Benedict, 2001). This procedure is repeated three times, which makes it possible to study the learning effects between the trials.

Visual learning and memory
The Brief Visuospatial Memory Test- Revised (BVMT-R) exposes participants for visual stimuli for ten seconds (Benedict, 1997). Six different figures printed proportionally on a piece of paper are held up in front of the participants. The respondents are supposed to remember the accurate place and the shape of the figures, then draw the figures as thoroughly as they possibly can. They are rewarded for accuracy and correct location. To discover visual learning effects, the BVMT-R is carried out in three trials.

Reasoning and problem solving
In the Mazes Test (Neuropsychological Assessment Battery-NAB) the participants have to complete seven mazes with gradually increasing difficulty (White & Stern, 2003). The mazes are printed on paper and completed with a pencil. Participants are rewarded for solving the mazes rapidly, since scores are based on the total time used on all seven mazes.

Social cognition
When measuring the domain of social cognition the MSCEIT, part D and H, is used (Mayer, Salovey, & Caruso, 2002). Participants are exposed to stories of various social situations, and have to evaluate the consequences of different actions. The text is read aloud, and the participants also have a copy of the text in front of them. Scores from the test were calculated using general consensus scores and computed into the MCCB scoring program.

Statistical analyses

Data analyses were done using the statistical package SPSS for Windows (version 16.0). All tests were two-tailed and the level of significance was set to $p= .05$. To examine and compare the neurocognitive performance of patients with schizophrenia and healthy controls, the applied method was independent samples t-test. Furthermore, resilience, hope, and self-efficacy, and variables of daily functioning, were portrayed using descriptive statistics and frequencies.

Data analyses were carried out using raw scores from neurocognitive measures. Standardised American norms for the youngest part of the group (<20 years of age) are missing, and the process of developing standardised Norwegian norms is still in progress. This lack of norms made it a necessity to use raw scores for data analyses in this thesis. Consequently, raw scores on single neurocognitive tests were analysed separately because a comparison of domains was impossible. Another consequence following the lack of standardised norms was the inability to use composite scores to comment on the overall neurocognitive functioning, as well as analysing the correlation between neurocognition and daily functioning. Controlling for the impact of premorbid differences in intellectual functioning was also prevented, since such an analysis would involve standardised scores from the WAIS-III and the MCCB.

To characterise the distribution of impairment within the patient group, a cut-off score of 1.0 *SD* below the mean score of the control group was used as a threshold for "moderate impairment", and 1.5 *SD* below the mean score of the control group, as a threshold for "severe impairment". Holmén et al. (2009) used similar cut-off criteria in their study of Norwegian adolescents with first-episode psychosis, to describe level of impairment within their patient group. Their methods were inspiring to our analyses, since we wanted to explore within-group differences in neurocognitive deficits in schizophrenia. Moreover, the cut-off scores, 1.0 *SD* and 1.5 *SD* below the mean score of the control group were used to investigate level of impairment in each individual in the patient group. Number of tests showing impairments in each individual profile was identified manually by counting test scores below cut-off.

RESULTS

Table 1. Demographic and clinical characteristics of patients with schizophrenia and healthy controls.

	Patients (*n*=18)	Healthy controls (*n*=18)
Sex (female)	8 (44.4 %)	8 (44.4 %)
Hand Dominance (R)	18 (100 %)	17 (99.4 %)
Age (Y)	21.6 (3.0)	21.2 (3.3)
Education (Y)	11.4 (2.2)	11.3 (2.2)
PANSS		
Positive	18.7 (3.6)	
Negative	20.7 (5.4)	
Total	77.2 (16.7)	
Treatment (hospitalised)	12 (66.7 %)	
Duration of untreated psychosis (wk)	62.8 (73.3)	

Note: PANSS, Positive and Negative Syndrome Scale.

Demographic characteristics of the patients with schizophrenia spectrum disorders, and healthy controls, as well as clinical information of the patient group, are listed in table 1. Age, education, PANSS scores, and duration of untreated psychosis in *Mean* (*SD*).

Table 2. Neuropsychological test results of the MATRICS Consensus Cognitive Battery for patients with schizophrenia compared with healthy controls, *n*=36.

	Patients		Controls			
	Mean	*SD*	*Mean*	*SD*	*t*	*p*
TMT–A	36.1	14.3	28.1	10.4	-1.94	.062
BACS	47.2	8.5	63.6	12.0	4.75	.000
HVLT-R	25.7	4.1	28.4	4.7	1.86	.072
WMS III	18.2	3.4	18.8	3.1	.52	.608
LNS	12.8	2.5	15.4	3.2	2.73	.010
Mazes (NAB)	17.8	6.2	23.5	2.3	3.65	.001
BVMT-R	24.9	5.3	30.2	4.2	3.32	.002
Category Fluency	20.9	5.6	24.1	6.6	1.58	.125
CPT-IP	2.2	0.6	2.7	0.4	2.95	.006
MSCEIT	87.2	11.8	90.6	9.4	.94	.356

Note: TMT-A, Trail Making Test-A; BACS, Brief Assessment of Cognition in Schizophrenia (symbol coding); HVLT-R, Hopkins Verbal Learning Test-Revised; WMS, Wechsler Memory Scale III (spatial span); LNS, Letter-Number Span; NAB, Neuropsychological Assessment Battery; BVMT-R, Brief Visuospatial Memory Test-Revised; CPT-IP, Continuous Performance Test, Identical Pairs; MSCEIT, Mayer-Salovey-Caruso Emotional Intelligence Test.

The MATRICS Consensus Cognitive Battery (MCCB) was used to examine neurocognitive differences between the patient group and the control group. Table 2 summarises the raw scores on the subtests of the MCCB. In the patient group, significant impairment was discovered in five subtests corresponding to five domains; speed of processing, working memory, reasoning and problem solving, visual learning/memory, and attention/vigilance. The remaining subtests did not reveal any significant differences between the groups. Gender was used as a control variable, and yielded no significant effects concerning between group differences, except on the subtest MSCEIT.

Eighteen participants in each group performed the subtests in the MCCB, except the Mazes test, where data is missing for one healthy control due to administrative problems.

Table 3. Number of patients with schizophrenia demonstrating neurocognitive impairments on the subtests of the MCCB, i.e. performance ≥1.0 *SD* and ≥1.5 *SD* below the mean of the control group, *n*=18.

	Impairment (≥1.0 *SD*)	**Impairment (≥1.5 *SD*)**
TMT-A	7 (38.9 %)	4 (22.2 %)
BACS	13 (72.2 %)	8 (44.4 %)
HVLT-R	7 (38.9 %)	2 (11.1 %)
WMS III	6 (33.3 %)	1 (5.6 %)
LNS	11 (61.1 %)	4 (22.2 %)
Mazes (NAB)	13 (72.2 %)	10 (55.6 %)
BVMT-R	8 (44.4 %)	7 (38.9 %)
Category Fluency	5 (27.8 %)	2 (11.1 %)
CPT-IP	10 (55.6 %)	6 (33.3 %)
MSCEIT	7 (38.9 %)	4 (22.2 %)

Note: TMT-A, Trail Making Test-A; BACS, Brief Assessment of Cognition in Schizophrenia (symbol coding); HVLT-R, Hopkins Verbal Learning Test-Revised; WMS, Wechsler Memory Scale III (spatial span); LNS, Letter-Number Span; NAB, Neuropsychological Assessment Battery; BVMT-R, Brief Visuospatial Memory Test-Revised; CPT-IP, Continuous Performance Test, Identical Pairs; MSCEIT, Mayer-Salovey-Caruso Emotional Intelligence Test. Df = 1.

In order to discover to what extent neurocognitive impairments were present in the patient group in our study, a cut off score for moderate impairment was set to 1.0 *SD* below the mean of the control group, and cut off score for severe impairment at 1.5 *SD*. The percentage of patients that performed ≥1.0 *SD* and ≥1.5 *SD* below the mean score of the control group on each subtest, and thereby show signs of impairment, are displayed in table 3.

Moreover, further examination of level of impairment, revealed that 16 patients (89.9 %) displayed moderate impairment on three or more subtests, while 10 (55.6 %) showed moderate impairment on five or more subtests. Ten patients (55.6 %) demonstrated severe impairment on three or more subtests, while the number was reduced to 4 (22.2 %) when number of subtests was increased to five or more.

Table 4. Resilience, hope, and self-efficacy scores in the patient group.

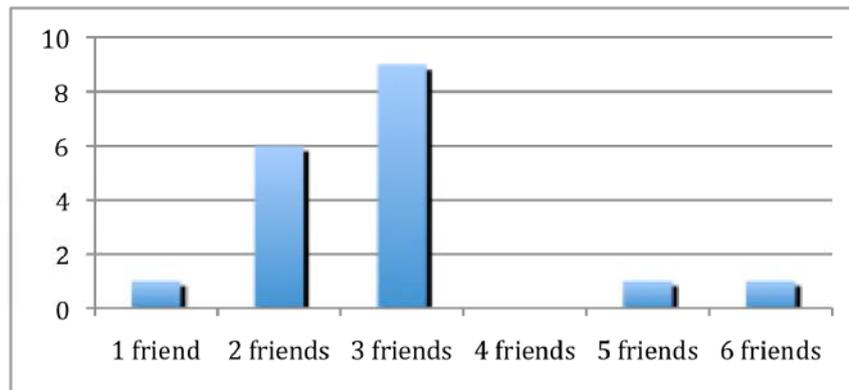|	Patients		
	Mean	*SD*	*n*
CD-RISC	57.1	14.4	15
HHI	34.6	5.2	18
GSE	27.8	5.0	18

Note: CD-RISC, Connor-Davidson Resilience Scale; HHI, Herth Hope Index; GSE, General Perceived Self-Efficacy Scale.

Data are missing for three of the participants in our patient group on CD-RISC, because the instrument was not included in the initial phase of the longitudinal study our data is a part of.

Table 5. Distribution on variables of daily functioning in the patient group.

	Patients		
	Yes	**No**	*n*
Employment	8 (44.4 %)	10 (55.6 %)	18
In education	9 (52.9 %)	8 (47.1 %)	17
Grocery shopping	9 (52.9 %)	8 (47.1 %)	17
Shopping own clothes	16 (94.1 %)	1 (5.9 %)	17
Domestic chores	13 (76.5 %)	4 (23.5 %)	17
Cooking	14 (82.4 %)	3 (17.6 %)	17
In a romantic relationship	1 (5.9 %)	16 (94.1 %)	17
Leisure activities	16 (94.1 %)	1 (5.9 %)	17
Contact with parents	18 (100 %)	0	18

Diagram 1. Number of close friends reported by the participants in the patient group, $n=18$.

Together, table 5 and diagram 1 describe daily functioning of participants in the patient group. On measures of activities of daily life, except employment, contact with parents, and number of friends, data are missing on one patient due to inconsistency in the administration of the interview.

DISCUSSION

Neurocognitive impairments and the MCCB

Data from this study discover differences between the patient group and the control group on several neurocognitive subtests, included in the MCCB. As presented in the introduction, previous studies have demonstrated the reliability and sensitivity of this test battery (Holmén et al., 2009; Nuechterlein et al., 2008). The MCCB is useful in detecting neurocognitive impairments in the patient group of our interest, where five tests corresponding to five domains, reveal significant differences between the groups. Even though five tests corresponding to four domains did not demonstrate significant differences, we would expect significant differences to be discovered on all the subtests of the MCCB, if the number of participants were higher. Based on the Norwegian study measuring neurocognitive differences between patients and controls with the MCCB, an exception to our expectation might be the measure of social cognition, the MSCEIT, since the usefulness of this test in detecting impairments in adolescents with schizophrenia was debated (Holmén et al., 2009). Together, these findings suggest that differences in neurocognitive functioning between patients with schizophrenia and healthy controls exist in our sample, and that the MCCB is useful in detecting these differences.

The five tests discovering differences between the groups correspond to five different domains (attention, executive function, learning, working memory, and speed of processing). Attention is a complex construct, and in our analyses vigilance, i.e. attention towards a relevant object, is measured with CPT-IP (Green, 1998). Our data examining degree of impairment in vigilance reveal moderate impairment in 55.6 % of the patient group when using a criterion of ≥ 1.0 *SD* below the mean of the control group. Severe impairment was demonstrated in 33.3 % of the patients, when the criterion of ≥ 1.5 *SD* below the mean of the control group, was used. Although attention is a miscellaneous construct, our data imply that vigilance is an aspect of attention impaired in patients with schizophrenia, and that the CPT-IP is useful in detecting the deficits. Despite the low number of participants, the current findings of attention deficits in the patient group, supports the broadly accepted agreement that many patients with schizophrenia struggle with different aspects of attention (Braff, 1993).

Executive functions involve complex cognitive processing such as planning, evaluating possible consequences of actions, and executing behaviour, and are considered important for responding and adapting to the surroundings (Rund, 2002). Impairments in executive functions are demonstrated in the patient group by our data, with moderate impairment in 72.2 % of the patients when a criterion of ≥ 1.0 *SD* below the mean of the control group is used, and severe impairment displayed in 55.6 % of the patient group when using a criterion of ≥ 1.5 *SD*. This is in line with previous findings that have proposed executive function deficits as a core feature in schizophrenia (Weickert et al., 2000). Our results may support that the MCCB, or more specifically the Mazes Test, is successful in detecting impairments in executive functions in patients with schizophrenia. At the same time, we cannot conclude whether the differences between the groups in reasoning and problem solving are discovered due to the sensitivity of the test or if it may implicate profound impairment in the patient group, since our study is not of psychometric character.

On the domain of working memory significant differences between the groups were detected by the LNS, a test measuring the verbal part of working memory. However, no significant differences were discovered in the visual part of working memory, measured with the WMS-III. The same phenomenon was observed on the domain of learning and memory, where the BVMT-R, tapping visual learning, revealed significant differences between patients and controls, while the HVLT-R, measuring verbal learning, did not. These findings only partly support our expectations, that significant differences would be detected on all neurocognitive subtests of the MCCB, with the possible exception of the MSCEIT. However, based on previous research, we would expect significant differences on all subtests of working memory and memory and learning to be discovered if the number of participants were higher (Gold et al., 1992; Gur et al., 2000; Keefe, 2000; Wobrock et al., 2009).

Two of the tests measuring speed of processing, as well as the measures of verbal learning and visual working memory, did not reveal significant differences between patients and controls, as opposed to our expectations, based on extensive work by the MATRICS Neurocognition Committee (Green et al., 2004a; Green et al., 2004b; Kern et al., 2004; Kern et al., 2008; Nuechterlein et al., 2008). One possible interpretation of our results might be that in fact no differences on these domains exist between the groups in our study. Hence, the significant difference found in scores on the BACS might be due to random errors, since the

other tests on the domain of speed of processing did not reveal significant differences. However, the high percentage of patients (72.2 %) demonstrating moderate impairment in speed of processing measured with the BACS, makes us question the interpretation of random errors. Moreover, patients suffering from schizophrenia differ to a large extent on measures of neurocognition and functional outcome (Green, 1998; Jobe & Harrow, 2005), which should also be considered a reason for not discovering differences between groups in a small sample like ours. Furthermore, the distribution is dependent on each individual score. Performance above or below the mode characterised as extreme scores, will have a major influence on the mean and create even larger within-group differences. In studies with a low number of participants, the mean is sensitive to extreme scores. To sum up, interpretations of the non-significant differences are dependent on the small sample, and based on previous findings we would expect significant differences to be discovered between the patients and controls on all subtests of the MCCB, when applied to a larger sample (Holmén et al., 2009; Kern et al., 2008; Nuechterlein et al., 2008).

No significant differences between the two groups were discovered on the domain of social cognition, measured with the MSCEIT, which is a replication of what was found in the single published Norwegian study concerning the MATRICS initiative (Holmén et al., 2009). A reason for our results might be that the domains selected when the MCCB was developed, were chosen on the basis of thorough factor-analyses, except the domain of social cognition, which was selected on experts' ratings alone (Nuechterlein et al., 2004). Another reason why we question the use of the MSCEIT in differentiating between patients and controls is that this test was chosen partly due to lack of alternative measures of social cognition (Nuechterlein et al., 2008). Additionally, Holmén et al. (2009) suggest two possible explanations why no differences between their two groups were detected. First, it might be that both groups performed well, which is supported by an indication of no differences between patients with schizophrenia and controls on knowledge on how to act in social situations, and that problems are made explicit when the knowledge has to be taken into use (Vaskinn et al., 2008). The second reason might be that both groups performed poorly, since the scores of the control group are below of what might be expected compared to the American norms for the young adult group. These interpretations might also be expected to be plausible to our results, but the lack of standardised norms for the Norwegian population, makes it difficult to confirm or invalidate either.

Furthermore, we also question the use of the MSCEIT because the fixed alternatives might not disclose the reasoning that leads the participants to their choice, and thereby the investigation of the entire complexity of social cognition will be hampered (C. Mohn, personal communication, April 24, 2010). Also, some alternatives might be incorrect according to the test question, but still be advantageous for the agent in the story in another context. Therefore it would be interesting to score the participants on the basis of their reasoning, their evaluations of different aspects of the stories, and their interpretations of the consequences of different actions. Additionally, it would also be informative to observe their social skills in a situation that requires interaction with others. Role-play, might be such an in vivo measurement of social cognition (Bellack, Brown, & Thomas-Lohrman, 2006).

Degree of neurocognitive impairment

Previous studies have revealed large individual differences in neurocognitive functioning and degree of impairment, amongst patients diagnosed with schizophrenia (Holmén et al., 2009; Palmer et al., 1997; Rund, 1998). Despite the variation in degree of neurocognitive impairment in the group, the majority probably experience an alteration from their premorbid level (Green, 1998). Findings from our data set support this heterogeneity in neurocognitive functioning. Approximately 90 % of the patients display moderate impairment on three or more tests, while the percentage was reduced to 55.6 % showing moderate impairment on five or more tests. Moreover, 55.6 % exhibit severe impairment on three or more tests, and scarcely 23 % of the patient group show severe impairment on five or more subtests. These results illustrate that a large amount of the patient group, struggle to some extent in terms of neurocognitive functioning. Furthermore, only a minor part of our patient group displays severe impairment on more than half of the subtests of the MCCB. In line with previous research, the amount of patients demonstrating neurocognitive impairments in our study, as well as the degree of impairment, varies according to the criteria of impairment in use (Palmer et al., 1997). Overall, this suggests that psychoses and schizophrenia may exist independently of profound neurocognitive deficits. Moreover, given these in-group differences, the sensitivity of a neurocognitive test battery is of major importance.

Resilience, hope, and self-efficacy

Our study also applied measures of resilience, hope, and self-efficacy, with the intention of describing what characterises young adults with first-episode psychosis. Our data show that the patients' perceived degree of resilience measured with the CD-RISC, is considerably lower than what has been found in the general population (Connor & Davidson, 2003). Moreover, the scores of our patients are also below of what has been found in a group of outpatients suffering from other mental illnesses. This implies that the patients with schizophrenia differ from both the general population and the outpatients with other diagnoses of mental illness in terms of resilience. A reason for this might be variations in the quantity and quality of stress experienced, and the ability to handle the stress they are exposed to. As presented in the introduction, resilience has been demonstrated to be modifiable by treatment in mental illness such as General Anxiety Disorder (GAD) (Connor & Davidson, 2003). It would be fruitful to investigate if resilience scores may also improve with treatment in patients suffering from schizophrenia.

The scores of hope in our study, measured with the HHI, are slightly below the mean in the general population (Rustøen et al., 2003). This indicates that the patients' experienced degree of hope is relatively preserved shortly after the outbreak of a first-episode psychosis. One might expect that the perceived degree of hope diminish proportionately with the severity of illness, but our data imply that a correlation between severity of illness and decreased degree of hope do not necessarily exist. In line with this, research has suggested that the individual's subjective view of health is a more important predictor of hope, than the presence of chronic disease itself (Rustøen et al., 2003).

Self-efficacy scores in the patient group, measured with the GSE in our study, are shown to be scarcely below the mean in the general population (Scholz et al., 2002). Receiving a diagnosis such as schizophrenia appears not to diminish the perceived belief of coping abilities in our patient group.

Researchers have not yet systematically investigated the connection between resilience, hope, self-efficacy, and schizophrenia (A. K. Torgalsbøen, personal communication, April 14, 2010), but it seems useful to look closer at resources within the individual to gain information on factors contributing to remission and recovery. First of all, strengthening a modifiable

quality already present in the individual represents a qualitatively different way of approaching the issue of remission and recovery, and would be a useful addition to the main focus of removing unwanted symptoms. This view will also provide the patients with agency, and might offer the opportunity to affect their outcome. Secondly, the inclusion of these measures represents another way of describing this patient group, with a possibility of discovering new characteristics of patients who recover. Furthermore, these characteristics could be of interest in developing efficient interventions and tailoring treatment to the individual in order to promote recovery in schizophrenia. Data from our study describe the patient group in terms of resilience, hope, and self-efficacy at baseline level. Measures across longer periods of time will generate new knowledge on how the variables change during the course of the illness. It will then be possible to evaluate the importance of these factors in relation to treatment and recovery in schizophrenia.

Daily functioning

Information on daily functioning demonstrated that 45 % of the patients are employed and over 50 % are attending high school or college, at baseline level. This does not mean that 95 % are either working or attending school, instead some of the participants reply affirmative on both questions. Twelve of the participants (66.7 %) were hospitalised at the time of testing, and we assume that the majority of these patients were either on sick leave at the time of testing or unemployed. However, we do not have access to precise data concerning information on employment or educational status, due to inconsistency and inexact wording of the questions in the interview. Therefore we are uncertain if the status reported by the patients represents their status before onset of psychosis, if they are employed but have a sick note, or if they are actually working. Moreover, one third of our patients (33.3 %) are outpatients at the time of testing. We must consider the possibility that some of these patients manage to function in work or educational situations, perhaps with the aid of vocational rehabilitation, "active" sick notes, and adjusted work loads, not covered by dichotomous variables like the ones used in our study. To sum up, interpretation of the results must be carried out in a careful manner.

Our data implicate that some of the patients might be able to function in working or learning situations, despite our results of impairments in the group on several neurocognitive domains, assessed with the MCCB. In other words, the findings suggest a possibility of retaining parts

of daily functioning when receiving a diagnosis of a mental illness traditionally associated with a chronic course. However, researchers have discovered rates of 10 % and 14.5 % in competitive employment activity in patients with schizophrenia at baseline level (Mueser et al., 2001; Rosenheck et al., 2006). When considering research on employment rates in patients with schizophrenia, we would expect our material to reflect approximately the same percentages at baseline level, consonant with the part of our data showing that the majority of the patients are hospitalised.

Even though some persons suffering from schizophrenia might be working or studying, we would expect them to struggle somewhat when performing tasks requiring neurocognitive processing based on our findings on the degree of neurocognitive impairment in the group. Supporting this are studies demonstrating decreased neurocognitive functioning in patients with schizophrenia, such as neuropsychologically unimpaired monozygotic twins with schizophrenia who performed more poorly than their unaffected twin (Goldberg et al., 1990). Furthermore, it is expected that cognitive enhancing interventions would be beneficial for most patients with the diagnosis (Green, 1998; Nuechterlein et al., 2008). This underlines the importance of assessing neurocognitive functioning with a sensitive test battery to discover the patients' strengths and weaknesses. In order to adjust working or learning situations, clinicians may introduce techniques to enhance learning, memory, and concentration, as well as normalising challenging difficulties, such as helping patients to acknowledge that they might need extra time due to reduced speed of processing. In other words, assessing neurocognitive functioning might be helpful in facilitating utilisation of patients' abilities and potential.

Our data concerning shopping own clothes, performing domestic chores, and cooking show that nearly all patients are themselves responsible for these tasks. Only half of the patient group does their own grocery shopping, but this might be due to their living situation, since more than half of these young adults are living with their parent(s). Together, this could mean that our patient group is able to manage their own household without being dependent on help from others and that parts of their daily functioning are preserved. However, we must consider the amount of patients hospitalised at the time of interviewing. The questions could be interpreted as an enquiry of independent living when not hospitalised and before the onset of illness. Conversely, what was reported could reflect chores carried out inside the

institution with help from others, in a safer environment than outside on their own. Both these ways of interpreting the questions could potentially overestimate the ability to keep a household. Additionally, the high percentages might also reflect skewness in the sample. Our sample might not be representative for the entire patient population, and perhaps the results reflect their relatively high level of independent living.

Information on relational functioning was obtained in terms of questions concerning romantic relationships and number of friends. Only one of the patients was engaged in a romantic relationship and 16 of 18 patients reported having three or fewer friends at the time of testing. These findings might indicate that the patients in our study struggle to interact and relate to others, and that social functioning is challenging. Also, the findings might be seen as a preference in the group to interact with few close friends rather than a group, which in turn might be a reflection of lack of social abilities. Knowledge on how to relate to a group of people might be present in the patients, but it could be difficult and complex to actually perform and adapt to social settings (Vaskinn et al., 2008). Such performance requires flexibility and the ability to simultaneously process a large amount of stimuli. Our patients do not differ from the controls on social cognition measured with the MSCEIT, but we assume that difficulties in interactions and social situations might be reflected in number of friends and few engagements in romantic relationships. Information on relational functioning is not available for the control group, and thus this possible interpretation remains a speculation.

Another aspect that might support our interpretation of the reported relational functioning could be the level of anxiety and depression often experienced by patients with schizophrenia. These affects are included as negative symptoms measured with the PANSS. The mean score on the scale of negative symptoms in our patient group is within the 40th percentile according to a sample of 101 patients with schizophrenia, indicating that these symptoms are present in a mild to moderate degree in our patients (Kay et al., 1987). Withdrawal could also be influenced by scores on positive symptoms such as paranoia, which are included in the scale of positive symptoms in the PANSS. The patient group in our study has a mean score within the 55th percentile according to the same sample, indicating a moderate degree of positive symptoms. These scores might reflect the difficulties in daily functioning, particularly in terms of relational functioning.

Moreover, personality dispositions might be another explanation to consider. Introversion and neuroticism can be part of the motivation why some people choose to stay in environments with fewer stimuli than others. Research also supports that these personality traits might play a part in the social withdrawal in individuals with a diagnosis of schizophrenia (Berenbaum & Fujita, 1994).

The small sample of patients in our study makes it difficult to generalise, and we do not know if our patient group is representative for the entire patient population suffering from schizophrenia. As previously mentioned, several were hospitalised at the time of testing, and this probably affected the information obtained on daily functioning. We assume that the patients with relatively preserved daily functioning also demonstrate few neurocognitive deficits. However, since we do not have access to Norwegian norms and therefore lack composite scores, it is difficult to examine these correlations. Variables of daily functioning will be interesting to study over the course of time, both isolated and in relation to neurocognitive functioning, to give a more detailed description of this patient group.

Limitations of the present study

Several limitations should be discussed in relation to the findings of our study. First of all, the low number of participants due to the fact that the recruitment of subjects to the main study is still in progress, must be considered. However, when doing research on this patient group one must consider the prevalence of persons suffering from this mental illness, which is believed to be stable across different populations and cultures, at approximately 1 % of the total population (Combs & Mueser, 2007). Furthermore, another selection criterion in our study is that the psychosis must be the first experienced by our participants, which limits our possible selection even further, since the annual incidence rates of schizophrenia has been found in the range of 0.16-0.40 pr 1000 population (Jablensky, 2000). Geographical limitations, in form of the small size of catchment area of the main study, is another factor contributing to a low number of participants. Recruitment from other regions than the south-eastern part of Norway, would be both time consuming and economically unfeasible. Keeping this in mind, a low number of participants in the patient group should be expected, and if this group is to be studied, one must proceed with the research despite the low number of possible participants. To sum up, at this stage the small sample hampers the possibility of drawing

conclusions and making generalisations, but the research will nevertheless provide us with valuable information on the particular group in focus.

According to the main purpose of this thesis, we expected differences to be discovered on all subtests measured with the MCCB. Reasons why differences were not detected on all subtests might be due to a number of factors. However, the most plausible explanation for not discovering expected differences in all neurocognitive tests seems to be the low number of participants. More participants in the patient group would strengthen the statistical power of the analyses and the confidence with which conclusions could be made. Moreover, there would be a reduced risk of randomised influence on the results, as well as decreased impact of statistical outliers and extreme scores. Therefore we must be careful not to underestimate the sensitivity of the subtests that did not reveal significant differences between patients with schizophrenia and healthy controls.

The use of raw scores in our data analyses makes it impossible to compare both patient group and control group with others of the same age. A lack of standardised data also prevents the use of composite scores, which is thought to be more ecologically valid measures and show higher correlations to functional outcome than single neurocognitive measures (Green, 1996). A sum of several neurocognitive domains probably generates a more reliable basis for generalisations and more accurate assumptions concerning everyday life and daily functioning.

A further limitation following the use of raw scores is being unable to control for premorbid intellectual abilities, by using WAIS-III scores as a control variable when examining differences in neurocognitive functioning between patients and controls. This would have been an advantage, providing more detailed information and facilitating a more precise conclusion. Perhaps large individual differences were present both within the patient group and between patients and controls, before the onset of illness. Despite this, Holmén et al. (2009) argue that an accurate measure of premorbid intellectual abilities will not be available after the onset of illness. Also, the prodromal phase and the development of schizophrenia are known to be gradual, and it is often difficult to determine the exact time of onset (Møller, 2005). Studies show that individuals suffering from schizophrenia display signs of neurocognitive deficits already at an early age (Bilder et al., 2006; Erlenmeyer-Kimling et al.,

2000). With this in mind, the validity of measures of premorbid intellectual abilities is questioned and the disadvantage of our study's lack of such measures seems less significant.

If composite scores were available, we would also have examined the correlation between neurocognitive functioning and duration of psychosis. As described in table 1, duration of psychosis varied from four weeks to five years, which could possibly have affected performance on the MCCB. However, Rund et al. (2007) discovered that the duration of psychosis was not related to neurocognitive functioning in schizophrenia, implying that other analyses than the correlation between neurocognition and duration of psychosis would be of greater interest. Furthermore, an analysis of the correlation between degree of symptoms, measured with the PANSS, and composite scores from the MCCB, would be desirable, but not possible, since we do not have access to composite scores.

Psychopharmacological treatment is a factor with possible influence on neurocognitive performance in the patient group, potentially affecting our results. All but one patient received psychopharmacological treatment at the time of testing, and consequently a comparison between medicated and non-medicated individuals within the patient group is hampered. Thus, we are not able to determine if an influence of medical treatment is present, and if so, the value of this influence.

A risk following the use of self-report scales, such as the CD-RISC, the HHI, and the GSE, could be that the scores might be influenced by a psychotic state of mind and therefore be vulnerable to the patient's degree of insight. The reliability of self-reports may be strengthened if the patient's state is stabilised and the positive symptoms are repressed with antipsychotic medication.

Another limitation that should be discussed is the basis for comparison on the CD-RISC, the HHI, and the GSE. As mentioned in the method section in this thesis, researchers have discovered norms for comparison in the general population for these instruments. In addition, a mean of outpatients with mental illness, such as depression and anxiety, is used in relation to the CD-RISC. However, the groups used for comparison are not matched with our patient group, and potentially influential variables are not controlled for, such as gender, age, and severity of illness. Also, these measures have not been used on populations suffering from

schizophrenia, and therefore no comparisons matched on the diagnosis are available. Moreover, we do not know if these measures are useful in revealing information on individuals with schizophrenia and their path towards recovery.

It is assumed that a control group whose participation is dependent on their own initiative, i.e. answering an advertisement, will be motivated in a different way than the patient group. These motivational differences are thought to affect the performance of the control group. In addition, volunteering controls often have another level of socioeconomic background than the patient group, which in turn may affect their performance.

Clinical implications and future research

In spite of these limitations, the study reveals several significant neurocognitive differences between the groups, corresponding to five distinct neurocognitive domains. Hence, this could be seen as supporting the use of the MCCB in detecting differences between patients and controls. Our data support the intended purpose of the test battery, namely that it could serve as a useful and appropriate tool in discovering neurocognitive impairments in patients suffering from schizophrenia. We predict that the MCCB will prove to be a helpful instrument for both researchers and clinicians in Norway, not only to elucidate impairments and resources, but also to help professionals adjust interventions and improve the patients' daily functioning.

As discussed in this thesis, heterogeneity in terms of neurocognition is common in the patient group. Assessing each individual who receives a diagnosis of schizophrenia with a cognitive test battery, like the MCCB, will have implications for treatment, and important information concerning the potential utility of interventions may be discovered. A thorough neuropsychological examination will disclose both the patient's resources and deficits. Thus, clinical use of the MCCB will aim at transforming the test results into practical information, developing and implementing helpful strategies, and thereby facilitating optimal neurocognitive and daily functioning in patients with schizophrenia despite their diagnosis. Patients may experience a more successful adaptation and integration to society with help of interventions in their daily life, on the basis of the neuropsychological assessment.

Information obtained on daily functioning illustrates heterogeneity in the patient group in our study, indicating the possibility of somewhat preserved abilities to function in everyday life after the onset of psychosis. Due to methodological inconsistencies, conclusions cannot be made. Still, in relation to the concept of recovery, which now includes social adaptation, working abilities, and daily functioning, as well as decrease in symptoms (Frese et al., 2009; Liberman et al., 2002), a description of this patient group in terms of daily functioning is useful.

Our study has used preliminary data that are part of a longitudinal study following patients for ten years. At baseline level, it is not possible to predict outcome or to draw conclusions concerning the process of recovery. When the data collection is complete and standardised scores of the Norwegian population are available, reliable information on the course of schizophrenia will enable the identification of possible predictors of recovery. On the basis of the heterogeneity in degree of impairment discovered in our study, we expect the patients showing few signs of neurocognitive impairments to have a more positive prognosis than those who struggle. In other words, neurocognition could be identified as a protecting factor, if a correlation between neurocognition and recovery exists.

Furthermore, we assume that resilience, hope, and self-efficacy, will covariate with recovery. Indeed, some researchers have discovered that the hope contributing to recovery is in fact the individual's own belief that recovery is possible (Jacobson & Greenley, 2001). This implies a responsibility for health care workers of inducing hope that recovery is possible when an individual receives a diagnosis of schizophrenia. More research on such concepts and their correlation to recovery will provide professionals with information on characteristics of persons who recover. In addition, more accurate predictions on outcome will be available, and interventions in therapy may be tailored accordingly.

Conclusion

We discovered significant differences between patients with schizophrenia and healthy controls on several neurocognitive subtests of the MCCB. Moreover, heterogeneity in the patient group was discovered on degree of impairment in neurocognitive functioning, as well as on variables of daily functioning. Our thesis examining measures of neurocognition, resilience, hope, and self-efficacy, and information of daily functioning, is yet another

scientific contribution concerned with promoting recovery and enhancing quality of life in patients with schizophrenia. Researchers aim to improve functional outcome by discovering modifiable factors facilitating recovery, founded in the reformed, multifaceted concept of recovery. This positive approach provides patients, relatives, and professionals with hope and motivation to continue the struggle towards a life of physical, mental, and social well-being for individuals with a diagnosis of schizophrenia.

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