"Cognitive Impairment and Outcome in Schizophrenia"

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ABSTRACT

Objectives: The main focus of this study was the investigation of cognitive dysfunction in schizophrenia, specifically memory and executive impairment, and the link this has with outcome in the illness. The hypotheses being that both memory impairment and executive dysfunction would be demonstrated and that cognitive dysfunction would be linked to outcome. An attempt was also made to replicate Liddle et al's (1987) finding of three syndromes of schizophrenic symptoms (Psychomotor Poverty, Reality Distortion and Disorganisation) and linking two of these factors to executive dysfunction.

Design: A group of 70 patients with schizophrenia at varying stages of the Rehabilitation process completed a neuropsychological battery of assessments including tests of memory and executive function. Correlational analyses were carried out on results. A between group comparison of "successful" versus "unsuccessful" outcome in schizophrenia with 15 patients in each group was also carried out.

Results: Memory impairment and executive dysfunction were found to be present and were disproportionately pronounced compared to overall level of cognitive impairment. The hypothesis that cognitive impairment would be linked to outcome was also substantiated in the between group analysis investigating "successful" versus "unsuccessful" outcome where two measures of executive assessments were demonstrated to be the best predictors of outcome. Finally, three Factors were identified through factor analysis, which corresponded closely to Liddle et al's (1987) 3 syndromes of schizophrenia. The hypothesis that the two Factors corresponding to Liddle's Psychomotor Poverty and Disorganisation would be linked to executive dysfunction was not supported.

Conclusions: This study supports the increasing recognition that neuropsychological deficits are an integral part of schizophrenia and significantly associated with outcome in the illness. This has led to the development of cognitive remediation strategies with the aim of improving neurocognitive deficits to aid the rehabilitation process.

Declaration:

This thesis has been composed by myself

and the work contained herein is my own.

Signed:

Oonagh F. Williamson

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their time.

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1.0 INTRODUCTION

This study reflects the expansion in the literature regarding cognitive impairment in schizophrenia and its relation to functional outcome, specifically:

1. The increased recognition that cognitive impairment is an integral component of the disorder

2. The growing evidence linking neuropsychological dysfunction to outcome

3. The resulting enhancement of cognitive remediation therapies

4. The recategorisation of the symptoms of schizophrenia into syndromes and linking these to cognitive impairment.

History and Theories of Schizophrenia

Towards the end of the Nineteenth Century Emil Kraepelin suggested that the term "dementia praecox" be used to describe a certain form of mental illness, which started in adolescence or early adulthood and followed an inexorable downhill course. He divided the functional psychoses, manic-depressive illness and dementia praecox, in terms of their prognosis. That is, the two groups were distinguished by whether or not they recovered completely. Eugen Bleuler expanded and elaborated on the notion of "dementia praecox" coining the term "Schizophrenia", meaning 'split mind'. He proposed that people with schizophrenia shared four fundamental symptoms: A) loosening of association, B) autism, C) ambivalence, D) disturbances of mood. Unlike Kraepelin's diagnosis by prognosis, Bleuler diagnosed the illness by the symptomatology. His 1911 monograph was so influential that within a generation Kraepelin's original term was discarded with the term "Schizophrenia" still recognised today as the most debilitating, chronic, psychiatric disability.

Approximately 1 % of individuals in western countries can be expected to be labelled "schizophrenic" at some time in their lives (Torrey 1987).

1.1.1 Aetiology

There have been many hypothesised theories and causes of schizophrenia over the years ranging from the mainly biological in nature such as genetic endowment (Gottesman & Shields 1982), abnormalities of brain structure or biochemistry (Green and Costain 1981) to the more psychosocial explanations such as family structure (Bateson et al 1956) and life events (Brown & Birley 1968). In fact, almost every variable known to affect human behaviour has been held to be important in the aetiology of the illness at some time or other (Bentall 1990). The exact cause of schizophrenia, however, remains elusive.

A genetic component to the illness of schizophrenia has been proposed since the time of Kraepelin (1913). Schizophrenia is known to run in families with a risk of 12.8% to children of a schizophrenic parent Gottesman (1991). This is compared to 1% in the general population. Adoption studies support a support a biological explanation rather than psychosocial influences (Heston 1966). It is unknown, however, how much genes contribute to the cause of schizophrenia although studies are recognising which particular chromosome regions are involved, of which there appear to be several. (Blackwood 2001).

Over the years, there have been several attempted explanations as to the aetiology, and also doubt as to the existence of the illness known as schizophrenia. Kraepelin and Bleuler both took a neurological approach believing the illness to be biological in nature and commented on a "disease of the brain". Kraepelin, in fact, saw himself more as a neurologist than a psychiatrist.

Over the last 100 years there have been certain trends in the main approaches to describing and explaining the aetiology of schizophrenia. The simplest model of schizophrenia is the traditional psychiatric "disease model", in which schizophrenia is thought to be an illness or disease with an as yet unidentified biological cause (Cutting 1985).

After the biological hypotheses in the early part of the century, psychoanalysts began to describe the illness in terms of anxiety. In the 1960's the writings of Laing and Szasz took a more social approach with Szasz (1961) proposing that "it simply does not exist" and Laing (1959) stating that schizophrenia was a "rational way of coming to terms with an insane world".

In the 1970's cognitive information processing models of schizophrenia and research designed to investigate these areas came to the fore with the common factor being that a deficit exists in the cognitive repertoire of the patient. The proposed key impairment in cognitive functioning would typically involve one or more of the main functions such as memory, attention, perception etc.

In the 70's and 80's, Stress-Vulnerability models (Zubin & Spring 1977 and Neuchterlein and Dawson 1984) made a significant impact on research into schizophrenia. These Vulnerability models provided a multifactorial account of the processes determining risk and relapse within schizophrenia. The Zubin and Spring (1977) model views schizophrenia as being an episodic disorder in contrast to Kraepelin (1913) who portrayed schizophrenia as a continuing disease process leading almost inevitably to a chronic disorder.

A fairly recent controversial proposal regarding the non - existence of the concept of schizophrenia, comes from Richard Bentall (1986). He believes that schizophrenia is not a meaningful scientific concept and that it should therefore be abandoned. Instead, he proposes that particular symptoms should be investigated. His work has received support from others such as Boyle (1995) who argues that schizophrenia research is in a degenerating phase. When research is in this phase, she argues using ideas from the philosophy of science that alternative research should begin and that there should be a move away from traditional 'schizophrenia' research.

1.1.2 Neurodevelopmental Model of Schizophrenia

Despite the above criticisms of traditional schizophrenia research, there has been a return by many scientists to biological theories of schizophrenia, which also take into account cognitive factors. Weinberger (1987), for example, supports a neurodevelopmental model to explain schizophrenia whereby a "fixed lesion" from early life interacts with normal brain maturation events that occur much later. This definite biological emphasis is indicative of the return to biological theories of schizophrenia. The neurodevelopmental model implies a genetic and environmental vulnerability to schizophrenia. The vulnerability changes depending where the person is along his/her developmental lifespan with late adolescence being the most critical time period. Vulnerabilities such as cognitive deficits in childhood, for example abnormalities in attention, may then result in a developmental delay that increases with age in those at risk for the illness. Environmental causes may include in utero viruses, food deprivation or injury during birth.

The proposal is that the development of schizophrenia is the result of an early brain Insult, either pre or perinatally which affects brain development leading to abnormalities which show up in a mature brain (Murray 1992; Bloom 1993). Evidence for this model is growing. In a meta-analysis of 40 MRI studies of brain imaging by Lawrie et al (1998) a variety of abnormalities were found in brain structure. For example increased volume in the lateral ventricles was found in both left (44%) and right (36%) ventricles and volume reduction in the temporal lobes (16%) and the amygdale/hippocampus (12%).

These abnormalities were found in newly diagnosed as well as in chronic schizophrenia and are, therefore, thought to be neurodevelopmental in origin rather than neurodegenerative. They appear to be non- progressive (Delisi et al 1991;Jaskiw et al 1994).

It is also argued that in schizophrenia there is a tendency for failure to develop normal cerebral asymmetries (Crow et al 1989; Falkai et al 1995). Normal brain symmetry is formed during the second trimester of gestation, which suggests that some pathological event interferes with this stage of development (Bartley et al 1993). There are also subtle abnormalities in childhood, which are described as evidence for the neurodevelopmental model such as low set ears to soft neurological signs including abnormal gait and epilepsy (Aylward et al 1984). Schizoid personality traits in childhood are also pointed as risk factors for development in the illness (Jones et al 1994).

The interaction of genetic vulnerability leading to brain abnormality with environmental risk factors pre or post-natally may be the route by which the illness develops (Holtam 2002). There are still criticisms regarding this model, however, including the question of delayed onset until the second or third decade of life. The illness remains dormant until this time and it is not clear how or why this happens. Holtam (2002) argues that further research is required regarding the understanding of brain development and maturation to provide further evidence for the neurodevelopmental model.

1.1.4 Cognitive Impairment and Early Predictors

Further evidence for the neurodevelopmental model in schizophrenia comes from research into cognitive factors in the illness. Historically, it was believed that cognitive dysfunction only affected the chronically ill population. It is now apparent that this is not the case and that cognitive dysfunction is present at all stages of the illness and that it may also pre date the onset of the disorder itself (O'Carroll, 2000; Liddle, 2000). Several studies now demonstrate that cognitive impairment such as low intelligence and verbal deficits in particular can be detected in childhood before development of the illness. Jones et al (1994) in their analysis of over 5000 people born in March 1946 and followed up through the UK National Survey of Health and Development, found that those who had not gone on to develop speech by the age of 2 were five times more likely to develop schizophrenia. David, Malmberg & Brandt (1997) investigated a 50,000 sample of conscripts to the Swedish army between 1969-1970 where cognitive function tests were carried out. Almost 200 conscripts went on to develop schizophrenia at some point in their lives and low IQ and poor verbal function were shown to be clear risk factors for the development of schizophrenia. Byrne et al (1998) measured cognitive function in a group of young people whose siblings had gone on to develop schizophrenia. Significant cognitive dysfunction in the form of executive impairment as measured by The Hayling Sentence Completion Test was found to be present in the group compared to controls.

The question is then posed that if this is the case, is cognitive impairment part of the neurodevelopment of the disorder and may it in fact be one of the causative factors of the illness? The suggestion that cognitive deficits may be a causative factor in the development of schizophrenia is an interesting point as cognitive impairment may lead to development of false ideas, beliefs and perceptions. Frith's (1992) neuropsychological model relating symptoms to cognitions has been received with great interest. He suggests that failures in self monitoring of willed intentions occurs in schizophrenia with the person no longer being aware that perceptions, thoughts and actions are self generated and instead attributes these activities to forces outside the self. Frith (1992) also suggests that negative signs such as poverty of speech and action are caused by a cognitive defect, that is, a disconnection between goals/plans (an executive function) and the generation of willed intentions.

1.2- Reliability and Validity of the diagnosis of Schizophrenia

The reliability of diagnosing the illness has improved greatly since the introduction of assessment systems such as ICD-10 and DSM-IV. At present, for a diagnosis of schizophrenia to be made according to DSM-IV, the following criteria have to be met:

A) Characteristic Symptoms. Two or more of the following symptoms; delusions, hallucinations, disorganized speech, grossly disorganised or catatonic behaviour, negative symptoms.

B) Social or Occupational Dysfunction.

C) Duration – for at least 6 months. D)

D) Schizoaffective and Mood Disorder exclusion

E) Substance/general medical condition exclusion.

Use of the Present State Examination in research situations has shown levels of agreement for the diagnosis of schizophrenia rising above 90% (Wing et al 1974). However, the validity of the concept is much less impressive. This refers to the meaningfulness or usefulness of the diagnostic categories, as judged by other criteria e.g. the symptoms should correlate with each other and it should be possible to predict the course and outcome of the illness (Bentall 1990). This is not the case with schizophrenia and is one of the reasons why authors such as Bentall(1986) and Boyle (1994) and others have doubts as to the existence of schizophrenia as it is now classified.

In defence, however, it can be argued that the course of many illnesses cannot be predicted, for example depression, but this does not make it an invalid concept.

Although many would admit to there being some doubt with regards to the validity of the diagnosis of schizophrenia, it may be necessary to continue to have a diagnostic category at present until something better can be devised to replace it. Kendell (1975) comments that we continue to use this system, if only because it is familiar and we have nothing better to put in its place.

It is clear that an illness such as schizophrenia is the most feared, and the most fascinating, and it is the model for the layman's concept of madness. It causes great suffering not only to the patient but to the lives of the families it touches, and also puts a huge burden on the health services. Therefore, it is necessary to continue to explore this distressing illness in all ways, in order to discover answers and possible ways of relieving the distress of the illness.

1.3- Cognitive Function in Schizophrenia

It has been recognised that deficits in cognitive function have been a part of the illness from the time of Kraepelin and Bleuler in the early twentieth century. The cognitive deficits which were noticed were particularly in those who suffered from chronic schizophrenia residing in institutions or hospitals and this has had increased recognition in more recent years also. The cognitive functioning generally measured was intellectual functioning and in the chronically ill patients which was often found to be substantially lower than in the general population (Nelson et al 1990; Crawford et al 1992).

1.3.1- Neuropsychological Approach to Schizophrenia

Although general intellectual and cognitive impairment have been demonstrated in schizophrenia in the literature (e.g. Johnstone et al 1976), a more interesting view is that it would prove more fruitful to follow a neuropsychological approach which looks at specific neuropsychological functions, gaining information not just about the level of impairment but also about the type of impairment. These are then linked to specific brain regions. Using this method of study, it is then possible to investigate impairments linking these impairments to specific sites in the brain, which may play a part in the illness. This would seem to be the approach of choice of most investigators today. However, it is important not to overinterpret results as errors can be made when trying to specify sites in the brain when in fact impairment may be the result of an overall decline in cognitive ability. Specific impairments must be shown to be present over and above an overall decline, that is, disproportionate deficits.

1.3.2 Specific Neuropsychological Impairment in schizophrenia

Discussion has emerged regarding the specific picture of neuropsychological impairment existing in schizophrenia with 3 main areas emerging as affected with attentional deficits, memory dysfunction and executive impairment demonstrated as the main rate limiting factors in the illness (Green et al 2000). This study will focus on two of these areas, namely memory and executive function.

1.4 Memory

The way in which the function or systems of memory is affected in schizophrenia has been increasingly recognised in the literature.

1.4.1 Memory Theory

Memory does not represent a single system, but is rather a complex combination of memory subsystems (Baddeley 1986). From the work of Atkinson and Shiffrin (1971), this can broadly be divided into three systems:

A) a brief set of sensory memory stores

B) a short term working memory, which is responsible for holding information temporarily (up to 30 seconds)

C) a long term memory store, which is responsible for retaining information to years. This can then be further divided into visual and verbal memory, and, semantic and episodic memory. Semantic memory is concerned with the memory of knowledge eg, the Capital of Spain. Episodic memory is more autobiographical in nature eg, remembering a holiday, what clothes you were wearing yesterday etc.

1.4.2 Memory Impairment and Schizophrenia

Previously, it was believed that memory remained relatively unaffected in schizophrenia apart from in chronic, institutionalised patients. Both Bleuler (1911) and Kraepelin (1919) believed this to be the case: For example,

"Memory as such does not suffer in this disease" - Bleuler (1911)

More recently, several authors have stated that memory remains intact in schizophrenia. Cutting (1990) reported that'

"There is no evidence whatsoever that schizophrenics have an amnesic syndrome"

Others would disagree with the above statements. In the same year as Cutting reported no evidence for an amnesic syndrome in schizophrenia, ironically a study by McKenna et al (1990) found exactly that. They discovered a pattern of memory impairment in their heterogenous group of 60 patients with schizophrenia. They found that memory impairment was common and that these impairments were "sometimes substantial and disproportionately pronounced compared to the degree of general intellectual impairment". What is more, the pattern of impairment was reported to resemble that found in the Classic Amnesic Syndrome such as in those suffering from Alcoholic Korsakoffs Syndrome. That is, wide-ranging deficits were found in long term memory with short term memory remaining intact.

In the McKenna et al study (1990) the Rivermead Behavioural Memory Test was used which is an ecologically valid measure of episodic memory impairment. Another advantage of this assessment tool is that performance is largely independent of intelligence (Wilson et al 1985). However, criticisms of the study have commented on the rather brief and crude tests of intellectual functioning such as the Mini Mental State Examination (Folstein et al 1975) and the MEAMS (Golding 1989). The authors state that although these tests are rather crude they are well standardised and validated.

Duffy & O'Carroll (1994) aimed to replicate the McKenna et al (1990) study and found that episodic memory impairment was indeed present in the heterogeneous group of patients with schizophrenia and that this was also disproportionate to the degree of general cognitive functioning. The degree of memory impairment they found was not attributable to medication (neuroleptic or anticholinergic) or degree of motivation or cooperation. They discovered also, however, that an Alcoholic Korsakkoffs Syndrome group had a far greater degree of episodic memory impairment than the schizophrenic group and that the schizophrenic group had significantly poorer performance on a test of semantic memory than the AKS group.

Several studies have been carried out since these papers appeared which apparently put force behind the claim that memory is in fact disproportionately impaired in people with schizophrenia. Lawrie et al (1995) demonstrated that memory dysfunction was associated with poor psychosocial outcome in schizophrenia. This study investigated good versus poor outcome in schizophrenia, comparing performances on several neuropsychological tests. After controlling for educational differences, the only significant measure left, which correlated with poor outcome was episodic memory dysfunction. This would indicate that those who are long stay patients or labelled "chronic" schizophrenics are more likely to have significant memory problems and this finding has implications for the management of schizophrenia, particularly for those who are in rehabilitation settings.

It is generally conceded, however, that memory impairments are prevalent in schizophrenia and not just in the chronically ill population but at all levels of the illness. Riley (2000) found that memory impairment was prevalent in a group of first episode, acutely ill patients. Heinrichs and Zakenis (1998) in a meta-analysis of neuropsychological impairment in the illness found global verbal memory deficit to be prevalent as well as a host of other cognitive deficits. Aleman et al (1999) also carried out meta-analyses on 70 studies looking particularly at memory impairment and found a stable association between schizophrenia and memory impairment.

They stated that the memory impairment was "wide ranging and consistent across task variables such as level of retrieval support (free recall, cued recall, or recognition), stimulus type (verbal versus non verbal), and retention interval (immediate versus delayed)". Both meta-analyses demonstrated moderate to large effect sizes for the impairments discovered.

Specific studies demonstrating deficits vary, from visual and spatial deficits (Rushe et al 1999), deficits in some aspects of short-term memory and, explicit long term memory (Keri et al 2000), verbal memory (Goldberg et al 1993, Addington & Addington 1999). Explicit memory relies on conscious recollection and can be explicitly stated through language as opposed to implicit memory, which occurs outside conscious awareness (e.g. how to perform certain tasks) and appears to remain intact in schizophrenia (Kern et al 1997). Impairments in remote memory, autobiographical memory, learning of new material (recall and recognition), have all been shown to be impaired in schizophrenia (Aleman et al 1999).

1.5 Executive Function

Executive function involves the frontal lobes of the brain and involves multiple processes such as the ability to plan and organise, reasoning, ability to change from one task to another, inhibition of responses, involvement in working memory, goal formulation, etc. In fact, executive function is involved in numerous activities, which cover the highest human functions of thought and intellect.

Shallice (1988) proposed the model of a Supervisory Attentional System (SAS), which is the higher order component of a 2 tiered information processing system. The lower level component is called the Contention Scheduling System (CSS), which operates automatically and is modulated by the SAS. The CSS is involved in routine, automatic activities such as driving whereas the SAS is involved in new or less routine tasks, which are under deliberate and conscious control e.g. inhibiting inappropriate action, shifting attention or new responses.

The thought that a "dysexecutive" syndrome may exist with the frontal lobes primarily being affected has long been believed. The term "dysexecutive syndrome" was first proposed by Baddeley (1986) as a functional characterisation of the variety of deficits traditionally grouped under the heading "frontal lobe syndrome".

1.5.1. Executive Function and Schizophrenia

The study of executive functioning in relation to schizophrenia has been well documented. The frontal areas of the brain have been implicated in schizophrenia since the time of Kraepelin (1913) and Bleuler (1911) who believed that the illness might attack, by preference, the frontal areas of the brain. Recent research has again begun to concentrate on this line of thought with numerous studies specifically investigating executive functioning of the brain with regards to schizophrenia.

Numerous studies have consistently demonstrated executive dysfunction in schizophrenia. Nopodolous et al (1994) used the Stroop Test and demonstrated executive impairment and Byrne et al (1998) used the Hayling Test to assess executive dysfunction with significant results. Assessments such as the Wisconsin Card Sort Test have frequently been used to measure executive function, and several studies have been carried out using this test, which has been claimed as specifically sensitive to frontal lobe lesions (Heaton 1981). Weinberger et al (1986) used an automated, computerised version of the WCST and found that the patients were impaired on this task and failed to activate the dorsolateral prefrontal cortical function. However, the question as to whether this result is evidence of executive impairment or if the dorsolateral prefrontal cortex was not activated simply because the schizophrenic group could not carry out the test remains unanswered.

Goldberg et al (1987) and Goldberg & Weinberger (1989) also found evidence supporting involvement of the frontal lobes of the brain in schizophrenia. This evidence has been related to the clinical picture of schizophrenia where it has been suggested that the negative symptoms of schizophrenia represent deficits in executive functioning (Andreason 1989).

Executive dysfunction has also been found to be present at all stages of the illness, not just in the chronically ill population. Riley et al (2000) investigated the neuropsychological picture of the disorder at the acute stage of the illness in first episode patients. They found impairment in both executive function and memory.

That the variety of testing materials used in research do not necessarily tap into the same aspects of cognition has been widely cited as an explanation for the different patterns of impairment reported in the literature. This includes tests apparently measuring the same cognitive function. For example, executive function covers such a large area of ability that most tests of executive function measure different aspects. The MSET (Modified Six Elements Test) and the WCST (Wisconsin Card Sort Test) are a case in point. The WCST measures speed of function and inhibition of an established response whereas the MSET is an ecologically valid measure of executive function assessing planning skills, scheduling and switching between activities over an extended period of time. Executive tests tap into a variety of cognitive functions which overlap but which are nevertheless diverse and therefore require to be investigated independently.

Although many studies have demonstrated deficits in executive functioning using tests such as the WCST, these studies have not always managed to separate out the effects of generalised cognitive impairment. Robinson et al (1980) believes that the WCST shows deficits of a more generalised nature. Some have, however, attempted to partial out these effects with conflicting results. Saykin et al (1991) found no evidence of selective executive impairment whereas Crawford et al (1993) discovered a disproportionate deficit in verbal fluency performance. One possibility is that this "mixed bag" of results may be due to the insensitivity to some aspects of executive functioning of current executive tests like the WCST.

Shallice & Burgess (1991), commenting on the limitations of current tests of executive functioning, stated that " the patient typically has one single problem to tackle at any one time, the trials tend to be short, task initiation is strongly prompted by the examiner and what constitutes successful trial completion is clearly characterised". In an attempt to overcome these limitations, Shallice & Burgess (1991) developed the Six Elements Test, a test purportedly more sensitive to everyday executive problems. This test requires patients to plan and organise their activities in order to carry out 6 tasks in a limited time period of 10 minutes without breaking certain rules. This test has been found by the authors to be sensitive to the everyday dysexecutive problems experienced by 3 head injured patients.

Evans et al (1995) have carried this research further by compiling a battery of assessments, which test everyday executive problems. Included in this battery of assessments called the "Behavioural Assessment of the Dysexecutive Syndrome (BADS)" is a modified version of the Six Elements Test and 7 other tests, which assess the deficits reflecting the difficulties patients have in daily life situations. The performance of 31 schizophrenic subjects on the "BADS" was compared with that of 35 brain-injured subjects and 26 controls. They also looked at the ability of the BADS to identify a specific impairment that is present over and above any coexisting general intellectual impairment.

The schizophrenic group were found to perform more poorly on the "BADS" than the control group and the suggestion was that for some of the schizophrenic group there was evidence of impairment in executive functioning, which was not just a consequence of a more generalised cognitive impairment.

The attempt by Shallice & Burgess (1991) and Evans et al (1995) to develop novel assessments of executive functioning is very welcome, particularly in view of the fact that the Six Elements Test and Modified Six Elements Test are designed to specifically look at the kind of everyday problems that may affect patients in daily life. Obviously, this has more ecological meaning than some of the more laboratory based assessments, which have no bearing or relevance to the patient being tested, or to staff.

The practical implications of assessments looking at everyday executive problems will have impact on rehabilitation programmes, in that staff and patients alike can readily recognise what problems the patient may-have in organising and planning his/her life, for example, and attempts to remedy the situation can then begin on the basis of the practical information gained from the test. This is particularly important with regards to community care.

This study is using three measures of executive function, which tap into different areas of the executive system. The MSET because it is an ecologically valid test has been chosen and taps into planning and organisational abilities as already mentioned. The Hayling Test and the Emotional sentences Completion Test tap into different areas of executive function including basic task initiation response, ability to shift cognitive set and inhibit inappropriate responses.

1.6 Single Case Methodology

A more radical approach to the investigation of schizophrenia has been has been proposed by Shallice et al (1991). He suggested that the single case study approach would be more fruitful in reaching conclusions about causality of schizophrenia than the present approach concentrating mainly on between group studies because of the problem of heterogeneity. He carried out the neuropsychological case study approach on 5 people with the illness who were chronically hospitalised. Strong evidence was found for executive deficits which were present in the subjects against a background of no, some or a great deal of general intellectual impairment.

It may be that this single case study approach has potential in schizophrenia research, particularly with regards to the heterogeneity of the illness. However, in attempting to establish general relationships between neuropsychological status and outcome, group studies clearly will continue to play an important role.

Evidence for impairment in memory and executive functioning using a neuropsychological approach can be seen to be readily available. Researchers tend to concentrate on one area of study or the other (for example, memory systems or executive functioning). It would appear that both areas have a part to play in such a heterogenous illness as schizophrenia. The present study intends to investigate both areas using ecologically valid measures which test everyday problems faced by patients in daily life and which also have meaning for those involved in the process of psychiatric rehabilitation.

1.7 Effects of Medication on Cognitive Functioning

The effect of medication on cognitive function has been debated for some time. Frith(1984) reported that anticholinergic drugs impair memory under experimental conditions, but deficits are not commonly observed at the doses used in psychiatric practice. The question of the deleterious effects of long-term use of neuroleptics continues to be debated (Kirkpatrick et al 1987). McKenna et al (1990) stated that the memory impairment they found was not easily attributable to neuroleptic or anticholinergic medication, with no correlations found in their study between medication and level of memory impairment. Others have also commented that no relationship has been found between the presence of general intellectual impairment and lifetime neuroleptic exposure (Owens & Johnstone 1980).

A study by Saykin et al in 1991 provides further evidence that medication may not have an effect on cognitive functioning in patients with schizophrenia. In the study, 36 acutely ill, young and unmedicated patients with schizophrenia were given a battery of standardised neuropsychological tests. Results showed selective deficits in memory and learning compared with other functions. The subjects in this study had been medication free for between 2 weeks and 10 years. It can therefore be surmised from the results of this study that the deficits found in the McKenna et al study (1990) are unlikely to be due to the effects of medication.

More recently, Saykin (1994) discovered deficits in verbal learning in a group of first episode never medicated patients with schizophrenia and in a group of unmedicated previously treated patients with schizophrenia giving further support to his previous study regarding the presence of memory impairment in schizophrenia independent of medication effects.

In a follow up paper to that of McKenna et al (1990), Tamlyn et al (1992) carried out an intensive study into 5 subjects. They found that memory impairment was prevalent and that this was not easily attributable to medication, cooperation, attention or motivation. However, they did find that degree of impairment was related to chronicity, severity, negative symptoms and thought disorder. Nevertheless, memory impairment was also found across a wide range of subjects and not just in those who were chronically or severely ill.

1.7.1 Medication and the newer atypical antipsychotics

An interesting development in the medication debate is the effect of the newer atypical neuroleptics such as clozapine, olanzapine and risperidone upon cognitive dysfunction, which some studies have demonstrated to be beneficial to neuropsychological function, improving attention, working memory and executive function. For example, Green and colleagues (1997) investigated a group of 59 treatment resistant patients with schizophrenia and assessed verbal working memory. Risperidone was demonstrated to be significantly superior to haloperidol in its effect on this particular cognitive function. Another study by Purdon et al (1998) compared the effects of olanzapine, risperidone and haloperidol on cognitive function. Risperidone was found to significantly improve global cognition, new learning and verbal memory and olanzapine was shown to significantly improve, from baseline measures, global cognition, new learning, attention, motor, executive function and non-verbal memory. Haloperidol, however, was found to have modest effects on attention only. Caution must be taken whilst interpreting these results however as it has been suggested that the improvements in cognitive function may be attributable to the wash out of previous drug regimes (Sharma, 1999).

The mode of action of these newer antipsychotics such as olanzapine, clozapine and risperidone in improving cognitive function may involve the NMDA system (glutamate/N-methyl-D-aspartate). Glutamate is the major excitatory neurotransmitter in the mammalian brain and it appears to play an important part in learning, memory and other neuropsychological functions (Breier 1999). Using this "bottom up" approach Breier (1999) suggests "a better understanding of the underlying causes of cognitive impairment may contribute to elucidating the pathophysiology of schizophrenia and the development of more efficacious treatments for this disorder".

1.8 - Reclassification of Schizophrenia into Syndromes

Attempts to recategorise the symptoms of schizophrenia has also led to evidence regarding the executive role in the disease.

Crow (1980) was one of the first to attempt to recategorise the illness. He linked the findings of the effects of neurotransmitters on symptoms; for example the effect of neuroleptics on symptoms where generally it is the positive symptoms, which the drugs can be seen to act upon. Crow (1980) recategorised schizophrenia into two types:

Type 1   Associated with hyperdopaminergic activity in a structurally normal brain. This is generally seen as the existence of positive symptoms without cognitive impairment in the patient.

Type2   Associated with the negative symptoms of the illness. It is not related to dopaminergic transmission but to cognitive and intellectual impairment.

Although this recategorisation was a welcome step forward in attempting to understand and explain the illness of schizophrenia, it has been criticised as being too simplistic. For example, many patients may fit both Types if they suffer from both positive and negative symptoms and there is no explanation in this model to account for the change in symptomatology over time by many patients.

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A more recent and major influence in the reclassification of the syndrome of the illness has been the work of Liddle (1987a) who factor analysed the correlations between symptoms of schizophrenia. Liddle (1987a) found only partial support for the positive/negative dichotomy. Instead, he discovered the existence of three distinct syndromes, which emerged from the analyses he carried out:

1. Reality distortion   Hallucinations and Delusions

2. Psychomotor Poverty   Poverty of speech, decreased spontaneous movements, blunted affect

3. Disorganisation   Inappropriate affect, poverty of content of speech, formal thought disorder

Liddle (1987b), in a further study, discovered that the Psychomotor Poverty and Disorganisation syndromes were associated with poor performance on tests of executive function. Linking these findings with two well known syndromes arising from frontal lobe lesions (pseudodepression and pseudo psychopathic syndrome (Blumer &Benson 1975), which have similar symptomatology and patterns of cognitive impairment, Liddle suggested that his syndrome of Psychomotor Poverty was consistent with dorsolateral prefrontal dysfunction and his Disorganisation syndrome with mediobasal lesions.

Two syndromes also appear to reflect volitional disorders; Psychomotor Poverty reflects a difficulty initiating activity and Disorganisation reflects a difficulty in the selection of appropriate activity. Liddle & Morris (1991) in accordance with this view found that both Psychomotor Poverty and Disorganisation were associated with impairment in neuropsychological tests of executive function. They also found that each syndrome was associated with a different aspect of impairment. Psychomotor poverty was correlated with impairment of word generation in a manner suggesting a reduced speed of mental processing and disorganisation was found to suggest a difficulty in suppressing inappropriate responses. Support for the work carried out by Liddle (1987) and the identification of three syndromes has been provided by Arndt et al (1991) and Pantelis et al (1991).

More recently, Bryson et al (2001) proposed that deficit syndrome schizophrenia, which refers to a putative subtype of schizophrenia in which negative symptoms are prominent, primary, enduring features of a person's baseline functioning (Kirkpatrick et al, 1993), represents a specific cognitive impairment in executive functioning.

1.9 Functional Outcome and Cognitive Impairment

A new trend in the research concerns the consequences of cognitive impairment in schizophrenia and the effect upon functioning in everyday circumstances or outcome. The expectation being that those with specific neuropsychological deficits would have problems in certain areas of everyday living. For example, deficits in memory function may affect ability to remember to take medication leading ultimately to possible relapse of symptoms. Impairment in planning and organisational skills, an executive function, might affect ability to go shopping or make a cup of tea. It is necessary to remember the steps involved in carrying out such an apparently easy task as making a cup of tea or to plan a shopping trip etc. In social communication, remembering someone's name or what is being said in conversation is a necessary skill. The inability to do so may lead to increase stress in an individual in this type of situation and ultimately to avoidance behaviour, increasing levels of stress and anxiety, inevitably resulting in a relapse of symptoms.

The stress – vulnerability model (Zubin & Spring, 1977; Neuchterlein and Dawson 1994) is the classic model of the effect of stress upon people who are predisposed to symptoms of schizophrenia. Cognitive factors are thought to be a vulnerability factor in this model increasing the likelihood of relapse following stressful incidents such as those mentioned.

Indeed, several studies have demonstrated the association between neuropsychological impairment and outcome. Lawrie et al (1995) reported that long term episodic memory was a predictor of poor prognosis in terms of outcome in a study comparing good versus poor outcome groups. Bryson et al (1998) suggested that verbal memory impairment was a rate-limiting factor in rehabilitation. Liddle (2000) examined cognitive impairment in schizophrenia and its impact upon social functioning by reviewing cohort studies, which recorded cognitive and social development of predictors of poor community outcome. He found that executive dysfunction, memory impairment and impairment on tests of vigilance were predictors of poor community outcome and impairment in skills learning.

Meta-analyses carried out by Green (1996, 2000) of recent studies demonstrated that the three main areas of cognitive function affected by the illness include: attention, memory and executive function. Verbal memory function was associated with all types of functional outcome with vigilance and executive function also significantly related to outcome. Problems encountered in the meta-analyses included the diverse range of cognitive tests used and the varied criteria used to measure functional outcome, ranging from psychosocial skill acquisition, community outcome to laboratory assessments of skills and social problem solving ability. The analysis did conclude, however, that neurocognition is related to functional outcome although it is not clear how it is related.

1.9.1 Psychiatric Rehabilitation

Psychiatric rehabilitation is essentially concerned with the individual person in the context of the environment (Watts & Bennet 1983), the aim being to restore the person to his maximum level of independence, psychologically, socially, physically and economically (Hume 1986). Psychiatric rehabilitation does not apply solely to resettlement in the community; it also applies to those for whom this is not a realistic objective e.g. those in long stay wards.

Psychiatric rehabilitation has continued to expand and improve over the last 25 years. The view of the concept has changed from the traditional implementation of industrial therapies for example, to nowadays encompassing short stay patients, those who have never been admitted to hospital, families, and, detailed programmes tailored to the individual needs of the person. The emphasis has also shifted from the hospital and institutional based rehabilitation to community centred rehabilitation. Goffman's (1961) views on the undesirable effects of institutions are well known. The characteristics of the institutional "syndrome" included apathy, lack of initiative, submissiveness, loss of interest, lack of expression etc

The shift from hospital based to community care began in the 1950s and gained momentum from the mid 1960's onwards to the present day where it has culminated in acts of law, notably the Community Care Act 1993.

The assumptions behind community care include the belief that socio cultural conditions significantly influence the manifestations and course of psychiatric illness and that reducing length of hospital stay or treating without admission to hospital were beneficial for the patient in terms of outcome of the illness. Hopes that it also saved money helped to influence Government decisions of the day.

The assessment of an individual in a rehabilitation setting is the foundation of any treatment regime, and it is essential to determine several factors; the severity of the illness, the chronicity of the disablement, the main causes, to determine strengths and needs, to allocate the appropriate professional help, to obtain baseline measures and to monitor and evaluate progress. It can also be useful to assess neuropsychological functioning as this might have a major impact on the life of the individual, particularly with regards to their ability to cope in the community. If cognitive deficits are present these can cause problems when the patient has to leave the structure and timetabled existence of the hospital regime and enter the chaos of the community.

Problems with memory, planning and organisational skills can cause major problems in the process of rehabilitation and can cause added stress to the life of the individual, particularly if they have not been noted as suffering from these impairments. Failure in the community will invariably occur if these problems are not addressed and this failure may be put down to lack of motivation or cooperation rather than cognitive deficit.

Evans et al (1995) emphasise the importance of executive function in relation to community care and the ability of a person to succeed in the community. The novel situations encountered when leaving the regimented timetabled existence of hospital life places further stress on the already weakened executive function and could plausibly be seen to precipitate relapse. Evans et al (1995) propose "a careful assessment prior to movement and where possible rehabilitation work should be undertaken to reduce the demands placed upon an impaired Supervisory Attentional System". It is well known that increased stress leads to an increase of rate of relapse in people with schizophrenia (Vaughn & Leff 1976). Attempts to keep stress levels low for this group of patients is therefore imperative.

In order to investigate memory and executive function in relation to rehabilitation status and outcome, it is necessary to quantify rehabilitation status. The present study involves one rehabilitation assessment scale in particular; the "Rehab Scale" devised by Hall and Baker in 1984, which measures the general behaviour of the patient in the rehabilitation setting. It is arguably the most widely known and used assessment scale for this purpose and in a recent review of the scale (Baker & Hall 1994) it was recognised to have been widely and successfully used by a number of professional rehabilitation workers. The reliability, validity and sensitivity of the scale have been thoroughly evaluated and there is extensive normative data on the scale Hall & Baker (1984).

1.9.2 Psychological Therapy, Schizophrenia and Psychiatric Rehabilitation

Although Psychiatric Rehabilitation services have expanded and improved greatly over the last few decades, there still remains a wealth of work to be carried out in order to provide the optimum service for people with long-term needs of the rehabilitation services. One such area, which continues to develop is that of helping people improve their skills base so that they can function at a level enabling them to live in the community. Often, it is everyday skills that are impaired and require strengthening. Poor social functioning has been recognised as a fundamental characteristic of schizophrenia since the days of Kraepelin and Bleuler, and the importance of social factors to the assessment of schizophrenia is clearly reflected in modern diagnostic criteria such as DSM-IV (Meuser et al 1991). Various methods have been introduced to try and combat these missing skills.

Social skills' training is one such area, which has flourished in the area of psychiatric rehabilitation. Liberman (1989) is one of the leading proponents of social skills training, believing it to be an important intervention in remediating the social deficits of psychiatric patients. In particular, those who suffer from the negative symptoms of schizophrenia, he believes, can gain benefit from a social skills programme. The implication is that social skills' training is an effective method of improving the coping skills and skills base of people with psychiatric illness.

1.9.3 Cognitive Impairment, Schizophrenia and Psychiatric Rehabilitation

More recently, further research has been carried out in the area of Social Skills Training attempting to tie in the cognitive deficits people in this population tend to suffer from, with problems associated with social skills training itself. In a study by Meuser et al (1991), social skills deficits in people with schizophrenia were found to be associated with memory impairments and not with positive or negative symptomatology. Perhaps not too surprisingly, the patients who had the worst memory impairments did not learn as much during the skills training. Meuser concluded that cognitive deficits in schizophrenia are associated with impairments in social skills and that such deficits may limit the rate of skill acquisition and clinical response to social skills training interventions. This supports the findings of Lawrie et al (1995) who found that memory impairment was the best correlate of poor psychosocial outcome in their group of schizophrenic patients.

If this is the case, it follows that the next step would be to try and remedy the cognitive deficits, if possible, and then attempt interventions such as skills training. Meuser et al (1991) in fact suggested that schizophrenic patients with memory deficits are capable of learning social skills albeit at a slower rate. Impairment in information processing in schizophrenia is well documented (Neuchterlein & Dawson 1984). Almost every aspect of functioning has been implicated from memory, ability to focus, processing speed, reaction time, problem solving ability etc. Research must discover how "cognitive deficits affect learning and retention during treatment, and the treatment process must be modified accordingly" (Bellack & Meuser 1993).

1.9.4 Cognitive Rehabilitation

Cognitive Rehabilitation strategies have been implemented by Bellack (1990) and Hogarty & Flesher (1992). They attempted to reduce attention and memory deficits and improve problem solving ability. So far, the success of these strategies has been variable. Generally, social skills groups or problem solving groups targeting this population, tend to target relatively complex functions such as reasoning. It has recently been argued that a more molecular approach is required and that deficits in basic processes such as memory and attention must be remediated before patients can learn problem solving or social skills (Brenner et al 1992; Spring & Ravdin 1992). Interest in this has led researchers to look at cognitive rehabilitation strategies used in the area of brain injured patients (Stuve et al 1991). Integrated Psychological Therapy (ITP) is a cognitive rehabilitation strategy devised by Brenner et al (1990) and it attempts to enhance basic cognitive functions before the implementation of problem solving and motor skills training. The cognitive training aspect is provided through a series of tasks adapted from neuropsychological test procedures (eg a card sort test).

So far, only minimal gains have been found in cognitive functioning and Bellack and Meuser (1993) are not very impressed by the results so far of cognitive rehabilitation, advising instead that coping skills, environmental change and compensatory strategies be focused on until it is determined exactly how patients with schizophrenia fail in these areas.

1.9.5 Service Delivery

It would be useful in terms of service delivery and patient need to be able to identify those people with schizophrenia who will succeed at a certain level of rehabilitation and those who will struggle. This would save money in terms of wasted resources and failed attempts at rehabilitation. Green (1996) also hypothesises that in terms of service delivery, patients who perform poorly on measures of rate limiting factors such as verbal memory will have more intensive utilisation of services than those who perform well. Identification of deficits may decrease the levels of stress experienced by those patients who are placed beyond their ability. This would enable cognitive remediation programmes to be introduced with the aim of improving functioning so that progress in terms of rehabilitation can occur. Reduction in relapse rate through targeting neurocognitive impairments may reduce the need for continuing and expensive psychiatric support. Although psychological interventions and services are often viewed as the expensive option in mental health service systems, intervention at this level may reduce costs longer term. Indeed Goldberg (1991) states succinctly "more expensive treatments may sometimes be cheaper for society".

1.9.6. Aims & Hypotheses

The main aims of study are investigate cognitive impairment in schizophrenia and to relate this to the level of outcome achieved. Two study designs will be employed. Firstly a correlational analysis exploring the relationship between cognitive dysfunction and outcome as measured by the Rehab scale. Secondly, a between group analysis of "successful" versus "unsuccessful" patients, measured by inpatient/outpatient status, will be used to test the prediction that the unsuccessful group will demonstrate higher levels of cognitive impairment, specifically executive dysfunction and memory impairment. Finally, this study is also exploring recent attempts to recategorise schizophrenia into patterns of symptoms through factor analyses (Liddle et al 1987a;b). Using results from a symptom rating scale, factor analyses of these will be carried out to determine whether similar syndromes can be identified and related to executive dysfunction.

The main hypotheses are as follows:

1) memory impairment will be found to be present in a heterogenous group of patients with schizophrenia and that this will be disproportionately pronounced compared to the degree of general cognitive impairment and will be directly associated with rehabilitation status. Those with poor rehabilitation status will be expected to have more severe memory impairment.

2) Executive dysfunction will be present in a heterogeneous group of patients with schizophrenia. This will be disproportionately pronounced compared to the degree of general cognitive impairment and will be directly related to rehabilitation status.

3) Level of neuropsychological deficit is predictive of "successful" or "unsuccessful" outcome as measured by rehabilitation status.

4) The Rehab scale will be found to have high inter-rater reliability

5) Using symptom rating scales, similar syndromes to Liddle's (1987) three (Psychomotor Poverty, Disorganisation, Reality Distortion) will be identified through factor analyses. Following Liddle & Morris (1991), Psychomotor Poverty and Disorganisation will be expected to be associated with poor executive task performance.

The implications for the psychiatric rehabilitation and remediation of patients of schizophrenia will be discussed in relation to results demonstrated.

2.0. METHOD

2.1. Power Analysis

A Power Analysis was carried out in order to calculate the number of subjects required for this correlational study. For research planning, it is useful to determine the sample size (N) necessary to have a specified power for a given alpha (significance criterion) and Effect Size. According to Cohen et al (1992): the significance criterion is generally taken to equal 0.05; the specification for power is 0.80, a convention proposed for general use; the effect size in a product moment correlation is simply the population r with the effect size taken to be large in this instance (r=0.50). Therefore, in this study, for a two tailed test 70 data pairs were necessary for correlations where r = 0.50, Power = 0.80, alpha = 0.05 (Cohen et al 1988).

2.2. Recruitment of Subjects

The recruitment of 70 subjects for the study took place over two time periods. Firstly, in 1994/5 where a total of 40 subjects were recruited from three regions within Scotland; Lothian, Grampian and West Lothian. All subjects had a diagnosis of schizophrenia according to DSM-III-R criteria at the time of testing. The second group of 30 subjects was recruited in 2000 from Fife in Scotland. All of these subjects had a diagnosis of schizophrenia at the time of testing according to the current criteria in DSM-IV-R. Two Groups are analysed in this study. **Group 1** (N=70) involves those subjects recruited in both time periods (1994/5 and 2000) and **Group 2** (N=30) involves those subjects recruited in the time period of 2000. It should be noted that **Group 1** includes those participants also used in **Group 2**.

2.2.1. Procedure for Recruitment of Subjects

Recruitment of each participant in both time periods followed the same procedure. Consultant Psychiatrists were given detailed information regarding the rationale behind the thesis and, if agreeable, asked to put forward the names of those patients under their care who would fit the criteria for inclusion to the study. With the consent of the named Consultant, case notes were accessed of those named participants and scrutinized for the entry criteria to the study. Discussion with the Consultant to confirm diagnosis was also carried out where appropriate e.g. if the diagnosis was not obvious from the case notes.

Following this, contact was made with the charge nurse or main keyworker involved with the participant to discuss the study. Information Sheets and Consent Forms were provided for each potential participant with the option of further discussion regarding the study if requested. Those that agreed to take part in the study were generally seen within two weeks of giving informed consent either within the hospital setting or at an outpatient clinic.

2.2.2. Criteria for inclusion

Diagnosis of schizophrenia according to DSM-III-R or DSM-IV-R criteria. All subjects were part of a Rehabilitation Service or had been in one of the following stages of rehabilitation. The centres differed in their approach but generally a patient in rehabilitation would progress through the stages in order:

(1)   in-patient status (slow stream)

(2)   in-patient status (fast stream)

(3)   day centre care

(4)   out-patient status/community living

2.2.3 Exclusion criteria

Exclusion criteria for both **Group 1** and **Group 2** in this study included a history of alcohol or drug abuse, concomitant brain damage, rehabilitation placement of less than one month or ECT within the previous 12 months.

2.3. GROUP 1 (N=70)

A total of 70 subjects were used in this correlational design study. All subjects had either a DSM-III-R or DSM-IV-R diagnosis of schizophrenia at the time of testing. Subjects were involved from four regions within Scotland, Fife, Lothian, Grampian and West Lothian. Forty of the subjects were recruited and tested in 1994/5 and 30 of the subjects were recruited and tested in 2000. Both sets of participants were recruited to the study following the procedure detailed above.

2.3.1. Subjects

Subjects were asked to participate from the following areas in Scotland:

A)   Royal Edinburgh Hospital, Edinburgh Rehabilitation Service

B)   Royal Cornhill Hospital, Aberdeen Rehabilitation Service

C)   Bangour Village Hospital, West Lothian, Rehabilitation Service

D)   Stratheden Hospital, Cupar, Rehabilitation Service

E)   Stratheden Hospital Fife, Community Outpatient Clinics

2.3.2. Procedure

Subjects were included in the study if it was thought they could understand and follow the procedures of the assessments being carried out. Staff and the psychiatrist whose care the subject was under were consulted regarding this, prior to patient contact, and patients were asked if they wanted to take part on the basis of staff opinions. In reality, this means that the most chronically and/or severely ill patients were not included in the study.

Assessment and rating scales were administered in the following order: (TABLE 4; APPENDIX A-F).

	Assessment / Rating Scale
A	Rivermead Behavioural Memory Test (RBMT)
B	National Adult Reading Test - Revised (NART-R)
C	Mini Mental State Examination (MMSE)
D	Krawiecka Rating Scale (The Manchester Scale)
E	Modified Six Element Test
F	Rehab Rating Scale

Table 1 - Assessments and Rating Scales administered

Having gained the consent of the patient to take part in the study, the assessment was carried out taking approximately 1 hour to complete.

The 70 subjects were administered the following assessments in order:

a)The Rivermead Behavioural Memory Test (RBMT)

This test was developed Wilson et al 1985. The assessment was designed to be sensitive to everyday memory impairment. It was used because of its ecological validity, its relatively undemanding and non-stressful nature, and because it taps everyday memory difficulties. Normative data and validity is well documented (Wilson et al 1985; 1989). It has been standardised and validated on a group of normal individuals (N=118, mean age 41.2, range 16-69) and on a group of individuals with brain injury (N-176; mean age 44.4;range 14-69). Another benefit of the test is that it has been found to be relatively independent of IQ (Wilson et al 1985; 1989). From these two studies, four score ranges were established to identify: normal, poor, moderately impaired and severely impaired memory ability. An added advantage of using the RBMT is that it has been used previously in similar studies of schizophrenia (McKenna et al 1990, Duffy & O'Carroll 1994), which allows for ready comparison. The test itself takes approximately 30 minutes to complete and consists of 12 sub-tests, each designed to give an objective measure of one aspect of memory performance. Subtests include: remembering a name, remembering a belonging, remembering to ask a question, recognition memory for 10 pictures and 5 faces, recalling a brief story, remembering a route round the room, remembering to deliver a message on this route.

b) National Adult Reading Test - Revised (Nelson 1982).

This is a measure of pre morbid IQ and consists of a list of 50 short, irregular words to be read and pronounced by the subject. Because the words are irregular, intelligent guesswork will not provide the correct answer and as the words are short , subjects do not have to analyse complex visual stimuli. This means that previous knowledge is relied upon rather than current cognitive capacity for performance (Nelson & O'Connell 1978). It is widely recognised that performance is highly correlated with IQ and that it is relatively resistant to illness effects. However, although the NART-R is a well-established tool for assessing premorbid IQ, problems regarding its use with those who have a schizophrenic illness have been documented (Crawford et al 1992). They suggest that performance of people with chronic schizophrenia on this test may be an underestimate of pre morbid IQ as intellectual impairment caused by the onset of schizophrenia may impair the performance. However, accepting these concerns, it is used in this study as it is the best available measure of pre morbid IQ and its reliability and validity have been well documented (Crawford et al 1989). The revised WAIS-R conversion norms were used.

c) Mini Mental State Examination (MMSE)

Devised by Folstein et al (1975), this assessment is a well-established broad test of cognitive ability and is a widely used screening test for dementia. It takes minutes to complete and is relatively easy to accomplish. It consists of 11 questions including items such as serial sevens, copying a simple diagram, writing a sentence, carrying out a 3 stage command, answering simple questions regarding place, orientation, time etc. A score of 23/30 or less has been shown to be a useful cut off for significant cognitive impairment and has been established as providing a clinically useful threshold for the existence of mild dementia (Anthony et al 1982).

d) Krawiecka Rating Scale (The Manchester Rating Scale)

This test is used for assessing the mental state of psychotic patients (Krawiecka et al 1977). The scale is divided into nine variables including depression, anxiety, hallucinations, delusions, incoherence of speech, poverty of speech, flattening of affect, psychomotor slowness, incongruity of affect. Each variable is rated on a 5-point scale (0-4) of severity. The basis for scoring the Krawiecka took the form of a standardised interview. In order to obtain a measure of overall severity the sum of each of the 9 ratings is taken. A measure of Positive Symptoms is obtained by taking the sum of the following 3 variables; delusions, hallucinations and incoherence of speech (range 012), and, a measure of Negative Symptoms by taking the sum of the following 2 variables- poverty of speech and flattening of affect (range 0-8), following Duffy & O'Carroll (1994).

e) Modified Six Elements Test (MSET)

Devised by Evans et al (1995), this is an assessment of planning and organisational abilities. It is a simplified version of the Six Elements Test originally devised by Shallice & Burgess (1991). The procedure is as follows; the subject is given instructions to carry out 3 tasks (Dictation - into a tape recorder of the best holiday ever had and of the most memorable event in their life, Arithmetic - two sheets of simple arithmetic sums, Picture Naming - two piles of 60 drawings of objects to be written down on paper) each of which is in two sections (A&B). The subject has 10 minutes to do the test, the aim being to complete part of each of the six sections but they are not allowed to do sections A & B of the same task one after the other. Once it is clear that the patient has understood the test instructions they are left to complete the test with a written copy of the instructions always present, thereby not placing a load on memory. Scores used for analysis are the number of tasks attempted (out of 6) minus the number of rule breaks (attempting A followed by B of the same task).

f) The Rehab Scale, devised by Hall & Baker (1984).

This is a behaviour rating scale designed to assess the behaviour of patients in Rehabilitation settings. It covers several aspects of behaviour, which are rated on the basis of staff observations (usually nursing staff or clinical psychologists) of the patient over a one-week period. The scale is divided into different sections: Deviant Behaviour, General Behaviour (Social Activity, Disturbed Speech, Self Care, Community Skills), Overall Rating and Total Score.

Scoring Criteria

Deviant Behaviour: each of the 7 items in this section is scored on a seven point scale and the sum of these gives a Total Deviant Behaviour score. The higher the score, the worse the deviant behaviour.

General Behaviour: Each of the 15 items in this section is scored on a scale of 0 to 9 with 9 representing the most deteriorated level of behaviour and 0 representing the level of behaviour expected in the community. To obtain a Total General Behaviour Score, the totals for each item are added together. The higher the Total General Behaviour Score, the poorer the General Behaviour of the person. The General Behaviour section can also be divided into 4 factors plus an overall rating from the 15 questions which can provide interesting information: Social Activity, Disturbed Speech, Self Care and Overall Rating. These are added together to provide the Total General Behaviour Score.

The scale can also serve several purposes within the Rehabilitation setting; assessing change in patients behaviour, selecting patients with potential for discharge, selecting disturbed/severely handicapped patients, selecting groups of patients, planning treatment e.t.c.

The Rehab scale has been well established as a reliable and valid scale, which is sensitive to change with data on 821 patients examined at different sites throughout Britain (Baker 1986; IIjon Foreman 1980; IIjon Foreman &Baker 1986). It is widely used throughout Britain in Rehabilitation settings for the purposes mentioned above. It was selected for use in the present study for the purpose of establishing the level of functioning of the patient and it has been recognised that this is a valid use of the scale in research studies (Baker & Hall 1994), particularly because of the extensive normative data on the scale. Exploring reliability, eight different pairs of raters rated 47 patients and all item correlations were significant beyond the 0.001 level, for example.

It is stated in the manual that where possible it is preferable for two members of staff to rate the behaviour of the patient so that reliability can be achieved. In this study the inter rater reliability of the Rehab scale was also investigated. Where possible, two members of staff were asked to independently rate the patient's behaviour in order to assess this. Previous studies have specifically looked at the inter rater reliability of the scale (Bell 1983; Carson et al 1988). Carson et al (1988), in a study assessing the ratings for an initial sample of 50 patients (mean age - 53.8 years; s.d. - 14.93; range - 22-77), found higher correlations coefficients than expected given the large number of raters used in the study (median r= 0.80, range - 0.58 to 0.90; $p<0.001$).

Finally, a short report detailing the subject's performance on the memory assessment, overall cognitive ability and Rehab scale score was provided, to be placed in the subject's file. It was thought that this information might be useful in the planning of future rehabilitation programmes for the subject.

2.4. GROUP 2

2.4.1. Subjects

A total of 30 subjects were used in this between group analyses with 15 subjects in each group respectively. All subjects had a diagnosis of schizophrenia according to DSM-IV criteria (American Psychiatric Association, 1987). All subjects were living in Fife, Scotland at the time of testing, either as hospital in-patients or in the community under the care of a psychiatrist.

2.4.2. "Successful" Group

Criteria for inclusion:

Fifteen subjects were included in this group. All were living in the community at the time of testing and had been for a minimum of 6 months. Each subject had previously been in psychiatric hospital and specifically had been through the rehabilitation service.

2.4.3. "Unsuccessful" Group

Criteria for inclusion:

Fifteen subjects were included in this group all of whom were in-patients (slow or fast stream) at Stratheden Psychiatric Hospital, Cupar, Fife. All were living in a rehabilitation setting within the hospital at the time of testing and had been for a minimum of 6 months. All subjects had experienced 2 or more failures at living in the community.

2.4.4. Procedure

30 subjects completed all testing except 3 who did not complete the National Adult Reading Test (NART-R) because they found it too difficult and the test was discontinued. The Rehab Scale was completed for all subjects by a nurse, Community Psychiatric Nurse or named carer. Testing took place in either the hospital setting or in an outpatient clinic room. Testing took no longer than 1½ hours on average to finish and Rehab forms were sent to carers/CPN/nursing staff to be completed. All were returned.

2.4.5. Ethical approval

Ethical approval for Group1 and Group 2 was gained from Fife Primary Healthcare NHS Trust Ethics Committee, Lothian Research Ethics Committee and the Joint Ethical Committee of Grampian Health Board & Aberdeen University.

2.4.7. Psychometric measures

The Cognitive assessments were administered in the following order:

	Assessment/Rating Scale
A	Rivermead Behavioural Memory Test (RBMT)
B	National Adult Reading Test – revised (NART-R)
C	Mini Mental State Examination (MMSE)
D	The Manchester Scale (Krawiecka)
E	Modified six Elements Test (MSET)
F	The Rehab Scale
G	The Hayling Sentence Completion Test
H	The Emotional Sentences Completion Test

Table 1a – Assessments used in Group 2 study

Two additions to the cognitive screening were introduced in **Group 2**:

1. The Hayling Sentence Completion Test (Burgess and Shallice 1997)

Devised by the authors in 1977, the test is sensitive to dysexecutive problems and provides a measure of basic task initiation speed as well as performance on a response suppression task. Two sections are given to the subject with both sections consisting of 15 sentences, each missing the last word. The examiner reads aloud each sentence to the subject, who is required to make a verbal response. In Section 1, the subject is asked to complete the sentence as quickly as possible and in Section 2, the subject is asked to provide a word which is unconnected to the sentence in every way e.g. "the captain wanted to stay with the sinking.......lightbulb".

Normative data and validity is well documented. It has been standardised and validated on a control group (N=71, mean age 45.1, SD–19.5) and three neurological lesion groups (N=91: Anterior Lesion Group N= 47, Mean Age–45.1, SD–13.7; Posterior Lesion Group N=27, Mean Age–43.5, SD-14.8; Bifrontal Lesion Group N=17, Mean Age–51.4, SD–13.0).

Scoring consists of a scaled score out of 10 with 10 placing the subject in the very Superior Range and 1 placing the subject in the Impaired Range. A score of 5 would place the subject in the 25th percentile and in the Moderate average Range etc. Five scores used in the analysis included:- Time taken to complete connected sentences, time taken to complete unconnected sentences, overall test score, error score, test taken to complete unconnected sentences minus time taken to complete connected sentences.

2. The Emotional sentences Completion Test (Power 2002)

This test includes a list of 20 sentences with the last word missing which have to be completed out loud by the subject. The subject is asked to complete the sentence as quickly as possible. The test provides a measure of executive function, particularly the subject's ability to provide a word whose meaning is an emotion to complete the sentence. Normative data is currently in the process of being compiled. Two scores were included for analysis in the study, ESCT Error Score, the number of errors made in completing the sentence i.e. providing a word whose meaning is not an emotion or is incorrect in terms of meaning, and ESCT Time Score, a measure of basic task initiation speed.

The test was devised in order to tap into similar aspects of executive function as the Hayling Sentences Completion Test and the procedure and measures provided are similar. The test investigates the individual's ability to assess verbal information regarding a situation within a social context and provide an answer, which requires an accurate perception of emotions. Components of social cognition include the perception of emotion and social schema. It is widely recognised that social cognition in schizophrenia can be impaired (Corrigan & Green 1993) and this assessment may provide a measure of the level of this impairment.

3.0 RESULTS

3.1. Planned Statistical Analyses

Statistical analyses were carried out on an Apple Mac and PC using SPSS. Descriptive statistical analysis is provided for both Groups 1 & 2 as well as demographical information. Distribution of the data was examined using the Kolmogarov-Smirnov Test of normality, the principal goodness of fit test for normal and uniform data sets, in order to decide whether parametric or non parametric analysis of data is required. All test results conformed to normal distribution ($p > 0.05$) and it was, therefore, decided to use parametric analysis of the data. The main analyses in both Group's 1 & 2 investigated the degree of relationship between variables using a parametric test of correlation, the Pearson Product Moment Correlation (Pearson's r). Further investigation of data was planned, including: Stepwise Multiple Regression of Group 1 to examine which variables accounted for most of the variance of the dependent variable "Rehab Total"; Factor Analysis of the symptom scale (Krawiecka); related t- tests were carried out (for matched subjects) in Group 2 to investigate the differences between means for the dependent variables and the independent variable "successful/unsuccessful" outcome using a one tailed hypothesis whereby the prediction is unidirectional, that is, the "successful" group will have higher test scores; Binary Logistic Regression of Group 2 data to determine whether the observed values of the "successful/unsuccessful" outcome group could be predicted from the observed values of the independent variables. More detailed rationale for these tests are provided in each section.

3.2. GROUP 1

3.2.1. Demographic and Clinical Information

A heterogeneous group of subjects was involved. The mean contact with a Rehabilitation Service was 7.7 years (range:- 6 weeks - 34 years, SD - 10.12). This was necessary so that a wide range of subjects would be involved who encompassed a wide range of severity and chronicity of illness.

From Table 2, there were 55 male subject and 15 female subjects in Group 1. The age range was 23 - 73 years with the mean age being 43.16 years (SD – 11.97). Within Group 1, there were 28 male subjects in the inpatient setting and 9 female subjects with the mean age for this subgroup being 43.1 years (SD – 12.73; age range – 23-73). The outpatient setting of Group 1 consisted of 27 male subjects and 6 female subjects with a mean age of 43.2 years (SD – 11.25; age range – 24-62).

	GROUP 1 N=70	GROUP 1 INPATIENTS N= 37	GROUP 1 OUTPATIENTS N= 33
Age	43.16 (11.97)	43.1 (12.73)	43.2 (11.25)
Sex M/F	55/15	28/9	27/6

TABLE 2 – Demographic information for Group 1(N=70)

The breakdown of the sample regarding rehabilitation setting included, 21 inpatients from slow stream wards, 16 inpatients from fast stream wards, 12 outpatients living in hostel type accommodation but still under the care of the service, and, 21 patients who attended day centres under the care of the service (**TABLE 3**).

REHABILITATION SETTING	NUMBER OF PATIENTS
In patient – fast stream	21
In patient –slow stream	12
Out patient status	16
Day centre	21

Table 3- No. of subjects in each rehabilitation setting, Group 1 N=70

Sixty three of the subjects in the sample were taking neuroleptic medication at the time of testing. This was recorded and converted into chlorpromazine equivalent amounts, where possible, using standard conversion formulae (Black et al 1985; Foster et al 1989) and with the advice of the Pharmacy Department at the Royal Edinburgh Hospital (Table 4). Four patients were also taking anxiolytic medication, 5 patient was taking antidepressant medication and 3 were prescribed Lithium. Thirty four out of the seventy subjects were also taking anticholinergic medication at the time of testing, either procyclidine or orphenadrine (Table 5).

Neuroleptics	Mean	Range
Chlorpromazine equivalents (Daily)	909mg	40-31 25mg
N=63	SD - 658	

Table 4- Neuroleptic levels of subjects.

ANTICHOLINERGICS	MEAN	RANGE
Procyclidine equivalents	12.4	5-30mg
N= 27	SD – 5.26	

Table 5- Antichohnergic levels of subjects.

70 subjects completed the Rivermead Behavioural Memory Test and Mini Mental State Examination with 66 subjects completing the Modified Six Elements Test due to refusal by 4 subjects. The Rehab scale was completed for all 70 subjects and was double rated, independently, for 13 subjects.

3.2.2. Statistical Analyses

3.2.3. Memory Impairment in Schizophrenia

The first hypothesis which was investigated was that memory impairment exists in a heterogeneous group of people with schizophrenia replicating the studies of McKenna et al (1990) and Duffy & O'Carroll (1994).

Rivermead Behavioural Memory Test: two scores can be obtained from the RBMT-

a) *Screening Score* which is the sum of the pass or fail score of each of the 12 subtests, (0-12 score)

b) *Profile Score* which is more sensitive as it gives points for tests,

which are barely failed (0-24 score)

The profile score was used for analysis in this study

Table 6 shows the overall distribution of RBMT Screening Scores, MMSE scores and MSET scores.

SCORING CRITERIA	RBMT	SCORING CRITERIA	MMSE	SCORING CRITERIA	MSET
Normal	12 (17.1)	*Normal*	55 (78.6)	*Normal*	26 (37.1)
Poor	22 (31.4)				
Moderately Impaired	27 (38.6)	*Mildly Impaired*	13 (18.6)	*Impaired*	44 (62.9)
Severely Impaired	9 (12.9)	*Severely impaired*	2 (2.8)		

Percentage scores in parentheses (%)

Key:

RBMT   -   Rivermead Behavioural Memory Test

MMSE   -   Mini Mental State Examination

MSET   -   Modified Six Elements Test

Table 6: Comparison of RBMT scores (memory functioning), MMSE scores (overall cognitive functioning) and MSET scores (executive functioning)

There is a wide range of scoring on overall memory functioning in the group of subjects, however, the overall level of performances is quite poor. Twelve patients scored within the Normal Range for memory functioning on the RBMT (17.1%); 22 patients scored in the Poor Range for memory functioning (31.4%); 27 patients scored in the Moderately Impaired Range for memory functioning (38.6%); 9 patients scored in the Severely Impaired Range for memory functioning (12.9%).

These results are compared with the MMSE cognitive test screening scores where fifty five patients (78.6%) scored in the range of 23-30 which is suggestive of normal cognitive functioning; 13 patients (18.6%) scored in the mildly impaired range of 18-23; 2 patients (2.8%) scored in the severely impaired range of 0-18.

These results demonstrate that memory functioning does appear to be disproportionately impaired compared to the overall level of cognitive impairment with only 17.1% of subjects scoring in the Normal range for Memory Functioning on the RBMT but 78.6% of subjects scoring above the cut off of 23 for mild dementia on the MMSE (Mowry & Burvill 1988).

3.2.4. Executive Dysfunction in Schizophrenia

Table 6 demonstrates the wide range of scoring on the Modified Six Elements Test. The overall level of functioning appears to be relatively poor with 44 (62.9%) of the subjects falling into the impaired functioning range using the scoring criteria devised by Evans et al (1995) to indicate impaired executive functioning. Impaired performance is defined by the Number of Tasks attempted <4. Twenty six patients (37.1%) scored in the normal range for this test.

This result can be compared to MMSE cognitive screening scores in Table 6. Fifty-five patients (78.6%) of subjects scored in the normal range of cognitive functioning for this assessment; 13 patients (18.6%) scored in the mildly impaired range and 2 patients (2.8%) scored in the severely impaired range.

Comparing the results it can be concluded that executive functioning does appear to be disproportionately pronounced when compared to the overall level of cognitive impairment with only 37.1% of subjects scoring in the Normal Range for Executive Functioning but 78.6% of subjects scoring in the Normal Range on the MMSE, a test of overall level of cognitive functioning.

It is worth mentioning that memory impairment is more prevalent with only 17.1% of subjects scoring in the Normal Range on the RBMT and 37.1%of subjects scoring in the Normal Range on the test of Executive Function. However, the comparison between what is considered "normal" across different assessments is problematic.

3.2.5. Executive Function and Memory

The effect of memory impairment on the test of executive function (Modified Six Elements Test) was analysed in order to investigate whether memory might be a confounding factor in this relatively new test. In contrast to Evans et al (1995), this study did find a significant correlation between memory impairment and the Modified Six Elements Test ($r=0.466$, $p<0.01$). See Table 7.

3.2.6. Memory Impairment, Executive Dysfunction and REHAB score

The prediction that severity of memory impairment would be directly correlated to level of rehabilitation status, a measure of outcome, was substantiated. A significant negative correlation was found between RBMT Profile Score and Rehab Score ($r=-0.300$, $p<0.05$; Table 7). However, no significant relationship was found between executive dysfunction and rehabilitation status as was predicted.

3.2.7. Correlates of Schizophrenic Test Performances and Clinical Variables

Results of the Pearson's Correlational analysis between variables are summarised in Table 7.

Rehabilitation Status:

Rehab total was negatively correlated with MMSE ($r=-0.304$, $p<0.05$), RBMT Profile score ($r=-0.3$. $p<0.050$) and RBMT Screening Score ($r=-0.252$, $p<0.05$). This variable was also correlated in a positive direction with both Anticholinergic medication($r=0.36$,$p<0.01$) and Chlorpromazine equivalents ($r=0.360$,$p<0.05$).

Memory:

Supporting the hypothesis that memory impairment is linked to outcome, RBMT Profile score was negatively correlated with Rehab Total score ($r=-0.300$, $p<0.05$). RBMT Profile score was also positively correlated with the assessments MMSE ($r=0.74$, $p<0.01$), NART ($r=0.148$,$p<0.01$) and MSET ($r=0.466$,$p<0.01$) . Negative correlations were also found with Age ($r=-0.29$,$p<0.05$) and Negative symptoms ($r=-0.27$,$p<0.05$). There was no correlation between RBMT score and Neuroleptic levels or Anticholinergic levels which lends increasing support to the claims made by McKenna et al (1990) that medication does not have a significant effect on memory functioning.

Executive Function:

Modified Six Elements Test Score was positively correlated with Age (r=0.447, p<0.01). Correlations were also found with MMSE (r=0.246,p<0.05) and RBMT (r=0.466,p<0.01). There were no correlations between Modified Six Elements Test and Medication, Negative or Positive Symptoms or Severity of illness. This is supportive of the theory of the lack of effect of medication on cognitive function.

Overall Cognitive Function:

MMSE scores were found to be negatively correlated with Age (r=-0.302, p<0.05), Negative symptoms (r=-0.273,p<0.05), Rehab Total score (r=-0.304,p<0.05) and correlated in a positive direction with Positive Symptoms (r= 0.341, p<0.01) and RBMT Score (r=0.740,p<0.01) but not with Medication (neuroleptics or anticholinergics) or the Modified Six Elements Test.

	AGE	NART	MSET	MMSE	Severity	Positive Symptoms	Negative Symptoms	RBMT.PRO	Rehab Total	Antich. Meds	Chlorpr. Meds
AGE	1.000	.094	-.447(**)	-.302(*)	.014	.078	.211	-.294(*)	-.021	-.048	-.318(*)
NART	.094	1.000	.187	.264(*)	-.092	.006	-.068	.418(**)	-.211	-.095	-.209
MSET	-.447(**)	.187	1.000	.246(*)	-.155	-.093	-.001	.466(**)	-.012	.080	.060
MMSE	-.302(*)	.264(*)	.246(*)	1.000	-.070	-.341(**)	-.273(*)	.740(**)	-.304(*)	.048	.015
Severity	.014	-.092	-.155	-.070	1.000	.127	.279(*)	-.153	-.143	-.118	-.104
Positive Symptoms	.078	.006	-.093	-.341(**)	.127	1.000	-.012	-.206	.210	.086	.227
Negative Symptoms	.211	-.068	-.001	-.273(*)	.279(*)	-.012	1.000	-.270(*)	.133	.005	-.015
RBMT.PRO	-.294(*)	.418(**)	.466(**)	.740(**)	-.153	-.206	-.270(*)	1.000	-.300(*)	-.039	-.132
Rehab Total	-.021	-.211	-.012	-.304(*)	-.143	.210	.133	-.300(*)	1.000	.360(**)	.311(*)
Antichol. Meds	-.048	-.095	.080	.048	-.118	.086	.005	-.039	.360(**)	1.000	.044
Chlorprom. Meds	-.318(*)	-.209	.060	.015	-.104	.227	-.015	-.132	.311(*)	.044	1.000

Table 7 – Pearson's Correlational Analysis of variables, N=70

Key: MSET- Modified Six Elements Test; MMSE – Mini Mental State Examination; NART-R – National Adult Reading Test Revised; RBMT Pro – Rivermead Behavioural Memory Test. Profile Score; Antichol.Meds – Anticholinergic Medication; Chlorprom.meds. – Chlorpromazine Equivalent Medication

3.2.8 - Regression Analyses of Dependent Variable "Rehabilitation Status"

Stepwise Multiple Regression was used to examine which variables accounted for most of the variance of the dependent variable "Rehab Total". This technique reveals all the variables related to the measure of interest. The following variables were included in the equation: Rehabilitation Total, Modified Six Elements Test Score, MMSE score, Nart-R Score, Negative Symptoms, Positive Symptoms, Severity of Symptoms, Rivermead Behavioural Memory Test Score, Severity of Illness and Age. MMSE was the first and only variable in the equation, which was found to be the best correlate of Rehab score. See Table 8 for a summary of results.

Step	VARIABLE	F	F.SIGN	ADJUSTED R2	B	BETA	T	SIGN OF T
REGRESSION 1								
STEP1	**MMSE**	11.796	0.001	0.152	-4.08	-0.408	-3.453	0.01
REGRESSION 2								
TAKE OUT MMSE								
STEP 1	**RBMT**	7.437	0.008	0.097	-1.65	-0.335	-2.72	0.008

TABLE 8: Stepwise Multiple Regressions on Correlates of Rehab Score

It was then decided, in a subsidiary analysis, to remove the variable of MMSE in order to discover which other variables would then be shown to be the best predictors of Rehab score. Removing the variable, MMSE, and carrying out a second stepwise multiple regression, the only correlate of Rehab score was found to be the memory score (RBMT), with no other variable showing up to be significant (Table 8).

These results are interesting as the best predictor of outcome as measured by the Rehab Scale is a broad measure of overall cognitive function. Taking this variable out of the equation, the next best predictor of outcome in this group of subjects was found to be a measure of memory, again supporting the hypothesis that cognitive impairment is linked to outcome.

3.2.9. Symptom Correlates of Schizophrenic Test Performance

Before attempting to factor analyse the symptoms of the Krawiecka Scale (9 variables), a correlational analysis was carried out of Symptoms with Test Performance (Table 9). The first **40** subjects tested were used for this analysis.

	Psychomotor Retardation	Anxiety	Delusions	Depression	Flattened Affect	Hallucinations
Rehab	.59**	-.11	.11	.13	.35*	.14
RBMT	-.44**	.08	.	-.01	-.12	-.27
MSET	-.27	.06	.29	-.04	.10	.03

	Incoherence of Speech	Incongruence	Poverty of Speech
Rehab	.52*8	.67**	.25
RBMT	-.47**	-.47**	-.21
MSET	-.30	-.14	.17

* - p<0.05; ** - p<0.01 (two tailed test)

Key: RBMT - Rivermead Behavioural Memory Test
MSET - Modified Six Elements Test

TABLE 9 - Correlation Matrix of Symptoms with Test Performance

Rehabilitation Status

*Rehab Total was found to correlate in a positive direction with Flattened Affect (r=0.35, p<0.05), Incoherence of Speech (r=0.52, p<0.01), Incongruence (r=0.67, p<0.01), Psychomotor Retardation (r=0.60, p<0.01).

Memory

*RBMT was found to correlate significantly with Incongruous Affect ($r=-0.47$, $p<0.01$), Incoherence and Irrelevance of Speech ($r=-0.47$, $p<0.01$) and Psychomotor Retardation ($r=-0.44$, $p<0.01$).

Executive Function

* Modified Six Elements Test - no significant correlations were found between executive function and symptomatology.

3.2.10. Factor Analysis of Symptom Scale (Krawiecka Scale)

Principal Component Factor Analysis was carried out of the 9 variables of the Krawiecka scale in order to investigate whether the same 3 factors could be identified as in the Liddle study (1987). Initial factors were extracted by the method of principal factors and subjected to oblique rotation. The factor analysis yielded three factors, which together accounted for 71.4 % of the variance. Each symptom has a high loading on only one of the three factors. The symptoms therefore segregate into three distinct syndromes. The Factor loadings and variance accounted for by each Factor are summarised in Table 10 whilst Table 11 demonstrates that the correlations between Factors are near zero.

	FACTOR 1	FACTOR 2	FACTOR 3
Anxiety	.13	.88	-.20
Delusions	.17	.74	-.25
Flattened Affect	.19	-.08	.91
Hallucinations	.38	.50	-.41
Incoherence/speech	.88	.18	.17
Incongruity	.84	.02	.07
Poverty of Speech	.30	-.09	.86
Psychomotor Retardation	.84	-.01	.32
Depression	-.07	.75	.14

	FACTOR 1	FACTOR 2	FACTOR 3
% total variance	30.5	26.0	14.9

TABLE 10 - Factor Loadings obtained by Factor Analysis of Krawiecka Scale Symptom Ratings and % Total Variance accounted for by each Factor

	FACTOR I	FACTOR 2	FACTOR 3
FACTOR 1	1.00		
FACTOR 2	.12	1.00	
FACTOR 3	.10	-.15	1.00

- P<0.05; ** - p<0.01; Pearsons correlation, (two tailed test)

TABLE 11 - Factor Correlation Matrix

The three factors identified show similarities to Liddle's 3 Factors as Table 12 demonstrates.

	Williamson (2002)	Liddle et al (1987)
Factor 1	Incoherence & Irrelevance	Inappropriate Affect,
Disorganisation	of Speech,Incongruity of Affect, Psychomotor	Poverty of content of Speech, Formal Thought
	Retardation	Disorder
Factor 2	Anxiety, Hallucinations,	Hallucinations, Delusions
Reality Distortion	Delusions, Depression	
Factor 3	Flattened Affect, Poverty of	Poverty of Speech,
Psychomotor Poverty	Speech	Decreased Spontaneous Movement,Blunted Affect

TABLE 12 - Comparison of Factors from two studies (Williamson 2002 & Liddle et al 1987)

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3.2.11. Correlations using Factors with Test Performances

Correlational Analyses were then carried out in order to find out which of the above Factors correlated with Test Performances. The specific hypothesis tested being whether the test of executive function would be significantly correlated with Factors 1 & 3 (Disorganisation and Psychomotor Poverty, after Liddle & Morris (1991)). (Table 13)

	FACTOR 1	FACTOR 2	FACTOR 3
Rehab	.67**	-.15	.12
RBMT	-.54**	.10	-.02
MSET	-.23	.19	.13

*- p<0.05; ** - p<0.01; Pearsons Correlation, (two tailed test)

Key: RBMT - Rivermead Behavioural Memory Test
MSET - Modified Six Elements Test

TABLE 13 - Correlation Matrix of Factors with Test Performance

From Table 13, Factor 1 (Disorganisation) was found to correlate significantly with Rehab Total (r=0.67, p<0.01) which is interesting in relation to the suggestion that the disorganisation syndrome might have some predictive value in treatment outcomes (Norman et al 1999). Factor 1 was also negatively correlated with RBMT Profile Score (r=-0.54,p<0.01). No significant correlations were found, however, between Factors 1 & 3 (similar to Liddle's Disorganisation and Psychomotor Poverty respectively) and the Modified Six Elements Score. This result contrasts with Liddle et al's (1991) study in which the two syndromes were associated with Tests of executive functioning.

3.2.12. Inter Rater Reliability of Rehab Scores

Two nursing staff completed the Rehab Scale independently for 13 of the subjects. Only 13 subjects were included in this part as staff were unable to complete information on all of subjects twice over due to lack of time and staff shortages. Correlational analysis was carried out using Pearson's product Moment Correlation as data was found to be normally distributed and data measured on an interval scale. The inter rater reliability of the scale was found to be highly significant ($r=0.83$, $p<0.000$) for the Total Rehab Scores as was predicted, supporting the continued implementation of this Scale. A paired t - test was then carried out to investigate whether these Rehab scores (for each subject rated twice) were significantly different from each other. No statistically significant result was found ($t = 0.66$, NS).

3.2.13. Subsidiary Analyses

Subsidiary analyses of the data were carried out. The relationships of the Three Factors with Rehab Scores were of particular interest.

Regression using Factors with "Rehab Score" as the dependent variable

A Stepwise Multiple Regression was used to examine which of the variables in the study (using the first 40 subjects), including the 3 Factors, would be the best correlates of Rehab Score. Variables included in the regression included the following: Rehab Score, MSET score, Age, Education, MMSE score, Nart-R score, RBMT score, Factor 1, Factor 2, Factor 3, Anticholinergics, Neuroleptics. A summary of the results can be seen in Table 14.

Step	Variable	F	F.Sign	Adjusted	B	Beta	T	Sign of T
1	FACTOR	19.79	0.00	0.36	14.87	0.62	4.45	0.00

TABLE 14 - Stepwise Multiple Regression on correlates of Rehab including Factors 1-3

Factor 1(Disorganisation) was the first and only variable in the equation, which was found to be the best correlate of Rehab Total Score.

3.3. GROUP 2

"Successful" versus "Unsuccessful" Outcome

3.3.1. Demographic and Clinical Characteristics

Groups were generally well matched. There were 10 males and 5 females in the "Successful" group and 11 males and 4 females in the "Unsuccessful" group. The age range for the "Successful" group was 24-62 years with mean age being 47.3 (SD – 11.8). Age range for the "Unsuccessful" group was 25-56 years, mean age 42.8 (SD – 9.45). Mean number of admissions for the "Successful" group was 4.1 (SD – 2.6) as compared to 4.1 (SD – 3.3) in the "Unsuccessful group. Twenty four of the 30 subjects were taking neuroleptic medication at the time of testing which was recorded and converted where possible into Chlorpromazine (CPZ) equivalents (Black, Richelson, & Richardson, 1985; Foster et al 1989).

Pharmacy at Stratheden Hospital advised that some of the newer atypical antipsychotic drugs (eg olanzapine) were not readily converted into CPZ equivalents. Twelve patients were taking anticholinergic medication at the time of testing, which was converted, where possible, into procyclidine equivalents.

	GROUP 2 "SUCCESSFUL"	GROUP 2 "UNSUCCESSFUL"
Age (SD)	47.3 (11.8)	42.6 (9.45)
Sex M/F	10/5	11/4
No.of Admissions (mean) (SD)	4.1 (2.6)	4.1 (3.3)

TABLE 15; Demographic information for GROUP 2

3.3.2. Statistical Analyses

3.3.3. Memory Function

In both the "successful" and "unsuccessful" groups it was found that memory impairment was present in disproportionate amounts to general level of cognitive impairment. In the "Successful" outcome group, 86.7% scored in the normal range for the measure of general cognitive impairment and only 13.3% scored in the normal range for the test of memory function. Similarly in the "Unsuccessful" outcome group, 80% scored in the Normal range using the measure of global cognitive impairment with only 20% scoring in the normal range on the memory measure. No significant differences were found between successful versus unsuccessful outcome memory scores (t=1.14, df=28,p=0.263). See Table (16)

	Success. RBMT	Unsucc. RBMT	Success. MMSE	Unsucc. MMSE
Normal	2 (13.3)	3 (20)	13 (86.7)	12 (80)
Poor	7 (46.7)	3 (20)	2 (13.3)	3 (20)
Moderate Impairment	4 (26.7)	7 (46.7)		
Severe Impairment	2 (13.3)	2 (13.3)		
Total	15	15	15	15

Key
RBMT – Rivermead Behavioural Memory Test;
MMSE - Mini Mental State Examination
(Percentages in parentheses)

TABLE 16- Comparison of Memory and Overall Cognitive Function Scores

3.3.4. Executive Function

In the successful versus unsuccessful group it was found that executive dysfunction was also disproportionately pronounced compared to general level of cognitive impairment, as is demonstrated in Tables (17 & 18).

	Hayling Successsful	**Hayling Unsuccessful**	**MMSE Successful**	**MMSE Unsuccessful**
Normal	14 (93)	3 (20)	13 (86.7)	12 (80)
Impaired	1 (7)	12 (80)	2 (13.3)	3 (20)
Total	15	15	15	15

(Percentages in parentheses)
Key: MMSE – Mini Mental State Examination

Table 17 Comparison of The Hayling Test and MMSE Scores

	MSET Successful	MSET Unsuccessful	MMSE Successful	MMSE Unsuccessful
Normal	4 (27)	3 (20)	13 (86.7)	12 (80)
Impaired	11 (73)	12 (80)	2 (13.3)	3 (20)
Total	15	15	15	15

(Percentages in parentheses).Key: MMSE – Mini Mental State Examination;MSET – Modified Six Elements Test

TABLE 18 –Comparison of the Modified Six Elements Test and MMSE Scores

3.3.5. Successful/Unsuccessful Group Scores and Test Variables – differences between means

T Tests were carried out to investigate differences between means for the dependent variables and the independent (or grouping) variable "successful"/"unsuccessful" outcome.

There was a significant difference between the variables Rehab Total and "successful/unsuccessful" outcome group ($t = 4.436$, df = 28, $p < 0.000$, one tailed). Also a significant difference between the conditions Hayling Test and the "successful/unsuccessful" outcome group was found ($t = 3.36$, df = 28, $p < 0.000$, one tailed). Significant differences between means were also found for the Hayling Sentences Test Time Taken to Complete Connected Sentences ($t=4.048$, df=28,$p<0.000$) and The Hayling Sentences Test Time Taken to Complete Unconnected Sentences Section ($t=2.11$, df=28, $p<0.044$) There was a significant difference between the conditions ESCT Time and "successful/unsuccessful" outcome group ($t = 2.74$, df = 28, $p = 0.01$, one tailed). The memory variable, RBMT Profile score, was not found to be significant ($p=0.26$) with outcome scores as was predicted.

3.3.6. Correlational analysis of Unsuccessful and Successful Groups

Pearson Product Moment Correlation Tables (19 and 20) demonstrate which variables are of interest to the study, significant and highly correlated.

3.3.7. Successful Outcome Group

In this group, age was negatively correlated with NART-R and positively correlated with MSET score ($r= 0.592$, $p< 0.05$ and $r=-0.641$, p.0.05 respectively). Duration of illness was negatively correlated with MSET ($r= -0.642$, p. 0.01). No measures of cognitive impairment, apart from MMSE and Negative symptoms ($r=-0.656$, $p<0.01$), were found to be related to severity of symptoms, negative symptoms or positive symptoms. Rehab Total was found to be correlated in a positive direction with The Hayling Test time taken to Complete Unconnected Sentences ($r=0.516,p<0.05$) and with the MMSE ($r=-0.623,p<0.05$). The MMSE was Positively correlated with ESCT Error ($r=-0.755,p<0.01$) and RBMT ($r=0.584,p<0.05$).

3.3.8. Unsuccessful Outcome Group

Negative symptoms were found to be correlated negatively with the MMSE ($r=-0.585$, p.0.05). No links were found with test variables and severity of symptoms apart from ESCT Error and Severity ($r=0.542,p<0.05$) or positive symptoms and cognitive variables. The MSET was found to correlate in a negative direction with duration of illness ($r=-0.643,p<0.01$). RBMT was correlated with ESCT Error ($r=-0.555,p<0.05$) and with the MMSE ($r=0.851,p<0.01$).

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	NART	MSET	MMSE	HAYLING	Severity	Positive Symptoms	Negative Symptoms	RBMT	REHAB Total	ESCT Time Score	ESCT Error Score	HAYLING Error Score	HAYLING Time 1	HAYLING Time 2
NART	1.000	-.253	.739(**)	.089	.021	-.110	.228	.671(*)	-.370	-.247	.390	.247	-.283	-.215
MSET	-.253	1.000	.142	.367	-.236	-.157	-.010	.253	-.023	-.205	-.182	.240	.000	.072
MMSE	.739(**)	.142	1.000	.277	-.253	-.103	-.118	.851(**)	.066	-.577(*)	.179	-.010	.170	.454
HAYLING	.089	.367	.277	1.000	-.252	-.369	.101	.426	.119	-.174	-.245	.027	-.051	.308
Severity	.021	-.236	-.253	-.252	1.000	.764(**)	-.010	.661(**)	-.091	.524(*)	-.209	.349	-.228	-.034
Positive Symptoms	-.110	-.157	-.103	-.369	.764(**)	1.000	.091	.035	.116	.195	-.343	.393	-.112	.083
Negative Symptoms	.228	-.010	-.118	.101	-.010	.091	1.000	-.023	-.238	.500	.032	.229	-.158	.008
RBMT	.671(*)	.253	.851(**)	.426	.661(**)	.035	-.023	1.000	-.099	-.555(*)	-.015	.345	-.104	.235
REHAB Total	-.370	-.023	.066	.119	-.091	.116	-.238	-.099	1.000	.053	.086	-.353	.216	.307
ESCT Error Score	-.247	-.205	-.577(*)	-.174	.524(*)	.195	.500	-.555(*)	.053	.187	1.000	-.296	.367	.012
ESCT Time Score	.390	-.182	.179	-.245	-.209	-.343	.032	-.015	.086	1.000	.187	-.118	-.179	.003
HAYLING Error Score	.247	.240	-.010	.027	.349	.393	.229	.345	-.353	-.296	-.118	1.000	-.286	-.450
HAYLING Time 1	-.283	.000	.170	-.051	-.228	-.112	-.158	-.104	.216	.367	-.179	-.286	1.000	.172
HAYLING Time 2	-.215	.072	.454	.308	-.034	.083	.008	.235	.307	.012	.003	-.450	.172	1.000

Key: NART – National Adult Reading Test; MSET – Modified Six Elements Test; MMSE – Mini Mental State Examination, RBMT – Rivermead Behavioural Memory Test; ESCT – Emotional Sentences Completion Test; Hayling Time 1 – Time to Complete Connected Sentences Section of Test; Hayling Time 2 – Time to Complete Unconnected Sentences Section of Test

Correlation Table 19 - Pearson Correlation Matrix of Clinical Variables and Test Performance in the "Unsuccessful" Outcome Group

	NART	MSET	MMSE	HAYLING score	Severity	Positive Symptoms	Negative Symptoms	RBMT	REHAB Total	ESCT Time Score	ESCT Error Score	HAYLING Error Score	HAYLING Time 1	HAYLING Time2
NART	1.000	.525	.668(**)	.131	-.156	-.396	.042	.724(**)	-.427	-.320	-.537(*)	-.284	.292	-.127
MSET	.525	1.000	-.057	.399	-.049	-.329	.403	.411	.141	-.147	-.265	-.255	.492	.151
MMSE	.668(**)	-.057	1.000	-.163	-.443	-.349	-.656(**)	.584(*)	-.623(*)	.119	-.755(**)	-.106	-.024	-.460
HAYLING score	.131	.399	-.163	1.000	-.227	-.110	-.040	.273	-.158	-.711(**)	.179	-.259	-.103	.323
Severity	-.156	-.049	-.443	-.227	1.000	.621(*)	.628(*)	-.093	.486	.287	.263	-.398	-.058	.364
Positive Symptoms	-.396	-.329	-.349	-.110	.621(*)	1.000	.000	-.116	.409	.172	.180	-.175	-.286	.466
NegativeSymptoms	.042	.403	-.656(**)	-.040	.628(*)	.000	1.000	-.206	.414	.034	.459	-.061	.325	.192
RBMT	.724(**)	.411	.584(*)	.273	-.093	-.116	-.206	1.000	-.431	-.155	-.537(*)	-.505	-.152	-.276
REHAB Total	-.427	.141	-.623(*)	-.158	.486	.409	.414	-.431	1.000	.219	.307	-.205	.181	.516(*)
ESCT Time Score	-.320	-.147	.119	-.711(**)	.287	.172	.034	-.155	.219	1.000	-.210	.131	.150	-.216
ESCT Error Score	-.537(*)	-.265	-.755(**)	.179	.263	.180	.459	-.537(*)	.307	-.210	1.000	.319	.073	.330
HAYLING Error Score	-.284	-.255	-.106	-.259	-.398	-.175	-.061	-.505	-.205	.131	.319	1.000	.368	-.038
HAYLING Time 1	.292	.492	-.024	-.103	-.058	-.286	.325	-.152	.181	.150	.073	.368	1.000	.349
HAYLING Time 2	-.127	.151	-.460	.323	.364	.466	.192	-.276	.516(*)	-.216	.330	-.038	.349	1.000

Correlation Table 20 -Pearson Correlation Matrix of Clinical Variables and Test Performance in the "Successful" Outcome Group

Key: NART – National Adult Reading Test; MSET – Modified Six Elements Test; MMSE – Mini Mental State Examination, RBMT – Rivermead Behavioural Memory Test; ESCT – Emotional Sentences Completion Test; Hayling Time 1 – Time to Complete Connected Sentences Section of Test, Hayling Time 2 – Time to Complete Uncomnected Sentences Section of Test

3.3.9. Correlational Analysis of Executive tests introduced in Group 2, N=30

As can be seen from Table 21 there are several significant correlations of the executive tests introduced in Group 2 with both cognitive and clinical variables. ESCT Time was positively correlated with Rehab Total (r=0.426,p<0.05). The Hayling Score was negatively correlated with RBMT and rehab Score (r=-0.383,p<0.05 and r=-0.395,p<0.05 respectively).

The Hayling score was also correlated with medication in a negative direction (r=-0.587, p<0.05) which is an interesting result in terms of the effect of medication on cognition. ESCT Error was negatively correlated with NART and MMSE (r=-0.394,p<0.05 and r=-0.628,p<0.01 respectively) and with RBMT (r=-0.518,p<0.01). It was positively correlated with negative symptoms (r=0.475,p<0.01).

	HAYLING	ESCTTime	ESCTError	Hayling Error	Hayling Time 1	Hayling Time 2	Hayling Time 3
NART	.267	-.265	-.394(*)	.049	.307	.061	-.034
MSET	.453(*)	-.240	-.214	.071	.411(*)	.205	.117
MMSE	.115	.001	-.628(**)	-.021	.153	-.091	.023
HAYLING	1.000	-.699(**)	.029	-.022	.266	.447(*)	-.098
Severity	-.076	.018	.415(*)	.096	.052	.259	-.061
PositiveSymptoms	-.109	-.037	.191	.201	-.073	.319	-.159
Negative Symptoms	.152	-.086	.475(**)	.169	.222	.168	-.008
RBMT	.383(*)	-.198	-.518(**)	-.012	.025	-.033	.191
Rehab	-.395(*)	.426(*)	.114	-.289	-.295	.066	-.121
Medication	-.578(*)	.395	.005	.245	.008	-.065	-.120
ESCTTime	-.699(**)	1.000	-.089	-.057	-.159	-.323	.267
ESCTError	.029	-.089	1.000	.044	.011	.184	-.065
Hayling Error	-.022	-.057	.044	1.000	.169	-.118	-.084
Hayling Time 1	.266	-.159	.011	.169	1.000	.461(*)	-.184

Key: NART – National Adult Reading Test; MSET – Modified Six Elements Test; MMSE – Mini Mental State Examination, RBMT – Rivermead Behavioural Memory Test; ESCT – Emotional Sentences Completion Test; Hayling Time 1 – Time to Complete Connected Sentences Section of Test; Hayling Time 2 – Time to Complete Unconnected Sentences Section of Test;ESCT Error- number of errors made in ESCT; ESCT Time- Time taken to complete ESCT; Hayling Time 3- Time 2 minus Time 1 score

Table 21 –Pearson Correlation Matrix of Executive Assessments used in Group 2 - N=30

3.3.10. Logistic Regression

Logistic regression was carried out to determine the likelihood that the observed values of the dependent variable ("successful/unsuccessful" outcome group) may be predicted from the observed values of the independent variables. This test was also chosen, as the dependent variable is a dichotomous variable, that is, the variable is split into discrete groups (successful and unsuccessful). Table 22 demonstrates which variables from the study are significant and of interest before carrying out logistic regression. It is recognised that the numbers in this study are small for carrying out such a regression analysis.

		Score	df	Sig.
Variables	HAYLING Time	2.204	1	.138
	AGE	.583	1	.445
	DURATION	.578	1	.447
	NART	3.094	1	.079
	MSET	2.567	1	.109
	MMSE	3.209	1	.073
	HAYLING	7.471	1	.006
	Severity	1.587	1	.208
	Positive symptoms	.956	1	.328
	Negative Symptoms	1.766	1	.184
	RBMT	1.865	1	.172
	REHAB Total	10.425	1	.001
	ESCT Time Score	5.305	1	.021
	ESCT Error Score	.061	1	.805
	HAYLING Time 2	5.988	1	.014
	HAYLING Time 1	10.428	1	.001
	HAYLING Error Score	.244	1	.622

Key: NART – National Adult Reading Test; MSET – Modified Six Elements Test; MMSE – Mini Mental State Examination, RBMT – Rivermead Behavioural Memory Test; ESCT – Emotional Sentences Completion Test; Hayling Time 1 – Time to Complete Connected Sentences Section of Test; Hayling Time 2 – Time to Complete Unconnected Sentences Section of Hayling test

TABLE 22–Correlation Table – Results of Interest to Binary Logistic Regression

Selecting those variables of interest and of significance to the study from Table 22, the significant variables were entered in step-by-step using a binary logistic equation to determine if the addition of the next variable was significantly improving the prediction. This was determined by checking chi square values at each step with variables being added until significance stops. Table 23 shows the variables found in the equation, which best predicted outcome. Rehab Total was found to be the best predictor of outcome. However, this result would have been expected, as the Rehab Scale is a measure of outcome itself. It was, therefore, decided to carry out a subsidiary analysis to remove this variable with a second logistic regression.

Step	Variable	B	S.E.	WALD	DF	Sign.	EXP(B)
Step1	Rehab Total	0.84	0.027	9.336	1	0.002	1.087
Step 2	Rehab Total	0.126	0.049	6.557	1	0.010	1.134
	Hayling Time2	-1.845	0.865	4.547	1	0.033	0.158
Take out Rehab Total							
Step 1	Hayling Time 1	-1.841	0.705	6.823	1	0.009	0.159
Step 2	**Hayling Time 1**	-4.962	2.359	4.425	1	0.035	0.007
	ESCT Time	0.233	0.120	3.773	1	0.052	1.262

Key; Hayling Time 1 – Time to Complete Connected Sentences Section of Test; ESCT- Emotional Sentences Completion Test

Table 23- Binary Logistic Regression on Variables on Correlates of "Successful"/"Unsuccessful" Outcome

Removing the variable REHAB Total from the equation, the best predictors of the variable "Successful"/"Unsuccessful" outcome were found to be two measures from tests of executive function, namely Hayling Time 1 and ESCT Time. The measure Hayling 1 is the time taken to complete the connected sentences section of the test and ESCT Time is the Time taken to complete the sentences with a connected emotion. These results are interesting as they suggest that two measures of executive function, which are measures of basic task initiation speed are the best predictors of outcome in this study. Memory was not found to be a predictor of outcome as was expected.

4.0.DISCUSSION

The main findings demonstrated in this study are as follows:

- Significant cognitive impairment was demonstrated to be present in this group of people diagnosed with schizophrenia, specifically memory impairment and executive dysfunction. These findings are in line with current research in this area.

- The memory and executive impairment was found to be disproportionately pronounced compared to overall level of cognitive dysfunction as measured by the MMSE. This supports the literature which suggests that specific cognitive impairment is not simply part of a generalised picture of cognitive decline (McKenna et al 1990, Duffy & O'Carroll 1994).

- Neuropsychological deficit was also found to be present at all levels of the illness, that is, in both successful and unsuccessful rehabilitation, supporting current theory that impairment is widespread and prevalent across the illness, not just in the chronically ill population (Aleman et al 1999).

- Cognitive impairment was found to be associated with outcome in this study, as was hypothesised. Memory impairment was found to be linked to an outcome measure, the Rehab Scale, with impairment on the memory function test associated with a poorer outcome. The best predictors of outcome in the between group study of "successful" versus "unsuccessful" outcome were shown to be two measures taken from the executive tests, The Hayling Sentences Completion Test and the Emotional sentences Completion Test, of

response initiation speed. This indicates that the successful group were able to respond more quickly to the task.

- The main group differences in the study investigating "successful" and "unsuccessful" outcome were found to be the executive measures: Hayling Overall Test Score; ESCT Time, a measure of basic task initiation speed; Hayling Time to complete connected sentences, also a measure of basic task initiation speed; and Hayling time to complete unconnected sentences, a response suppression measure. This suggests that those who were unsuccessful in rehabilitation had greater impairment in executive function.

- Investigating reclassification of schizophrenia into syndromes, three factors were found which closely resembled the 3 factors described by Liddle et al (1987) of Psychomotor Poverty, Disorganisation and Reality Distortion. None of these factors correlated with executive functioning, contrasting with the results dscribed by Liddle et al (1991). The factor of disorganisation was, however, linked to the outcome variable, Rehab score, suggesting this factor and the symptoms it represents may be indicative of poorer outcome.

4.1 - Memory Impairment

Significant impairment in memory, in particular episodic memory impairment, was demonstrated, indicating and supporting the growing wealth of research that memory impairment is an integral part of schizophrenia at all levels of the illness (Heinrich & Zakanis (1998), Wykes & Dunn 1992, Green et al 2000). The levels of memory impairment were found to be disproportionately pronounced compared to level of general cognitive impairment as measured by the MMSE. This supports the results of several recent studies which report similar findings (McKenna et al 1990; Duffy & O'Carroll 1994; Lawrie et al 1995). Dividing subjects into both "successful" and "unsuccessful" groups (n=15), memory impairment was also found to exist over and above general levels of cognitive impairment. The Rivermead Behavioural Memory Test is a valid measure of episodic memory function and consists of a number of subtests measuring verbal, spatial, visual and prospective memory. Green et al (2000) in their meta analysis discovered that verbal memory was most significantly linked to outcome. Further analysis of the Rivermead Behavioural Memory Test may have demonstrated which subtests were of significance in terms of the impairment profile.

The memory impairment found in the present study was not found to be attributable to medication (anticholinergics or neuroleptics) which again supports recent studies (McKenna et al 1990; Duffy & O'Carroll 1994) claiming that medication does not have a significant effect on memory functioning. Performance on the memory test did not correlate with symptom severity or positive signs of the illness which suggests that cognitive dysfunction is independent of clinical symptomatology supporting Aleman et al (1999) looking at memory impairment in schizophrenia in their meta analysis, in particular recall and recognition memory, and found that significant memory impairment was evident in schizophrenia. The impairment was "stable, wide ranging, and not substantially affected by potential moderating factors such as severity of psychopathology and duration of illness". There was a link to negative signs of the illness, however, which may reflect that negative symptoms are related to poor outcome and general levels of cognitive impairment (Liddle 1987, Tamlyn et al 1992).

A criticism which could be made of study concerns the assessment used to test overall cognitive impairment (MMSE). This is a rather crude and brief assessment and was used mainly because of its brevity and in order to replicate previous studies. It may not necessarily be the most sensitive measure of overall cognitive function available and future studies may wish to investigate levels of overall cognitive function using more thorough assessment methods. Using more thorough neuropsychological testing would allow for better comparisons with memory assessment in order to better ascertain the selectivity of memory impairment against other aspects of neuropsychological function.

The correlation found between memory impairment and the test of overall cognitive function (MMSE) is interesting as although memory impairment was found to be disproportionately pronounced compared to overall levels of cognitive functioning it is clear that memory function is not the only function affected but that it is part of a wider pattern of deficits that can occur in schizophrenia, as this relationship suggests. Frith et al (1991), Kolb and Wishaw (1983), for example, showed in their studies that the illness is characterised by some degree of general intellectual or cognitive decline. The pattern of impairment in this study suggests, however, that although there may be some general cognitive decline, the selective deficits are significantly pronounced compared to this general level of decline. This is more in line with McKenna et al (1990) who theorised that specific patterns of deficit exist over and above general intellectual impairment.

4.1.1. Memory Impairment and levels of Rehabilitation, an outcome measure

Memory impairment was found to be significantly correlated with rehabilitation status, a measure of outcome, in this study suggesting that the greater the degree of memory impairment found, the poorer the outcome as measured by this scale. From the stepwise multiple regression carried out, following the MMSE, Rivermead Behavioural Memory Test was found to be the best predictor of Rehabilitation status. These findings lend support to the growing body of work which specifically places memory impairment as one of the significant cognitive factors related to outcome in the illness (Green et al 2000).

Lawrie et al (1995) also found that memory impairment was the most highly associated variable with the psychosocial outcome of their sample group of schizophrenic patients. It is interesting, however, that the MMSE, a broad measure of overall ability, was shown to be the best predictor of outcome as measured by the Rehab scale as this suggests that the greater the overall level of intellectual decline the worse the outcome, over and above any specific deficits. However, as the correlational analyses showed, MMSE scores were associated with memory deficit and executive dysfunction even though the scores were disproportionately pronounced, possibly pointing to a sub group of severely impaired patients with widespread deficit who have the poorest outcome. It would be expected, that those more chronically ill patients would have greater deficits in cognitive functioning than the less chronically ill as suggested by (Owens & Johnstone 1980). Those that had been unsuccessful at progressing through rehabilitation would fit this criteria.

4.1.2. - Executive Dysfunction

Impairments in executive functioning were found to be present supporting various studies which claim that executive function and the frontal lobes play a significant part in the illness (Liddle et al 1991, Liddle 2001). Impairment in executive functioning was also found to be disproportionate compared to the overall cognitive dysfunction found in the subjects as measured by the Mini Mental State Examination. This was true for each of the three tests of executive function used in the study (The Hayling Test, The Emotional Sentences Completion Test (ESCT) and The Modified Six Elements Test (MSET)) measuring different aspects of executive function. The MSET measures ability to plan, organise and switch between activities. The Hayling Test measures simple response initiation and response suppression, as does the Emotional Sentences Completion Test.

Splitting subjects into the "successful" versus "unsuccessful" groups (n=15), executive dysfunction, as measured by the three tests used in the study, was still found to be prevalent and disproportionate to general level of cognitive impairment except for the successful outcome group's performance on the Hayling Test, where both MMSE and Hayling Test results placed the majority of subjects in the **normal** category. This points to those in the "successful" rehabilitation group having fewer executive problems as measured by this test.

These findings are consistent with the current consensus regarding schizophrenia and neuropsychological deficit, that is, executive function is one of the main areas of impairment demonstrated in the illness. Weinberger et al (1986) proposed that more selective executive function deficits were to be found in schizophrenia than global cognitive decline. In terms of risk factors for developing schizophrenia, Byrne et al (1999) showed that high-risk subjects, siblings of those with schizophrenia, performed more poorly than controls on tests of executive function (The Hayling Test) and memory (Rivermead Behavioural Memory Test). This also points to selective deficits being present even before the illness progresses, according to a neurodevelopmental approach. Several other studies have found impairments to be present in schizophrenia on tests of planning and organisation including the MSET (Shallice et al 1991) and on the Tower of London Task (Robbins et al 1998).

Shallice et al (1991), however, stated that "all chronic schizophrenics have problems associated with processes tapped by 'frontal tests' and that some schizophrenics have, in addition, a more widespread cognitive impairment". In this study, the significant correlation between executive tests and the MMSE, a test of broad cognitive ability, provides more support for Shallice's (1991) theory. It appears likely that there are a number of subgroups of schizophrenia and the heterogeneity of the illness is shown to be a problem in the field of neuropsychology as well as clinically. Attempting to map out specific areas of neuropsychological impairment does appears to be a promising field although the varied tests used, the insensitivity of many of these tests may serve to confuse the issue.

A case in point is the Modified Six Elements Test which is an ecologically valid, relatively new test which assesses everyday planning and organisational problems. The results are promising as it demonstrates that problems in executive functioning can be picked up with anassessment tool which has more meaning and practical validity than some of the other so called tests of executive functioning which are not particularly user friendly or practical(eg. WCST).

The Modified Six Elements Test examines specific aspects of executive functioning, particularly those concerned with failure at the level of the Supervisory Attentional System (SAS) in the Norman & Shallice (1986) model of the control of action. Problems at this level would result in poor planning and organisational skills, poor decision making, error concentration, novel sequences of actions etc (Evans et al 1995). However, Evans et al (1995) who modified the Six Elements Test admit that perhaps the test does not measure all the hypothesised functions of the SAS. This may go some way to explaining why not all schizophrenic subjects in this study were found to have executive dysfunction, as measured by the MSET at any rate. On the other hand, it may be that not all schizophrenics have executive dysfunction. Palmer et al (1997), for example, found that 27% of their sample assessed for neuropsychological impairment were neuropsychologically "normal", thus highlighting that cognitive impairment in schizophrenia is the norm, but also that some patients remain unimpaired.

It may be that in such a heterogeneous illness some may have selective impairments whilst others do not but instead have a widespread cognitive impairment. There is a distinct possibility, and the feeling by many is, that as the clinical picture of schizophrenia is so diverse and heterogeneous then the neuropsychological and cognitive picture will turn out to be of this heterogeneous nature also. Chua and McKenna (1995) put forward a similar view, that schizophrenia is a "heterogeneous disorder clinically and one which many believe will ultimately found to be aetiologically heterogeneous as well". It is perhaps futile, therefore, to attempt to strive to seek the one specific impairment that is present in all patients with this llness. A more useful approach may be to find out the patterns of neuropsychological impairments that can exist in schizophrenia.

A possible criticism of the present study may be that perhaps one of the more laboratory based measures of executive function with good normative data should have been used in preference to this relatively new, ecologically valid test of executive function (MSET). However, the MSET was used primarily because of its ecological validity, as was the Rivermead Behavioural Memory Test, as this is felt to be of prime importance in the assessment of neuropsychological functioning in the rehabilitation area, particularly with regards to the possible practical information that can be taken from the assessments.

The lack of sensitivity of other executive dysfunction assessments is also well known and was another reason for choosing a newly developed test. For example, the Wisconsin Card Sort Test has been criticised by Mountain & Snow (1993) who carried out a detailed analytical review of publications involving the measure. They concluded that clinical findings do not support the use of the WCST as an indicator of executive dysfunction. The Hayling Test measures similar executive functions as the WCST and was used in this study as it is a quick, simple test to administer and more user friendly than the WCST. Similarly with the Emotional Sentences Completion Test which is a very short and straightforward test to complete although normative data is still incomplete for this test.

It may have been more useful, in the present study, to change the order of presentation of assessments or to use two assessment sessions instead of one single session. Invariably, it was felt that subjects were either too tired, bored or "fed up" by the time the MSET or the Hayling Test was presented. Four subjects refused to start the MSET assessment because of these reasons. The concentration and attention of subjects may also have been affected by this time although a few minutes rest between assessments was given, if requested.

4.1.3. Executive Performance and Outcome

From the logistic regression carried out, The Hayling Test Time taken to complete Connected Sentences as well as the Emotional Sentences Time taken to complete Sentences, both executive measures, were predictive of outcome in terms of the "successful" versus "unsuccessful" group. This ties in well with other studies which have also demonstrated that executive dysfunction is linked to outcome in this population. Green at al (2000) in their meta-analysis carried out concluded that executive functioning, mainly as measured by the WCST, was related to functional outcome in schizophrenia. These aspects of the executive tests measure basic task initiation speed, an executive function, and suggest that those who were able to respond more quickly to the task were more likely to succeed in rehabilitation as measured by the criteria for "successful" /"unsuccessful" outcome in this study. Liddle (2001) suggests there are two main types of executive function that can predict poor outcome, impaired planning and initiation of activity which is representative of negative symptoms of the illness and, impaired selection of activity representing the disorganisation syndrome. The results in this study would suggest that the former is present although no relationship with negative symptoms of the illness was apparent.

Tests may, therefore, measure different aspects of executive function. The WCST measures mainly ability to shift set, basic task initiation speed and suppression of response as does the Hayling Test and the ESCT. The MSET, however, was not found to be linked to outcome in this study which may be due to the fact that it measures a different aspect of executive function, namely planning and organisational skills. This may suggest that the group of subjects who have succeeded in living in the community in this study have better executive abilities in terms of being able to work out rules, initiating responses and suppressing habitual responses whereas planning and organisational abilities are not necessarily better in the successful group.

Executive Processes cover such a large number of complex thinking skills and are called executive functions because they are part of a system which acts in a supervisory capacity in the overall hierarchy of brain processing (Shallice 1988). It seems likely that the executive system is composed of a number of different processes which can be impaired singly or in combination (Robbins et al 1996). The complexity of the executive system may go some way to explaining the varied results regarding the range of executive impairments found in schizophrenia and also the heterogeneity of schizophrenia itself results in varied patterns of impairments. However, some consistency may be emerging that executive impairment in the form of response suppression and initiating responses is linked to outcome as noted above.

4.1.4. Between Group Differences – "Successful" versus "Unsuccessful" groups

The main differences between the two groups were measures of executive function. The Hayling Test Overall score, the Hayling Time to complete connected sentences, The Hayling Test time to complete unconnected sentences, and the Emotional Sentences Test Time taken to complete sentences were all found to be significant in terms of showing differences between the successful and unsuccessful groups. This suggests that the successful group had fewer executive impairments than the unsuccessful group in the area of basic task initiation speed and response suppression. These results give further support and credence to Green et al (2000) and Liddle (2001) who both purport that executive function is related to outcome in schizophrenia. Interestingly, no difference between groups for memory function was demonstrated suggesting perhaps that memory impairment was prevalent across the board in this sample.

4.1.5. Effect of Memory Functioning on Executive Tests

Whilst carrying out the assessments with the Modified Six Elements Test, it became evident that perhaps a confounding factor may be the effect of the subject's memory on the ability to remember the relatively complicated instructions. Although the instructions are left in front of the subject throughout the assessment it appeared that most subjects would not look at them once they had begun the assessment meaning that their ability to remember the verbal instructions was extremely important. Of course, it may be that the subjects did remember the instructions and that once they started the test their executive problems became evident with an inability to change set from the task they were doing or their lack of planning and organisational skills.

In fact, Evans et al (1995) also questioned executive impairment being independent from memory impairment whilst using the Modified Six Elements Test in their study. From their between- group analysis they found that there was no correlation between the two variables and concluded that the executive impairment they demonstrated was dissociable from memory impairment.

In the present study, however, significant correlations were found between memory and the MSET and the Hayling Test variables suggesting that, in this study, memory impairment may have been a confounding factor in the test of executive functioning. It may be that the prevalence of memory impairment at all levels of schizophrenia affects functioning in many different areas, including performance on tests of executive functioning or as Goldberg et al (1989) have suggested, memory impairment in schizophrenia appears to affect the recall aspect of memory over recognition and propose that this may be indicative of an executive pattern of impairment. The memory deficits observed in the illness may be secondary to other deficits such as executive dysfunction, rather than primary cognitive deficits. Alternatively, it could be that it is the interface between memory and executive function that is crucial in schizophrenia thereby accounting for the relationship. After all, executive function is known to play a crucial part in the theory of working memory elaborated by Baddeley (1986) and is thought to play an important role in long term memory also (Baddeley & Wilson 1988).

It was also interesting to note that memory impairment was much more prevalent than executive dysfunction in the sample group. This could indicate that memory problems are more widespread than problems with executive function or, a more likely explanation, that what is considered the "normal" range in different tests can be problematic.

4.1.6.Clinical Symptoms, Outcome and Cognitive Impairment

The only cognitive correlates found to be linked to clinical symptoms were: severity of symptoms found to be linked to executive dysfunction as measured by the variable ESCT Error. Negative symptoms were also found to be correlated with ESCT Error, MSET and the MMSE.

The relationship shown between negative signs of the illness and the MSET and ESCT Error variables ties in with the hypothesis that negative symptoms are associated with a general failure to initiate action (Liddle 2001). These two variables are measures of executive function. Executive dysfunction tends to correlate with negative signs of the illness as suggested by Johnstone & Frith (1996) and Andreason (1989). Negative signs are generally said to be associated with a failure to initiate action states and Frith (1994) believes this could arise from an impaired executive system. Hence, the association is perhaps not all that surprising. However, no relationship was found between negative signs and executive variables measuring basic response initiation speed, as already noted.

No link between symptoms and outcome was discovered suggesting that symptom severity, positive and negative signs of the illness are not predictors of good or poor outcome. Rather, this study suggests that cognitive function, as measured by memory and executive function, are the best predictors of outcome in these two groups. This is consistent with recent findings which suggest that symptomatology is not necessarily a key indicator of prognosis in the illness. Greene (1996) in his meta-analysis found that there was no relationship shown in the studies between psychotic symptoms and functional outcome measures.

Medication (chlorpromazine equivalents) were found to be linked to Rehab Status and interestingly the Hayling Test Overall score. This suggests that in this study medication may have had an association with performance on this test with poorer performance linked to increased levels of medication being taken. However, medication equivalents for several subjects were not included in the analysis due to the problems with converting the newer atypical antipsychotic medications and may have had some bearing on these findings.

4.1.7.Evidence for the Syndromes of Schizophrenia

The present study found evidence for three syndromes of schizophrenia which closely correspond to the three syndromes found by Liddle et al (1987a;b). That study used more sophisticated measures of symptomatology than the present study including, the Scale for the Assessment of Negative Symptoms (SANS; Andreason 1982). The present study used only a brief, crude measure of symptomatology covering 9 variables, the Manchester Scale (Krawiecka et al 1977). The results seem more impressive given the crude assessment tool used. Further evidence is therefore provided for the existence of syndromes of schizophrenia which can coexist in a patient. These syndromes can evolve during the course of the illness with the patient for example firstly showing symptomatology corresponding to the syndrome of Reality Distortion and then the symptomatology changing, as the illness progresses, corresponding to the syndrome of Psychomotor Poverty, and so on.

Because it is possible to have symptoms which fit into more than one of the syndromes the suggestion is that the syndromes do not represent distinct types of schizophrenia (Liddle et al 1987a). Instead, the syndromes reflect discrete pathological processes occurring within a single disease. This in turn would suggest that there is a fundamental abnormality in schizophrenia which depending on the individual patient and their environment etc can take on any one or more of the discrete pathological processes. This suggestion made by Liddle et al (1987a) appears to make sense in view of the heterogeneity of the illness and the change over time of the symptomatology within any one individual who suffers from the illness.

The way forward would appear to be to think in these terms. Liddle and Barnes (1990) feel that the "heterogeneity of schizophrenia is better described in terms of syndromes which can coexist in a patient".

4.1.8. Syndromes of Schizophrenia and Executive Function

The presence of syndromes of schizophrenia is becoming clearer as the above studies, including the present one, suggest. There is also evidence that these syndromes correspond to different symptoms and also to different patterns of neuropsychological impairment. Evidence has been accumulating for some time regarding this. For example, Crow (1980) suggested that the illness consisted of two types, one corresponding to Negative symptomatology and the other to the Positive symptoms. Although this model is simplistic, the reasoning and rationale behind it is plausible. Much work has also been carried out on the link between negative symptoms and cerebral ventricular abnormalities (Johnstone et al 1978) with those who have negative symptoms being more likely to have ventricular enlargement.

The present study attempted to investigate whether two of the syndromes found (Psychomotor Poverty and Disorganisation) were associated with executive functioning. The results did not support this hypothesis. In Liddle et al's study (1991) the schizophrenic syndromes he had earlier identified in 1987 were investigated and he hypothesised that two of the syndromes, namely Psychomotor Poverty and Disorganisation, would be associated with impairments in neuropsychological test of executive functioning. He indeed found both syndromes to be associated with different patterns of executive impairments. Psychomotor Poverty was associated with slowness of mental activity and Disorganisation was associated with impairment in tests where the subject is required to inhibit an established but inappropriate response.

The Modified Six Elements Test used in this part of present study measures aspects of executive function used in the control of the Supervisory Attentional System (Norman & Shallice 1986) and problems here result in poor planning and organisational skills, poor decision making, difficulties in novel situations or technically difficult situations for example. It may be that no relationship was discovered between the Factors and this test of executive function (MSET) because different aspects of executive function were being measured. In the Liddle et al (1991) study the Stroop Test (Stroop 1935), the Modified Card Sort Test (Nelson 1976), Reitan's Trail Making Test (Reitan 1958), the FAS word fluency test (Borkowski et al 1967) were all used as tests of executive function. These assessments measure speed of function and inhibition of an established response, which were related to the Factors.

However, the MSET measures neither of these aspects of executive function and this may explain the lack of relationship between this test of executive function and the 2 Factors.

Other studies, however, have also failed to find links between specific symptoms and patterns of neuropsychological impairment. Morrison-Stewart et al (1992) in his study of schizophrenic subjects, for example, found no correlations between frontal lobe neuropsychological test performance and negative symptoms. On the other hand, Liddle et al (1992) using PET scan found negative symptoms to be significantly correlated with areas of the prefrontal cortex.

A difficulty in the area of executive function research is highlighted here, as the nature of executive function covers so many different aspects, all of which cannot be measured by one, or possibly many, of the tests currently available in this field. The insensitivity and lack of evidence regarding what these tests measure exactly has not been forthcoming as it is extremely difficult to isolate aspects of executive function, they are inextricably linked to other systems of functioning. A critique of executive function research and the frontal lobes has been made recently by David (1992) who comments that Executive tests do not actually measure executive function and that the "frontal lobes do everything in general and nothing in particular". The way forward, he suggests is to follow the lead of Shallice & Burgess (1991) for example, who devised the Six Elements Test, and take real - life tasks and break them down into their component parts.

It would seem from the research that the findings are variable regarding the above hypotheses associating syndromes or symptoms with impairments in executive functioning. This appears to be a familiar picture with regard to schizophrenia research where perhaps the heterogeneity of the illness again prevents consistent, clear findings from becoming evident. It may be that what exists are subtle impairments or pathology and Chua and McKenna (1995) suggest that any "brain pathology is subtle and that these subtle differences take the form of quantative differences that must be isolated against a background of often wide normal variation rather than the presence of some easily recognisable lesion".

4.1.9. Symptom Correlates of Test and Rating Scale Performance

Using symptoms taken from the Manchester Scale (9 variables), rehabilitation status was found to be related to negative symptoms and symptoms of thought disorder which supports studies suggesting that negative symptoms are related to outcome (Johnstone et al 1978; Andreason & Olson 1982). In a post hoc analysis the factor of disorganisation was shown to be the best predictor of rehabilitation status. This is an interesting result relation to the suggestion that the disorganisation syndrome might have some predictive value in treatment outcomes (Norman et al 1999).

Similarly, memory impairment was related to both negative and thought disorder symptoms which lends support to the Tamlyn et al (1992) study where memory impairment was strongly correlated with negative symptoms and thought disorder also. The test of executive function (MSET) was found to have no strong pattern of correlations with symptomatology which may be explained by the fact that no relationship exists or perhaps the rating scale as already mentioned, measures only certain aspects of executive function.

4.2.0. The Rehab Scale

This scale was found to have high inter rater reliability for the Total Rehab Score which is supportive of similar studies carried out by Bell (1983) and Carson et al (1988) . The Rehab Scale is certainly a well known, valid and reliable scale which is very useful in the rehabilitation area. Its usefulness is extended as it is possible to use it in several areas of rehabilitation and not just in psychiatric rehabilitation for which it was first designed eg, alcohol & drug problems, head injury, depression. A recent review of the scale carried out by Hall & Baker (1994) concluded that the scale has been particularly successful in the area it was first developed for as well as in the community. They recommended, however, that as the scale only gives a measure of the "behaviour" of the person it is also necessary to gain assessments of other areas of the person's functioning eg neuropsychological, self reports, family reports.

Assessment scales in rehabilitation tend to fall into the same category, that is, of measuring only behaviour or the symptomatology of the person. Wykes et al (1992) also suggest that perhaps other variables such as cognitive deficits play a part in the rehabilitation of the person. In their study investigating possible predictors of failure in rehabilitation programmes using a mixed group of chronic patients, they found that patients with cognitive difficulties are "likely to remain in more supportive psychiatric settings despite rigorous rehabilitation procedures". Results from the present study support this hypothesis as relationships were found between selective neuropsychological deficits and rehabilitation status.

Other scales measuring outcome may have been of more use in the present study for a number of reasons. The Rehab Scale was designed for use in the hospital setting and its transfer to use in the community has been welcomed although it was not designed specifically for this and may miss pertinent areas regarding community care. Comments made by several keyworkers who filled in the forms in the successful group living in the community suggested that this was not an appropriate scale to be using with this client group as its intended use is within the hospital setting. Questions were said to be not specific enough to pinpoint problems within the community and it was suggested that in order to live successfully within the community low scoring in areas of community skills, social activity, self care etc, was absolutely necessary which was borne out in the scoring. This questionnaire may not be sensitive enough regarding outcome in terms of community functioning.

It was viewed as a useful tool, however, within the hospital for monitoring progress within the rehabilitation setting and predicting who may move on from the hospital environment successfully. In this setting, as cognitive skills improve it would be expected that function in every day living skills also improves.

An often noted criticism of the scale (Hall & Baker 1994) is the use of the term "Deviant Behaviour" which is felt to be outdated terminology and somewhat offensive to the population being rated by the use of the scale. Examples of items covered in the section entitled "Deviant Behaviour" include violence, self injury, sexual acts, absconding, talking to self, verbal aggression.

Although the scale is relatively easy to understand and complete by staff, shortage of staff, increased workload and lack of time to fill in scales resulted in a poor retrieval rate for the two forms to be scored for each subject independently by two raters. This was simply impossible in some situations and is reflected in the number used in the inter rater reliability analysis with only 13/70 subjects being double rated

4.2.1.Neuropsychological Impairment and Rehabilitation

Generally, results of this study support recent findings that cognitive impairment is an important part of this illness and, therefore, must be addressed at an earlier stage in the treatment process. A growing body supports the development of the introduction of rehabilitation/remediation strategies to address the importance of cognitive impairment in schizophrenia. The suggestion is made by Wykes et al (1992) that the ability to assess cognitive deficits " enables a fuller assessment of the patient's abilities in order to design a client centred programme".

Critique of cognitive rehabilitation comes from Bellack (1992) who feels that the current "optimism" in this field is not justified and that it is overambitious. He states that as neuropsychological assessments are not sensitive enough to be specific in terms of precisely which functions are deficient then it is not possible to, therefore, devise programmes to remediate these deficits when no one is quite sure what they are exactly. He suggests a more beneficial approach would be to "focus on environmental change and compensatory strategies" instead which have been widely proposed in rehabilitation following brain injury (eg Wilson et al 1989).

4.2.2. Rehabilitation and remediation of cognitive impairment

Remediation implies that the underlying process being targeted is made better or corrected whereas rehabilitation means that the person or problem is supported but not necessarily "cured". The aim of a rehabilitation service is generally a combination of the two, that is "to produce both lasting improvements in the deficits themselves and supporting the areas of continuing weakness" as described by Wykes (2000). Several types of rehabilitation/remediation programmes have been developed over the years including the following examples which can be connected specifically to work on neurocognitive difficulties:

1. IPT- Integrated Psychological Therapy

This approach was first introduced by Brenner et al in 1984 and involves work on a number of different aspects of the person's life including social skills and cognitive difficulties. One sub–programme focuses on cognitive deficits. The format is group work with a didactic approach to tackling the difficulties. Results have been varied with Brenner et al (1984) finding improvement in cognitive abilities but not for social skills. Spaulding et al (1999) compared a group receiving social skills training alone or the cognitive sub programme and social skills training. They found a significant effect of the sub programme on social skills. Criticism has also focused on the group format with comment made by Spaulding et al (1999) that this covers too many levels of ability due to the varied nature of deficits in the illness with drop outs occurring because of either too high or low a level of functioning.

2. CET – Cognitive Enhancement Therapy

This approach uses computer software packages to help individuals attain social cognitive milestones by providing meaningful and self directed approaches rather than role plays devised for them. It is based on work carried out on brain injured individuals and was developed by Hogarty & Flesher (1999). A neurodevelopmental model of schizophrenia is adhered to with the assumption being that developmental deficits produce delays in social learning. Patients take part in 6 months of non-social cognition training before going on to train in social cognition. "Gistfulness" is a rather useful description given to the skill the participants are trying to develop. This term suggests they are attempting to get the gist of information through the interpretation of various types of information. This type of rehabilitation draws heavily from the theories of social cognition particularly that the apprehension of the gist of social problems and situations is a problem in schizophrenia. Hogarty & Flescher (1999) have demonstareted that CET is effective in enhancing social competence and performance in this group of individuals.

3. CRT – Cognitive Remediation Therapy

Developed initially in Australia by Delahunty & Morice (1993), a combination of laboratory and clinical approaches is used with patients on a one to one basis using techniques such as scaffolding, mnemonic techniques and errorless learning to help patients attain success without any reference to failure within the programme. Continual reinforcement and encouragement is given to the individual.

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This approach has been further developed by Wykes and her colleagues in England (1999). They compared CRT with a control therapy consisting of psychosocial activities. Remediation was shown to improve performance in cognitive flexibility and memory. An improvement was also found in social behaviour. With improved self esteem an interesting find in this group also. This is a potentially important finding which requires further investigation as "subjective distress and poor self esteem are often the targets of cognitive behavioural therapy. It is logical that improved neurocognitive performance would be associated with less subjective distress" (Spaulding & Poland 2001).

4. Behavioural approaches to attentional deficits

Silverstein (1998) has been one of the main proponents of this type of approach to rehabilitation. He suggests that the main area of deficit which requires to be addressed in schizophrenia is attention. If attentional deficits are present and not subsequently addressed before going on to work on higher level deficits such as memory or executive processes, he predicts that failure is inevitable. He uses operant methods such as shaping in order to tackle attentional difficulties in the most chronically and severely ill, in patient populations. Differential reinforcement of successive approximations is used. Menditto et al (1991) also utilised shaping procedures to increase the attention span of in patients. Verbal praise, tokens and a snack were used as incentives. After 12 months, six out of seven subjects had shown a substantial improvement in attentional function. Silverstein et al (1998) replicated the findings with similar improvements in attention.

Errorless learning is another behavioural method which can be successfully incorporated into rehabilitation programmes. Errorless learning involves the patient succeeding at every stage of the process and has been used in several studies successfully (O'Carroll et al 1999, Wykes et al 1999).

4.2.3. Social Cognition

Rather than considering individual frameworks and theories in schizophrenia, more and more frequently researchers and academics are recognising and proposing an eclectic framework for explanations of what is happening in schizophrenia. A case in point would be the increasing recognition that social cognition theories are playing in the schizophrenia debate alongside the more biological approaches and indeed the neuropsychological model.

Social cognition is concerned with "the processes and functions that allow a person to understand, act on, and benefit from the interpersonal world" (Corrigan & Paul 2001). One of the main characteristics in schizophrenia according to DSM-IV is impairment in social functioning.

Links between neurocognitive deficits and deficits in social cognition are already apparent. Deficits in social cognition may be evident at many stages in the illness. For example, the development of deficits in social cognition in adolescence may involve impairment in attention and motor control which may play a part in an inability to acquire social cognition, according to (Spaulding & Poland 2001).

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Learning may be impaired as a result of these deficits in terms of social rules and interactions. Social cognition processes may also usefully be involved in the treatment effects of rehabilitation strategies, for example, looking at cognitive activity outside the neurocognitive domain such as social problem solving, social skills training, attribution style etc (Spaulding & Poland 2001).

Cognitive deficits can also be linked to social cognition in terms of social perception and problem solving. Corrigan and Green (1993) and Corrigan & Toomey (1995) found that people with schizophrenia had deficits in ability to process abstract information which interfered with social perception and problem solving. People with schizophrenia have difficulty understanding and reacting to abstract information.

Gistfulness is another area which ties in social and neurocognitive theories. In social situations, people generally consider and act upon the "gist" of interpersonal interactions. This skill is learned through the acquisition of an extensive repertoire of symbolic representations of situations, responses in the form of scripts and roles. Gistful social cognition, as described by Hogarty & Flescher (1999), is a process of rapidly matching situations to response scripts and roles before processing all of the attendant information. Faulty or inefficient gistfulness has clear implications for the efficiency and competence of social behaviour according to the authors.

Rehabilitation and remediation strategies already link in with social cognition theories such as CRT, IPT and CET as described above. The development of the Emotional sentences Completion Test used in this study, also relates to both neurocognitive theory and social cognition and attempts to relate the two. The ability to measure executive function also based on social cognition theory (the perception and understanding of emotions) is an interesting approach.

Social cognition theories and links to information processing models of schizophrenia and outcome are generally accepted in the literature and exciting research tying in these frameworks in terms of the pattern of deficits, links to symptomatology, aspects of social cognition and outcome is the next step forward.

4.2.4. Mediators

In fact, Green et al (2000) in their influential paper relating specific cognitive impairments to outcome suggests that social cognition may be a mediator between neurocognition and social competence. Green recognised that although neurocognitive factors were indeed related to outcome it was not clear **HOW** they were related. Social cognition was suggested as a possible mediator between neurocognition and social competence by Green & Neuchterlein (1999). This theory suggests that components of social cognition such as perception of emotion may be distinguished from basic neurocognition.

Using social cognition as a mediator may help to fine tune what it is that is being measured in terms of neurocognitive deficits and outcome. Measures of specific aspects of social cognition may help in this respect. This may also help to find out whether deficits in social cognition are general rather than specific.

Learning potential is also suggested by Green (2000) to be a potential mediator. Learning potential involves the latent capacity of a person to learn rather than focussing on developed abilities (Grigorenko & Sternberg 1998). It requires a shift in assessment from what the patient knows to what the patient is capable of learning, Assessments which may be able to measure this include the WCST as used by Schottke et al (1993) where three types of learners were identified .Validity of learner status in schizophrenia is starting to be demonstrated (Wiedl & Weinhobst 1999). For example, nonlearners are more likely to be in non demanding rehabilitation settings.

Information regarding learning potential may then be used when placing patients in rehabilitation or remediation programmes. High learners may be placed in more complex programmes whilst nonlearners may be considered for rehabilitation strategies using errorless learning techniques. Errorless learning places few demands on the subject with high probability for success at each level of training. Success using this type of approach which was previously used in brain injured individuals comes from O'Carroll et al 1999. Their group of subjects with schizophrenia who had memory impairment were found to benefit significantly when they were not allowed to make any mistakes during learning.

Wykes et al (2001) also use methods such as errorless learning in their cognitive remediation packages which may take pressure off nonlearners in their subjects. Learning potential and social cognition may indeed be stepping stones in the link between cognitive deficits and functional outcome. Assessment of these mediators would appear to be a pre requisite before deciding which type of rehabilitation programme a person is placed in.

4.2.5. Optimum Treatment Packages

Now that a consensus is being reached regarding the importance of cognitive impairment in schizophrenia and the potential of remediation therapies for targeting these deficits, optimum treatment may well be achieved for people experiencing this devastating illness. Optimum treatment might possibly include a combination of the following:

1. Screening /Vulnerability

The screening of individuals at possible risk of developing the illness either as a result of genetic links or picked up due to developmental delay in school/home etc may be the first point in augmenting the treatment in terms of predicting and implementing the most effective strategies for limiting the impact of this illness at an early stage through family interventions, medication, education, introduction of coping strategies, support etc. Early intervention needs to be delivered at the earliest stage possible, particularly within the first 2-5 years (Birchwood et al 1997).

2. Neurocognitive Dysfunction

A complete neurocognitive profile would be of immense benefit in terms of predicting outcome and in deciding which type of remediation programme or placement would be of most benefit. A thorough neuropsychological assessment as early as possible in the development of the illness would be of most benefit to patient and the service alike. This may include measures of learning potential and social cognition.

3. Medication

The introduction of newer antipsychotics such as olanzapine and risperidone working on the nmda system, although at an early stage in terms of conclusive results regarding effectiveness, may have the potential for helping cognitive deficits in schizophrenia and therefore generally helping the person function in society.

4. Remediation

As noted, various strategies and programmes are being researched and utilised in various parts of the world with interesting results. Further research is required to pinpoint which approaches are most appropriate and economical in today's money conscious health services. Results are promising and suggest that remediation of cognitive deficits is possible with lasting results which generalise to other aspects of functioning such as social skills and improving self-esteem.

4.2.6. Limitations of the Study

Regarding the design of the study, a correlational approach was employed. Given the relatively small sample size caution has to be taken with regards to interpretation of the results. Also, results from a correlational analysis do not imply causality rather they measure the degree of relationship between two variables. At the outset, this design was chosen as it was deemed most appropriate, taking into account these limitations.

The study covered a wide age range (23-73, mean age - 43.16, S.D. – 11.97) which may not be a representative sample of the population and this particularly applies to interpretation of data whereby those participants of an older age may have been exhibiting cognitive decline related to the ageing process. However, normal distribution of the age variable was found and it was, therefore, decided to include the variable in the analyses. The level of specific cognitive impairment, as already discussed, was also found to be present over and above general level of cognitive impairment as measured by the Mini Mental State Examination (MMSE). Including the variable of age as a covariate in partial correlations may have addressed this issue.

Finally, the use of the Mini Mental State Examination (MMSE) as a brief global measure of cognitive ability may be criticised as inappropriate for measuring overall level of cognitive ability, perhaps being less sensitive and detailed in its measurement than more robust assessments such as the WAIS-III. However, it was chosen in this study as it is an extremely brief and easy to administer test of cognitive ability, is widely used as a screening test and is well standardised and validated. It has also been used in previous studies assessing similar patient groups (Duffy & O'Carroll 1994; McKenna et al 1990) which is useful for comparison of results.

4.2.6. Conclusions

It would appear that the search for the aetiology of the illness of schizophrenia will continue to be an intense field of study for the foreseeable future and that the debate over conflicting results will also continue. The heterogeneity of the clinical picture seems to be mirrored in the neuropsychological patterns of impairments found and perhaps this should be more readily accepted and recognised.

Cognitive impairment is an integral part of the illness, a fact which does not now appear to be disputed following the increased abundance of literature on the topic. That these neuropsychological impairments are linked to functional outcome is also an accepted development in the field of schizophrenia research. This study has supported these two premises in that: selective neurocognitive deficits were identified in the areas of memory and executive dysfunction and these were shown to be disproportionately pronounced compared to overall levels of cognitive impairment; memory and executive dysfunction were also demonstrated to be related to outcome as measured by the Rehab Scale, an outcome measure, and by the definition of being "Successful" in proceeding through the rehabilitation process which corresponds to Green et al's (2000) results of a meta analysis investigating neuropsychological deficit and functional outcome in schizophrenia. The association between these two areas has led to interesting debate and theory surrounding remediation strategies such as specifically targetting neurocognitive deficits in remediation programmes and considering social cognition theories and learning potential as possible mediators between the two domains of neurocognitive deficits

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and functional outcome. The study also demonstrated further support for recategorisation of schizophrenia into three defined syndromes, closely matching the syndromes of Reality Distortion, Disorganisation and Psychomotor Poverty, described by Liddle (1987) which account for certain patterns of symptoms in the illness. No association was, demonstrated, however, between these syndromes and cognitive dysfunction as had been hypothesised.

Support for a neurodevelopmental model of the illness seems to be increasing with interaction on many levels at different times in an inividuals life. Indeed, Mortimer & McKenna (1995) propose that the investigation of schizophrenia should take on a "levels of explanation " approach whereby it is necessary to look at three distinct levels of the illness- brain dysfunction, neuropsychological impairment and symptoms, and to "then try to understand how abnormality at one level is associated with abnormalities at adjacent levels". This would appear to be a commonsensical approach which should be promoted and adhered to if any progress is to be made with regard to the understanding of schizophrenia.

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Appendix

National Adult Reading Test (NART)

SECOND EDITION

Answer/Record Sheet

Name: .... Date of test: ....

	Errors		Errors
CHORD		SUPERFLUOUS	
ACHE		SIMILE	
DEPOT		BANAL	
AISLE		QUADRUPED	
BOUQUET		CELLIST	
PSALM		FACADE	
CAPON		ZEALOT	
DENY		DRACHM	
NAUSEA		AEON	
DEBT		PLACEBO	
COURTEOUS		ABSTEMIOUS	
RAREFY		DETENTE	
EQUIVOCAL		IDYLL	
NAIVE		PUERPERAL	
CATACOMB		AVER	
GAOLED		GAUCHE	
THYME		TOPIARY	
HEIR		LEVIATHAN	
RADIX		BEATIFY	
ASSIGNATE		PRELATE	
HIATUS		SIDEREAL	
SUBTLE		DEMESNE	
PROCREATE		SYNCOPE	
GIST		LABILE	
GOUGE		CAMPANILE	

KRAWIECKA:

Rating made by replies to questions (about past week):

Depressed (how severe, how frequent)	0	1	2	3	4
Anxious (how severe, how frequent)	0	1	2	3	4
Coherently expressed delusions (how getting on with other people; whether anyone seems against him; whether he can think clearly; any interference with thoughts; thoughts read; reference to him on television or newspapers	0	1	2	3	4
Hallucinations (hearing voices or seeing visions)	0	1	2	3	4

Ratings made by observation:

Incoherence and irrelevance of speech	0	1	2	3	4
Poverty of speech, mute	0	1	2	3	4
Flattened affect	0	1	2	3	4
Incongruous affect	0	1	2	3	4
Psychomotor retardation	0	1	2	3	4

Side effects

	Absent	Mild	Marked
Tremor	0	1	2
Rigidity	0	1	2
Dystonic reactions	0	1	2
Akathisia	0	1	2
Difficulties with vision	0	1	2
Other (specify)	0	1	2

Rating:
Absent for all practical purposes	0
Some evidence of symptom, but not pathological	1
Present just sufficient to be regarded as pathological	2
Marked	3
Severe	4

Modified Six Elements Test Recording Sheet

Subject: .... Date:..........................

During the test, record the order of tasks attempted by the subject and the time spent on each.

Task	Time on task

Scoring

a. Number of tasks attempted   =

b. Number of rule breaks   =

Total Score (a-b)   =

Record of overall time on tasks and number of correct responses:

Task	Total time on task	Number of correct responses
1A		-
1B		-
2A		/ 60
2B		/ 60
3A		/ 60
3B		/ 60

THE TASKS

1. To dictate into the tape recorder (which will be running for the whole 10 minutes) the following:

    A. Describe the best holiday that you have had.

    B. Describe any memorable event in your life.

2. To write down the names of as many pictures as you can (in order).

    A. Those in the left-hand pile

    B. Those in the right-hand pile

3. To solve 2 sets of arithmetic problems (as many as you can in order)

    A. Set A

    B. Set B

SUMMARY OF INSTRUCTIONS

In the next 10 minutes you have three different tasks to do. You can check the time with the watch.

Each task is in two sections; A and B.

You will not be able to do everything in ten minutes, but you should try to do at least part of each of the six sections. However you **must not** do section A and B of the same task one after the other. eg. you must not do section A of the Arithmetic task followed by section B of the Arithmetic task.

conversation.

If mute, tick this box. ☐

| Patient never started off a conversation him/herself. | Occasionally started a conversation. | Started conversations with staff and patients. |

14. How sensible was the patient's speech?

If mute, tick this box. ☐

| Bizarre, delusional or jumbled speech. Impossible to make sense of what was said. | Talked some nonsense and some sense. | Spoke sensibly and to the point. |

15. How clearly did the patient speak?

If mute, tick this box. ☐

| Speech unclear, impossible to make out what was being said. | Speech partly unclear, but could be mainly understood. | Speech was easily heard and understood. |

16. How good were the patient's table manners?

| Bad table manners. Spilt food all over front, used fingers, scoffed food. (If staff fed patient rate here) | A bit messy. Spilt some food on self. | Ate normally. Did not spill food. Would not have stood out in a cafe. |

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23. How good was the patient's general everyday behaviour last week?

| Taking everything into account, very poor socially and at doing things for self. | Several problems were present which would affect the patient's ability to live outside hospital. | Taking everything into account, as good socially and at looking after self, as needed to live outside hospital. |

In answering the questions so far you have considered the patient's behaviour during the last week. On the whole, was the patient's behaviour during the week:

better than usual ☐

about the same as usual ☐

worse than usual ☐

Please add any comments that you wish to make about the patient's behaviour:

....

....

....

....

....

Subject and test details

Name

Age

Date of test

Further details

The Hayling Sentence Completion Test

Score summary

Box A   **Box B**   **Box C**   Total scaled scores

☐ **+** ☐ **+** ☐ **=** ☐ →

(Section 1 Scaled score)   (Section 2 Scaled score)   (Section 2 Errors scaled score)

**Hayling overall
scaled score**

☐

Table E

Total scaled scores	Overall scaled score	Classification
23	10	Very superior
22	9	Superior
21	8	Good
20	7	High average
17–19	6	Average
15–16	5	Moderate ave.
13–14	4	Low average
11–12	3	Poor
10	2	Abnormal
< 10	1	Impaired

Hayling Section 1: sensible completion

- *In a moment I am going to read you a series of sentences, each of which has the last word missing from it. I want you to listen carefully to each sentence, and when I have finished each one, your job is to give me a word which completes the sentence. Do you understand?*

Practice

- *Before we start, I'll give you a couple of practice sentences so that you can get the hang of it. Are you ready?*

Response   **Time**

P1 The rich child attended a private

P2 The crime rate has gone up this

Test

- *OK, that's the end of the practice items. The next few sentences I'll read aren't really any more difficult than the two you've just done. But the important thing is that I want you to give me your answer as quickly as you can – the faster the better. Is that clear?*

1 He posted a letter without a
   or: He mailed a letter without a

2 In the first space enter your
   or: In the first blank enter your

3 The old house will be torn

4 It's hard to admit when one is

5 The job was easy most of the

6 When you go to bed turn off the

7 The game was stopped when it started to

8 He scraped the cold food from his

9 The dispute was settled by a third

10 Three people were killed in a major motorway
   or: Three people were killed in an interstate

11 The baby cried and upset her

12 George could not believe that his son had stolen a

13 He crept into the room without a

14 Billy hit his sister on the

15 Too many men are out of

Total time (raw score) →

Scaled score (transfer this to box A in score summary above)

Table A

Raw score	Scaled score	Comment
0	7	High ave.
1–9	6	Average
10–18	5	Moderate ave.
19–22	4	Low ave.
23–50	3	Poor
51–60	2	Abnormal
>60	1	Impaired

1

The Brixton Spatial Anticipation Test

- *'There are many pages here which all have the same basic design on them. There are always ten positions, and one of them is always coloured blue'* [point to filled circle on page one]. *'However the coloured one moves around according to various patterns that come and go without warning. These numbers* [point to numbers underneath the circles] *are just here to refer to the position – there is nothing complicated or mathematical about this test'.*
- *'Now, as I turn the pages over, your job is to pick up on the pattern as best you can, and point to where you think the blue one is going to be on the next page. It's not guess-work – you can work it out. For instance, imagine the blue one was here* [point to position 6], *and then when I turn the page it goes to 7, and then to 8, then to 9 – you might reasonably expect it next to go to 10'.*
- *'From time to time the pattern changes without warning, and then it is your job to pick up on the new pattern as best you can. Do you understand?'*
- Give further assistance if necessary
- *'Obviously the first time you have nothing to go on, so your first answer will have to be a guess – have a guess as to where the blue one will be next'*

Item/page	Correct answer	Subject's response	Correct/incorrect
1	any		
2	3		☐
3	4		☐
4	5		☐
5	6		☐
6 *	7		☐
7	4		☐
8	3		☐
9	2		☐
10	1		☐
11	10		☐
12 *	9		☐
13	10		☐
14	5		☐
15	10		☐
16	5		☐
17	10		☐
18	5		☐
19 *	10		☐
20	7		☐
21	8		☐
22	9		☐
23	10		☐
24	1		☐
25	2		☐
26 *	3		☐
27	10		☐
28	9		☐

Item/page	Correct answer	Subject's response	Correct/incorrect
29 *	8		☐
30	1		☐
31	2		☐
32	3		☐
33	4		☐
34 *	5		☐
35	4		☐
36	10		☐
37	4		☐
38	10		☐
39	4		☐
40	10		☐
41 *	4		☐
42	9		☐
43	9		☐
44	9		☐
45	9		☐
46	9		☐
47	9		☐
48 *	9		☐
49	9		☐
50	8		☐
51	9		☐
52	8		☐
53	9		☐
54	8		☐
55	9		☐

← Total number of errors (raw score)

• Scaled score

Table D		
Raw score	Scaled score	Classification
0–7	10	Very superior
8	9	Superior
9–10	8	Good
11–13	7	High average
14–17	6	Average
18–20	5	Moderate ave.
21–23	4	Low average
24–25	3	Poor
26–31	2	Abnormal
>31	1	Impaired

EMOTION SENTENCE COMPLETION TEST

		Response	Time
1.	Winning the lottery made him feel so		
2.	His sudden death left them in tears feeling		
3.	Losing the match left the team feeling		
4.	As she stood up to speak she was trembling and felt		
5.	Stepping in the dog mess made her feel		
6.	The film was so sad that they all		
7.	He came top of the class and felt		
8.	The used car salesman had conned them and they felt		
9.	Her dress falling down in public made her feel totally		
10.	Walking out and forgetting to pay left her feeling		
11.	The dark alley at night always made her feel		
12.	The date went so well she felt		
13.	He rudely interrupted her and she suddenly felt		
14.	Seeing the lorry hurtling towards her she suddenly		
15.	The team were cheated by a bad decision and felt		
16.	After the party he thought he'd been too argumentative and felt		
17.	The accident nearly scared him to		
18.	He scored the winning goal and felt		
19.	The break-up of the relationship left her feeling so		
20.	Being deliberately lied to left him feeling		