

Portfolio including Thesis

Volume 1 of 2

MARIANNE KREUTZ

A portfolio submitted in partial fulfilment of the
requirements of the University of Hertfordshire
for the degree of Degree of Doctor of Clinical Psychology
including a Thesis entitled:

**Performance of People with
Mild Cognitive Impairment or early Alzheimer 's Disease
on the Behavioural Assessment of the Dysexecutive Syndrome
Test Battery**

The programme of study was carried out in the Department of Psychology,
University of Hertfordshire

November 2004

Volume 2 restricted access

CONTENT

Essay 1	p. 3
Essay 2	p. 25
Small Scale Service Related Project	p. 45
Critical Literature Review	p. 82
Thesis	
Title page	p. 107
Table of contents	p. 108
Abstract	p. 112
Introduction	p. 114
Methods Section	p. 138
Results	p. 150
Discussion	p. 173
References	p. 194
Appendices	p. 204
Critical Review Paper	p. 234

ESSAY 1

Essay title:

Anxiety and depression are so interwoven that it is difficult to view them as separate. Critically argue your position on this statement, illustrating with clinical case examples.

Submitted by:

Marianne Kreutz
Year 1 Clinical Psychology

October 2002

word count: 5041

‘Anxiety and depression are so interwoven that it is difficult to view them as separate. Critically argue your position on this statement, illustrating with clinical case examples.’

Introduction

The question of anxiety and depression as separate or as one clinical phenomenon deserves to be considered from different perspectives. I will contemplate approaches from psychopathology and psychology along with evidence from research and clinical case illustrations. In this way I will demonstrate that at present both approaches supporting or opposing the above statement are valuable for improving clinical practice. However, none of the theoretical perspective discussed is without shortcomings. I will therefore argue from a position, which at times shows varying sympathies but overall remains both critical and open-minded.

Wider issues have arisen for me in the attempt to critically evaluate relevant literature, which I am unable to address comprehensively. Theories of mental disorder and of normal human experience and emotion have often been developed without attempting to explain both. Theorists who attempt to bring these areas closer together deserve credit. However, as the essay title implies, this paper will focus on anxiety and depression as psychopathological categories. In psychiatry, those who put psychopathology on a continuum with normal experience remain a minority. Whilst I concentrate on arguments brought forth in psychopathology, I am aware of neglecting useful alternative perspectives. A further tension arises from the dualism of practitioner and scientist: as a clinician I see people with their individual clinical presentations. Conversely, as I review theoretical perspectives my focus changes from people to diagnostic entities.

I will start by contemplating theoretical and methodological developments in psychopathology. This will address classification systems, the issue of comorbidity,

and alternative approaches to this phenomenon. Research evidence presented later will readdress this question. Next, a psychological perspective will extend the discussion by moving away from the medical model. Clinical case examples will be considered as a final aspect. I will conclude with a summary of my position and arguments in favour of newly developing approaches, capable of explaining both differences and communalities in anxiety and depression.

Psychopathological perspectives

The question about the nature of the relationship between anxiety and depressive disorders is essentially a problem that falls into the scientific domain of psychopathology. It is thus affected by changing assumptions, traditions, methods and theories in this discipline. Developments that have helped to shape the central issue will be considered here. Psychiatric classification systems and their implications will be addressed first, followed by a discussion of comorbidity and symptom overlap as well as different models of the relationship between anxiety and depression.

Classification systems

Psychopathology has a long tradition of classifying mental disorders into taxonomic systems. A categorical approach and general principles of classification have contributed to the difficulties encountered in trying to assess the relationship between anxiety and depression.

Kraepelin proposed psychiatric disorders as discrete and mutually exclusive disease entities. He claimed that any patient would be unlikely to have more than one disorder (Maser & Cloninger, 1990). This implies that anxiety and depression could not co-occur, a fact neither borne out in clinical observations nor research. Patients with anxiety or mood disorders often have features of multiple mental disorders (*ibid.*). At the conceptual level two factors contribute to this.

Firstly, textbook descriptions of specific disorders are prototypical and thus oversimplified. They rarely match the complex clinical presentation of an actual patient (Maser & Cloninger, 1990). Secondly, no individual sign or symptom is either necessary or sufficient to diagnose a specific psychiatric disorder. Instead, psychiatric disorders are defined as syndromes, and diagnostic criteria are based on a set of co-occurring but otherwise non-specific symptoms (ibid.). Although certain symptoms attain more importance for particular psychiatric disorders, symptom overlap abound. This is certainly true for anxiety and depression, and any patient experiencing most of the overlapping symptoms need only suffer few of the more specific ones to receive a dual diagnosis. Hence, it becomes obvious why anxiety and depression can be difficult to separate in certain cases. A categorical approach to classification, which allows for overlap between categories will stay problematic, as boundaries between syndromes remain indistinct. Recent developments in taxonomic systems do not resolve this issue.

Attempts to date have not been able to support Kraepelin's position. Psychiatric disorders appear to be neither discrete nor mutually exclusive. Once we permit their co-occurrence, the extent of overlap becomes of interest. In principle, the higher this is the more the question of homogeneity arises and a search for communalities seems indicated. Again, variance is already introduced at the conceptual level, as different classification principles artificially increase or decrease observed co-occurrence between syndromes. The latter is called comorbidity, an issue I will address in more detail after considering the implications of hierarchical principles and descriptive-empirical approaches.

Hierarchical principle

Once a commonly used principle of classification, the hierarchical principle gives organic mental disorder primacy over other psychiatric disorder. Although this assumption is problematic, as it can be difficult to differentiate between direct effects of an organic disorder or adjustment problems, this is tangential to the current topic.

However, other psychiatric diagnoses are also ordered hierarchically on the basis of postulated causative processes. Disorders for which a somatic basis is assumed are ranked above those presumed to have psycho-social origins. Sometimes a hierarchically higher diagnosis takes priority over another disorder, which also could have been diagnosed. For example, the DSM III specified that agoraphobia should not be diagnosed, if a current major depressive episode or Obsessive Compulsive Disorder had been diagnosed. Use of hierarchical classification principals has several implications for our debate, illustrated by the example from DSM III. On the one hand, subsuming agoraphobic symptoms that are additional to a diagnosis of a major depression acknowledges that anxiety and depression can be interwoven. On the other hand, this rules out a further diagnosis and artificially reduces comorbidity estimates.

Descriptive systems

Current diagnostic systems, in particular DSM IV and ICD 10, have tried to address some problems of previous classification systems, but other issues remain problematic. DSM and ICD aspire to be atheoretic, descriptive and empirically based, however, DSM contains inclusion and exclusion criteria for which there is little evidence (Maser and Cloninger, 1990). Unlike previous systems, no assumption is made that each mental disorder is a discrete entity with sharp boundaries to other mental disorder or to normal experience (Maser and Cloninger, 1990), a development which corresponds better to evidence.

However, diagnostic features are shared by multiple disorders and minimal efforts are made to avoid multiple diagnoses, yet, the issue of comorbidity is not addressed specifically. Not surprisingly, increased syndrome co-occurrence has been observed and at least a degree of comorbidity is artifactual due to shared diagnostic features. Efforts to avoid artificial comorbidity have predominantly targeted restricted syndromes which are nearly always included as part of a more pervasive disorder (Maser and Cloninger, 1990). Thus hierarchical principles risk artificially

decreasing comorbidity whereas current classification systems risk increasing observed rates.

Comorbidity

Comorbidity has been defined as “any distinct additional clinical entity that has existed or that may occur during the clinical course of a patient who has the index disease under study” (Feinstein, 1970, in: Pasnau, & Bystritsky, 1994). Although use of the term varies, essentially, two or more disorders are assigned. Whereas some authors would like to restrict the concept to disorders (Maser and Cloninger, 1990), I prefer to consider a broader definition for the current purpose. We may reasonably assume that a patient with a particular diagnosis, who has a number of additional symptoms may still be distressed by these, even when no second diagnosis is justified. All symptoms deserve clinical attention and I will consider evidence of co-occurring symptoms alongside comorbidity estimates. This addresses part of the question how interwoven anxiety and depression are. However, Pasnau, & Bystritsky, (1994) suggest that it is more fruitful to focus on differences, such as those symptoms that differentiate between both (for example, diurnal variation of mood in depression, depersonalisation/derealization in anxiety).

Cross-sectional comorbidity research is common, yet, important clinical implications arise from longitudinal research. Maser and Cloninger (1990) compare a patient with first onset of panic attacks in the course of depression with another patient whose lifelong panic disorder becomes complicated by secondary depression. Cross-sectional features are similar, but treatment of the former should primarily target depressive symptoms. The second patient should be treated for panic attacks, as additional symptoms should alleviate as the primary symptoms improve. Moreover, asymmetry in the comorbidity of anxiety and depressive disorders has been found: patients with a depressive disorder are more likely to remain free from additional anxiety, whereas the risk of a person with anxiety disorder to develop depression later on is much greater (Maser and. Cloninger, 1990).

Different hypotheses have been developed that try to account for the observed comorbidity between anxiety and depression. Most do not challenge categorical diagnosis of psychiatric disorder, however, others would like to see this replaced by a dimensional approach to psychopathology. If we assume validity of any suggested approach, different implications for treatment ensue. I will discuss advantages, disadvantages and clinical implications of different hypotheses.

Wittchen (1996) sees the scientific community divided into two groups, which he calls 'splitters' and 'lumpers'. These represent largely the divide between a categorical ('splitters') and dimensional ('lumpers') approach to classification. They can be viewed as extreme positions, whereas alternative suggestions can be construed as middle ground.

The 'splitters' position is embodied in the two predominant diagnostic systems, DSM-IV and ICD-10. Major classes of mental disorders are descriptively divided into smaller units (Wittchen, 1996) to increase understanding of mental disorder and develop more specific treatment strategies for individual syndromes. The main weakness lies in overlap of diagnostic features contributing to artificial comorbidity. A strong point is that research into the phenomenon of comorbidity has been stimulated, which will help to establish how closely linked anxiety and depression are. Emphasis on differences between disorders should stimulate research into causes of difference and how anxiety and depression may be viewed as separate. Clinically, the latter might allow us to develop more specific case formulations.

Wittchen (1996) describes as 'lumpers' those scientists who favour a search for commonalities in disorders. The moderate supporters attempt to identify ways for grouping disorders together, for example, based on shared vulnerabilities. Goldberg (1996) talks about anxiety and depressive syndromes as belonging to the same spectrum of disorder. More extreme followers of this perspective argue for a complete rejection of categorical classification in favour of a dimensional approach to psychopathology. Krueger (1999) states that common mental disorders show comorbidity because they are indicators of a smaller number of underlying

dimensions. He calls these 'core psychopathological processes' and suggests that research should focus on these rather than specific disorders. Implications for clinical practice would be far reaching. In as much as treatment guidelines are based on diagnostic categories, these would need to be revolutionised, to be brought in line with dimensions.

Moreover, a dimensional perspective implies a continuum between normal and psychopathological experience and further research would be stimulated to account for differences in experience along the dimensions. This may lead to novel treatment approaches. Critics of dimensional approaches, however, point to the good validation of some categorical diagnoses.

Some theorists have started to consider a middle ground position. Here, I would place Maser and Cloninger's (1990) suggestion that comorbidity patterns could be a way forward in developing more appropriate classification systems. Whilst the usefulness of existing categorical classification systems is recognised the value of a more dimensional perspective (i.e. empirically supported comorbidity patterns) is also acknowledged.

The notion of comorbidity between anxiety and depression does not in itself specify the nature of the relationship between the two groups of disorder. Different hypotheses have been suggested. The 'pluralistic model' sees them as distinct disorders and comorbidity between any two disorders would be expected at the prevalence rate of one disorder for the group of patients affected by the other disorder. However, observed rates are much higher. The clinical implication, if this approach were true, would be that each disorder has to be treated separately. Another hypothesis states that comorbid depression and anxiety is a separate clinical entity (Pasnau, & Bystritsky, 1994). Although this would seem to help the 'splitters' out of a tight corner, true mixed states are rare (Wittchen, Schuster and Lieb, 2001). Comorbidity occurs mostly between two disorders for which full criteria have been met. The 'unitary theory' states that depression and anxiety are variants of the same disorder (Pasnau, & Bystritsky, 1994) or have a common aetiology (Wittchen, 1996).

This hypothesis reflects dimensional thinking and the same treatment could be suggested for both. Closely linked is the 'severity hypotheses'. Research findings support that patients who have both an anxiety and depressive disorder tend to be sicker and more difficult to treat (Pasnau, R. O. & Bystritsky, A., 1994).

Expectation for treatment duration would be increased, expectation for treatment success would be lowered.

I have already raised the 'primary-secondary distinction' in connection with cross-sectional versus longitudinal comorbidity research.. Anxiety disorders often precede mood disorders, and a causal mechanism, such as demoralisation, has been suggested (Hawton, Salkovskis, Kirk and Clark, 1989, Wittchen, 1996). For example, one of my clients reported that his worsening social phobia made him feel increasingly depressed. Research evidence for a primary-secondary distinction is strong. Suggested treatment hence would depend on the primary disorder that affects a patient, but hereby a more precise treatment could be achieved (Maser and Cloninger, 1990; Pasnau, & Bystritsky, 1994).

Classification systems to date remain highly problematic. Attempts to address the question of psychopathology very differently seem appealing to me, for example dimensional approaches. These abandon the idea of categories and at the same time put psychopathology on a continuum with normal experience. At present alternative approaches are fraught with their own methodological problems and remain incomplete or unconvincing. Furthermore, despite flaws a categorical approach has been used for a long time and helped understand and treat mental distress. I think it would take a long time for a different approach to replace the existing system. The transition would have to be managed without creating a vacuum in care. This could be achieved by a new model that goes beyond current practice but can account equally well for our present knowledge. Such a new system would integrate the strengths of both categorical and dimensional approaches whilst overcoming some of their problems. Krueger and Piasecki's (2002) model, which I will discuss later, comes closest. In the mean time, we do well to keep those hypotheses in mind,

which can fruitfully inform our clinical practice (e.g. primary-secondary distinction), but stay aware of their hypothetical nature.

A Psychological perspective

Unlike psychopathology, many psychological approaches are not particularly concerned with establishing the validity of specific psychiatric syndromes.

Psychological theories have focused more on the question how to explain ‘abnormal’ experiences and develop suitable intervention strategies. Liberated to a degree from defining psychopathology, they can contribute to the debate of similarities and differences between anxiety and depression, by exploring commonalities in the development and maintenance of different disorders.

I will consider aspects of cognitive-behavioural theory in some detail. Due to restrictions on length I have chosen only one psychological approach rather than not doing justice to more theories (such as psychoanalysis, attachment theory and the helplessness-hopeless model). There are several reasons for choosing Cognitive Behaviour Therapy (CBT): I am familiar with working with this approach, thus I can consider my own case material to illustrate certain points. CBT is well researched and has a good evidence base. Moreover, I think CBT has used both categorical and non-categorical thinking to advance practice and thus demonstrates how both perspectives can be usefully employed.

Beck’s theory of emotional disorder focuses on the role of schemata in the aetiology and maintenance of psychological disorder. Schemata develop early in life in response to certain situations and can later become reactivated in situations, which remind the person of the earlier experience. They are core beliefs about the self, other people and the world, which guide the person’s perceptions, interpretations and behaviour in situations in which a particular schema is relevant. Once activated schemata are thought to lead to systematic biases and distortions, to make

experiences consistent with the schemata (Weary and Edwards, 1994; Williams, Watts, MacLeod, Mathews, 1997).

The main difference between anxiety and depressive disorders lies in the specific content of the schemata (Beck, 1976; Beck & Emery, 1985 in Weary and Edwards, 1994). Schemata associated with depression contain negative views of the self, the world and the future, such as information about personal loss, hopelessness, and failure. In anxiety disorders, the content of schemata revolves around themes of personal physical or social danger, vulnerability, and uncertainty (Weary and Edwards, 1994; Williams, Watts, MacLeod, Mathews, 1997).

However, there are also similarities in the thought content of anxious and depressed people: Both disorders are associated with self-deprecatory thoughts, thoughts of helplessness and negative self-evaluation, and thoughts that negative outcomes for the future are likely (compare Weary and Edwards, 1994). Further common factors relate to attentional biases, such as self-focused attention, which detract from attention directed at the environment. Poor social relationships and a wish to withdraw can also play a role in both anxiety and depression (Hawton, Salkovskis, Kirk and Clark, 1989; Weary and Edwards, 1994).

Similarities in thought content and social withdrawal became obvious for two of my clients, one whose main problem was social phobia and one with a diagnosis of moderate severe depression. The socially anxious client expressed beliefs that other people would perceive him as a failure, if he blushed in their presence. He had also started to doubt his own ability as he was underachieving in his current job. For the depressed client almost any incidence of procrastination or interruption in task achievement would evoke thoughts of being a failure. Thus selective abstraction and overgeneralisation of perceived failure played a role for of both clients.

Additionally, both felt uncomfortable in social situations and had withdrawn increasingly from company, as they anticipated discomfort or adverse judgement from others. This avoidance helped maintain feelings of anxiety and depression, as

neither social success nor much positive reinforcement from social activities could be experienced.

Within CBT different authors have developed more specific models for different disorders, in particular anxiety disorders (Wells, 1997). These are useful to help develop more precise formulations for individual clients. Thus a return to a categorical view of psychiatric disorder has been useful to advance cognitive behavioural treatment for specific disorders.

Research evidence

Although it may seem that comorbidity research favours a perspective that sees anxiety and depression as closely linked, several points need not be forgotten. Conceptual and methodological problems, such as symptom overlap between diagnoses, can artificially inflate comorbidity. However, even when this is avoided, comorbidity between psychiatric disorders remains considerable (Wittchen, 1996). Published comorbidity rates also vary depending on the population and time window studied, the particular disorders investigated and how comorbidity is defined. Nevertheless, common findings emerge. Secondly, there are equally a large number of people who suffer with either an anxiety or depressive disorder, but do not show noticeable symptoms of the other syndrome.

Comorbidity between anxiety and depression is present in general population samples, but higher in clinical samples, such as psychiatric in- and outpatients (Wittchen, 1996). Comorbidity rates are higher than would be expected, when the prevalence rates of disorders are taken into account. Although mixed anxiety-depressive states are a heterogeneous mixture, available data indicates that secondary depression in anxiety is more frequent than primary depression with coincident anxiety symptoms (Maser & Cloninger, 1990). Clinically significant mixed states where neither syndrome meets diagnostic criteria are rare (Wittchen, Schuster and Lieb, 2001). An important clinical implication is that comorbid anxiety-depressive

disorders have a poorer outcome both compared to anxiety or depression alone (Emmonds., Simmonds and Tyrer, 1998).

The Munich Follow-up general population study, in which half the sample had no psychopathological symptoms, found a comorbidity rate of 4.4% between anxiety and depressive disorders, or 9.9% when subthreshold conditions were taken into account (Wittchen, Schuster and Lieb, 2001). This translates into 20% of diagnosed cases having both and around 45% showing symptom overlap at subclinical level. Sartorius, Üstün, Lecrubier, and Wittchen (1996) likewise report that in the WHO study in general health care nearly half the cases of depression and anxiety appeared in the same patients at the same time.

Rates in clinical samples are about twice as high (Wittchen, Schuster and Lieb, 2001). Pasnau and Bystritsky (1994) cite cross-sectional rates of comorbidity between anxiety and depression of 25-40% (Regier et al., 1988: in Pasnau & Bystritsky, 1994). Similarly, Angst (1996) found longitudinal associations between major depressive episodes and any anxiety disorder of 30-44%. These are among the lowest rates published for clinical samples.

Highest comorbidity tends to be reported for panic attacks, generalised anxiety disorder and obsessive-compulsive disorder with major depression (Pasnau. & Bystritsky, 1994; Wittchen, 1996; Wittchen, Schuster and Lieb, 2001). 40% to 91% comorbidity has been found for panic disorder and depression, and up to 80% of patients with Obsessive Compulsive Disorder or Generalised Anxiety Disorder also report depressive symptoms (Pasnau & Bystritsky, 1994). Cloninger, Martin, Guze and Clayton (1990) report secondary depressions in 55% of the Washington University Clinic sample, but also report that patients were less likely to have a secondary diagnosis if the mood disorder was primary.

Lastly, research undertaken by Krueger (1999), who favours a dimensional approach to psychopathology, should be mentioned. He used confirmatory factor analysis on a subset of DSM-III-R disorders assessed in the National Comorbidity Survey. This

yielded a 3 factor structure with 2 highly correlated dimensions. Krueger settled for a 2 factor solution, which represented data for the clinical subsample better. The 'internalising factor' comprises two subdimensions, "anxious-misery" and "fear", and the other factor represents an 'externalising' dimension. Krueger concludes that his findings support suggestions that comorbidity results from common, underlying core psychopathological processes.

What do these findings tell us in relation to the question, whether depression and anxiety are separable from each other? I largely agree with Sartorius et al. (1996) that the frequent co-occurrence of both disorders raises serious questions about their separability and that we need to consider adjusting current classification systems. However, whilst Emmonds et al. (1998) agree that the efficiency of our current diagnostic systems is limited, they also highlight the value of categorical diagnostic decision in allowing us to ask answerable questions and make treatment recommendations. I further think that there is a risk involved in abandoning a categorical system prematurely until a new system becomes available that not only accounts better for current findings, but is also able to make treatment recommendations and provide an evidence base.

Whereas I find a dimensional approach to psychopathology an attractive alternative, I do not think that attempts to date have been satisfactory. I see considerable shortcomings in Krueger's (1999) attempt to arrive at a dimensional structure. In my opinion, he does not provide a convincing rationale for the inclusion and exclusion of particular disorders to determine major dimensions of psychopathology by factor analysis. Notably, OCD has not been included, although other studies have shown its high comorbidity with depression. Likewise, how can Krueger hope to find a comprehensive dimensional structure of psychopathology, if he neglects psychotic disorders. These may not only add a further dimension to his model, but will probably load highly on the internalising factor, as symptoms of anxiety and depression are frequent in psychosis. A major criticism of factor analysis is that it will only find an order for those elements investigated.

Interestingly, both categorical and dimensional approaches use similar data to support their respective positions. Proponents of the categorical approach emphasise difference, the existence of pure cases, asymmetry in comorbidity and the value of categorical distinctions for treatment recommendation and prognosis. Proponents of dimensional approaches on the other hand stress that research findings are largely consistent with a perspective that anxiety and depression share common psychopathological features (Wittchen, 1996).

Krueger and Piasecki (2002) have recently developed Krueger's earlier ideas (1999) into a model which is able to integrate both the 'splitters' and 'lumpers' perspective. He calls this the hierarchical spectrum model: clusters of syndromes represent the dimensional perspective and he postulates non-specific etiological factors exerting an influence across syndromes. In contrast hierarchically subordinate clusters of symptoms (integration of the categorical perspective) are also influenced by specific etiological factors, which impact on which syndrome a person will develop within the superordinate cluster. Moreover, Krueger and Piasecki also consider how this model allows psychological and psychopathological perspectives to come closer together. I therefore think their model has great heuristic value to allow future progression from the currently unsatisfactory status quo of psychopathological diagnosis, provided the whole spectrum of psychopathological symptoms is included in a search for dimensions or commonalities.

Clinical case examples

I am aware that as a novice to the profession I have taken comfort in a categorical approach, as this provided me with practical guidelines on what questions to ask and treatments to offer. Writing this essay I have therefore become conscious that I could have missed or disregarded potentially important information. For some of my clients additional concerns, that had not been mentioned in the initial interview, surfaced in later sessions. I will aspire to overcome this shortcoming in future by assessing more thoroughly for co-occurring symptoms.

Although the number of clients I have seen thus far is small, a picture as mixed as the quoted research results has already begun to emerge: Most of my clients showed symptoms of different syndromes and this seemed observable irrespective of relative recent onset or severity of illness. One notable exception was a client with a moderate driving/ accident phobia following a road traffic accident, who throughout treatment only reported symptoms of anxiety. The impact of these on his social functioning were limited whilst other areas of functioning remained unaffected. It would therefore seem unlikely that this client would develop secondary depression as his symptoms were neither worsening nor seemed to be a particular problem most of the time. Albeit only a single example, I feel impelled to keep an open mind on the value and validity of categorical classifications, until a convincing model has been developed and researched which can account for both comorbidity and so-called pure cases.

On the other hand, both a client with a complicated grief reaction, but no formal diagnosis, and a client with a bipolar disorder, currently depressed (mania remitted more than 15 years ago), reported symptoms of low mood and anxiety. Low mood, sleep problems and worries were common to both, whilst the former also showed safety behaviours (checking) and the latter client social anxieties and avoidance behaviour. Pervasiveness rather than type of symptoms seemed to be a major difference between both clients, the former only experiencing them intermittently, whereas the latter had been suffering with these symptoms for a number of years, in a range of situations and with greater intensity.

Other clients have already been discussed in the main text of the essay, but I would like to include a further client, whose example raises a number of additional questions and problems, which are beyond the scope of this essay. The referral letter for this client mentioned problems with anger, depression and a chronic health problem. The client himself perceived anger as his main problem, an emotional problem frequently encountered in clinical practice but not adequately included in psychopathological classification systems. Furthermore, comorbidity of depression and other disorders, in particular chronic health problems is also a frequently

observed phenomenon and restriction of any discussion to anxiety and depression alone is necessarily limited.

However, despite observed overlap, for a number of my clients it was also true that different symptoms had different importance, and either anxiety or depression appeared to be the predominant problem. Clinical case examples have also been published in the literature and are particularly useful to provide guidance on specific treatment approaches for comorbid conditions (e. g. Moras, Telfer and Barlow, 1993), while larger non drug treatment trials are still outstanding.

Conclusion

In summary, it is my opinion that credible arguments can be brought forward both in favour and against viewing anxiety and depression as separable. As both positions seem fruitful for clinical considerations, I would consider it premature to disregard either. Each perspective has its own strengths and weaknesses, and has received some clinical as well as empirical support. This contradiction is one that I feel needs to be resolved for any account of observed psychopathological phenomena to be credible. The more practical side of me favours categorical thinking, whilst ideologically I favour dimensional approaches. Answers to the questions in what way anxiety and depression are or are not separable will bring us closer to a revised view of psychopathology that accounts well for observed phenomena.

A satisfactory attempt to integrate both and take a middle stance is still outstanding, although both Maser and Cloninger's suggestions to think in patterns of comorbidity (1991) and Krueger and Piasecki's hierarchical-spectrum model show potential. Personally, I find the latter heuristically more promising. I hope, as the model gets developed further, it can retain an appropriate balance between categorical and dimensional thinking rather than become dominated by either for ideological reasons. I also think that any attempt would remain incomplete, if it does not

succeed in accounting for both psychopathological and normal phenomena as a continuum of human experience.

It does seem worthwhile to try to clarify how much overlap between different disorders, such as anxiety and depression might be artifactual and what degree of co-occurrence is 'true' comorbidity. Although we are unlikely to arrive at a universally agreed estimate, the process will surely contribute to an increased knowledge of psychopathological phenomena.

Clinically, as there appear to be distinct and separable aspects to both anxiety and depression we should pay attention to them and treat them in their own right. At the same time, overlap is so considerable that it should become standard practice for any practitioner to assess for a range of symptoms in clients, particularly those symptoms known to co-occur frequently. This way we can ensure that we do not overlook comorbidity in clients, who might not freely talk about all their complaints. In carefully assessing the extent of any additional symptoms, when they first appeared in relation to other symptoms and where the main complaints for the patient lie, we should be able to target our treatment strategies effectively to alleviate suffering.

References

American Psychiatric Association (1980). Diagnostic and Statistical Manual of Mental Disorders (3rd edn.) (DSM - III). Washington, DC: American Psychiatric Press.

American Psychiatric Association (1994). Diagnostic and Statistical Manual of Mental Disorders (4th edn.) (DSM - IV). Washington, DC: American Psychiatric Press.

Angst, J. (1996). Comorbidity of Mood Disorders: A Longitudinal Prospective Study. British Journal of Psychiatry, 168 (S30), 31-37.

Beck, A. T. (1976). Cognitive Therapy and the Emotional Disorders. New York: International Universities Press.

Cloninger, C. R., Martin, R. L., Guze, S. B. and Clayton, P. J., (1990). The Empirical Structure of Psychiatric Comorbidity and its Theoretical Significance. In: J. D. Maser & C. R. Cloninger (Eds.), Comorbidity of Mood and Anxiety Disorders (pp. 439-462). Washington D. C: American Psychiatric Press.

Emmanuel, J., Simmonds, S. and Tyrer, P. (1998). Systematic review of the outcome of anxiety and depressive disorders. British Journal of Psychiatry, 173 (suppl. 34), 35-41.

Goldberg, D. (1996). A Dimensional Model for Common Mental Disorders. British Journal of Psychiatry, 168 (S30), 44-49.

Hawton, K., Salkovskis, P. M., Kirk, J. and Clark, D. M., (1989). Cognitive Behaviour Therapy for Psychiatric Problems. A Practical Guide. Oxford: Oxford University Press.

Krueger, R. F. (1999). The Structure of Common Mental Disorders. Archives of General Psychiatry, 56, 921-926.

Krueger, R. F. and Piasecki, T. M. (2002). Toward a dimensional and psychometrically-informed approach to conceptualising psychopathology. Behaviour Research and Therapy, 40 (5), 485-499.

Maser, J. D. & Cloniger, C.R. (Eds.), 1990. Comorbidity of Mood and Anxiety Disorders. Washington D. C.: American Psychiatric Press.

Maser, J. D. & Cloniger, C.R., (1990). Comorbidity of Anxiety and Mood Disorders: Introduction and Overview. In: J. D.Maser & C.R. Cloniger (Eds.). Comorbidity of Mood and Anxiety Disorders (pp. 3-12). Washington D. C: American Psychiatric Press.

Moras, K., Telfer, L. A., & Barlow, D. H. (1993). Efficacy and Specific Effects Data on New Treatments: A Case Study Strategy With Mixed Anxiety-Depression. Journal of Consulting and Clinical Psychology, 61 (3), 412-420.

Pasnau, R. O. & Bystritsky, A., (1994). On the Comorbidity of Anxiety and Depression. In: J. A. den Boer & J. M. Ad Sitsen (Eds.). Handbook of Depression and Anxiety. A Biological Approach (pp.45-53). New York: Marcel Dekker, Inc.

Sartorius, N., Üstün, T. B., Lecrubier, Y. and Wittchen H. U. (1996). Depression Comorbid with Anxiety: Results from the WHO Study on Psychological Disorders in Primary Health Care. British Journal of Psychiatry, 168 (S30), 38-43.

Weary, G. and Edwards, J. A. (1994). Social cognition and clinical psychology: Anxiety, depression, and the processing of social information. In: R. S. Wyer and T. K. Srull (Eds.). Handbook of social cognition; Vol. 2: Applications (2nd ed., pp.289-338). Hillsdale, N.J: Lawrence Erlbaum Associates.

Wells, A. (1997). Cognitive Therapy of Anxiety Disorders. Chichester: Wiley.

Williams, J. M. G., Watts, F. N., MacLeod, C. and Mathews, A. (1997). Cognitive psychology and emotional disorder. Chichester: Wiley.

Wittchen H. U. (1996). What is Comorbidity - Fact or Artefact. British Journal of Psychiatry, 168 (S30), 7-8.

Wittchen, H. U., Schuster P. and Lieb, R. (2001). Comorbidity and mixed anxiety-depressive disorder: clinical curiosity or pathophysiological need? Human Psychopharmacology – Clinical and Experimental, 16, S21 –S30.

World Health Organisation (1992). The Tenth Revision of the International Classification of Diseases and Related Health Problems (ICD-10). Geneva: WHO.

ESSAY 2

Essay title:

**Critically discuss the concept of ‘challenging
behaviour’ and the role of the clinical psychologist
in assisting with this.**

(Essay in core area ‘Learning disabilities’)

Submitted by:

Marianne Kreutz

Trainee Clinical Psychologist

Year 1

November 2003

Word count: 5000

Critically discuss the concept of ‘challenging behaviour’ and the role of the clinical psychologist in assisting with this.

Introduction and definition

‘Challenging behaviour’ is a term that refers to a broad class of behaviours. It has replaced related concepts, such as ‘dysfunctional’, ‘maladaptive’ and ‘problem behaviours’. Emerson (2001) argues that these earlier concepts made implicit assumptions about the psychological characteristics of the behaviour that have been queried. For example, challenging behaviour is now thought to serve a function for the person and can be considered ‘adaptive’ for getting needs met. The introduction of the term ‘challenging behaviour’ deliberately shifted focus towards the social construction of behaviour as ‘challenging’. I will discuss this issue after introducing a definition of challenging behaviour.

Defining a broad class of behaviours in a meaningful way is a difficult task without assuming common causes or function. Emerson (2001) defines challenging behaviour as:

‘Culturally abnormal behaviour of such an intensity, frequency or duration that the physical safety of the person or others is likely to be placed in serious jeopardy, or behaviour which is likely to seriously limit use of, or result in the person being denied access to, ordinary community facilities. (Emerson, 1995).’

Notably, behaviour is classified by its consequences (risk of physical harm or social exclusion) and normative deviance (‘culturally abnormal’). The focus on impact can also be seen in Emerson’s (2001) descriptive summary of challenging behaviour:

‘... unusual behaviours shown by people with severe intellectual disabilities. These include aggression and destructiveness, self-injury, stereotyped mannerism, and a range of other behaviours which may be either harmful to the individual (e.g. eating inedible objects), challenging for carers and care staff (e.g. non-compliance, persistent screaming, disturbed sleep patterns, over-activity) and/or objectionable to members of the public (e.g. regurgitation of food, the smearing of faeces over the body).’

Emerson's definition and description appeal, as they seem to capture the whole range of 'challenging' behaviours. Emerson could be criticised for focussing too much on people with severe intellectual disabilities. Prevalence in this group is higher, but people with milder difficulties also engage in challenging behaviour. It is important not to lose sight of this fact, as more able patients may verbalise important information to increase our understanding of challenging behaviour.

A glance beyond the speciality of Learning Disabilities may also reveal limitations or identify hidden assumptions. A critical appraisal of Emerson's definition highlights some problems with the concept of challenging behaviour. Given limited defining characteristics, a number of behaviours not normally considered as 'challenging' would be compatible with Emerson's definition. Arguably, the behaviour of an agoraphobic (never leaving the house) is culturally abnormal and seriously limits the person's use of ordinary community facilities. Deliberate self-harm may place the person's physical safety in jeopardy and shares some common features with self-injury (such as endorphin release). Yet, what assumptions do we make by using different terms? Challenging behaviour and criminal behaviour can overlap, but on what basis do we decide it is both? Is inappropriate sexual behaviour less 'challenging' in a person with average IQ? What could we learn from considering culturally deviant behaviours across ability levels to increase our understanding of challenging behaviour? Do we consider similarities enough or do we make implicit assumptions that we need to review critically, for example, are we prejudiced towards behaviourism when assessing people with learning disabilities?

I do not wish to argue that there are no differences between the examples I have provided and the widely accepted view of challenging behaviour. Furthermore, some of these issues have already been considered in the literature. However, if we address the question on what basis we categorise one behaviour as challenging but not a similar one, we might be able to refine the concept of challenging behaviour; otherwise it could remain a 'catch all' and less meaningful.

Some issues raised above might now be considered routinely, such as the impact of physiological states or mental illness on the person's challenging behaviour. This has been an important development but we also need to keep the issues alive. Otherwise we risk neglecting bodies of knowledge, even if some aspects might be more difficult to assess in people with learning disabilities. For example, as we believe that a large part of human behaviour is mediated by a person's interpretation of events, do we also routinely consider the role of cognitions in challenging behaviour? If behaviour such as 'non-compliance' arises in the context of depression (lack of interest & motor retardation), do we cease to label it 'challenging', as we would not consider the same label for a person without learning disabilities?

This leads us back to the question of social construction, which I consider an important issue raised by the concept 'challenging behaviour'. It highlights that challenging behaviours lies in the eye of the beholder, and thus means a significant shift in focus. For whom is the behaviour challenging? Emerson (2001) rightly points out that a number of behaviours may not put individuals at risk, might even be experienced as pleasurable by the person (e.g. self-stimulatory behaviour), but would still be viewed as challenging. These behaviours may be challenging for the people who care for that person, services or other people who come into contact with the individual. Challenging behaviours often elicit a range of negative emotions in those who observe them, such as shock, fear, disgust or irritation (Hill & Dagnan, 2002). These are experienced as unpleasant and can lead to unhelpful reactions towards the person with challenging behaviour, such as withdrawal from the individual. Heyman et al. (1998) raise a related point when they discuss a risk management dilemma: labelling an individual as challenging could forewarn staff, but could also damage the quality of services that a person receives.

As challenging behaviour is socially constructed thresholds for classification may be variable. While Emerson (2001) draws attention to cultural abnormality and the intensity, frequency or duration of behaviours, decisions remain a matter of personal judgement. Although agreement between individuals might be considerable, some differences will exist, influenced by attitudes and value systems. In an era that

stresses normalisation and community integration behaviour is viewed as challenging if it interferes considerably with social integration. It is doubtful that some behaviours would have been perceived as equally challenging during the period of large institutions. We may speculate that behaviour received less attention, if it did not present a management problem (e.g. rocking).

Whereas this may look obvious, it seems worth reflecting, whether similar but subtler prejudices still exist. Do we perceive profound inactivity as equally challenging as aggression? Both can be seen as culturally abnormal and interfering with access to community facilities. However, I would postulate that aggression is more likely to be noticed and to receive intervention due to the associated risk. Nor might inertia elicit an equally strong emotional response in others. Recognising the social construction of challenging behaviour does not prevent that additional judgements are made based on interpersonal outcomes.

Social construction affects the term challenging behaviour itself. Intended to shift focus from the individual to the system response it still has acquired negative connotations. Whereas in many contexts a challenge can be perceived positively we may tend to think challenging behaviour is something to be wary of.

Although some behaviours are only perceived as challenging by the environment, others present a challenge to the individual himself. They may wish to decrease some behaviour but might not have the necessary skills. For example, Emerson (2001) describes a patient who used physical restraints to stop his self-injurious behaviour, but these also prevented him doing other activities. People on the autistic spectrum might engage in ritualistic or obsessive behaviours, which may help regulate arousal. However, they can become a problem for the person, if he feels compelled to engage in them longer than he wants to. On a darker note, challenging behaviour has also been used a justification by staff to abuse people in their care, such as physically reprimanding and restraining the person for their challenging behaviour.

Despite some limitations of the concept ‘challenging behaviour’, it would be unjustified to diminish the achievements that have been made in the area. Clinical approaches are well grounded and have many positive features. Multiple theoretical models inform practice; non-aversive intervention strategies have improved ethical practice. Highlighting social construction calls attitudes towards challenging behaviour into question and changes assumptions about what may constitute desirable outcomes. Behaviour that is no longer seen as dysfunctional but as communicating need or distress would not be adequately addressed by simply trying to stop it. Instead the person needs to be encouraged to develop functionally equivalent behaviour that is socially acceptable. Clinical psychology has contributed much to these changes in clinical practice and should continue in this role.

‘Challenging behaviour’ will probably remain a concept defined in terms that cannot be readily objectified or operationalised. Despite its broad scope it serves as shorthand for communication and may even facilitate access to appropriate services, (although we need to remain alert to Heyman’s (1998) risk management dilemma, too). Specialised ‘challenging behaviour’ services can be seen as a positive development, which communicates the importance of meeting the needs of the person appropriately. The prevalence of challenging behaviour has been estimated at 7-14% in all people with intellectual disability, but at 22 – 33% in people with severe or profound learning disabilities (Emerson, 2001). Risk factors include male sex, specific disorders (e.g. Lesch-Nyhan syndrome, autism) and additional disabilities. Multiple challenging behaviours in one person, childhood onset and high persistence over time are common. Hence it is a clinical issue affecting a significant minority of people with learning disabilities and the services that provide for them.

Whereas Emerson’s definition deliberately remains free from psychological theory, when we try to understand the challenging behaviour of a particular individual then theory and evidence base play important roles. They inform hypotheses, assessment methods and intervention. Functional analysis provides a broad framework for arriving at a formulation for challenging behaviour, in which a range of variables is included in the assessment process. These include person and setting factors

alongside reinforcement contingencies. Thus biological, ecological or systemic models are drawn on and integrated into behaviour theory (compare Haynes & Hayes O'Brien, 2000, and Herbert, 1987).

Theories of challenging behaviour

A fundamental shift in understanding challenging behaviour occurred when it began to be seen as functional, often communicating need or distress, rather than as purposeless or undesirable. Behaviourist theories still prevail, but biological and ecological models have also found support. The role of mental illness in challenging behaviour has also been considered. By contrast, the role of cognitions in mediating challenging behaviour seems neglected and could be made an area of future development. However, psychodynamic theories have received little evidence and no longer play a large part in formulating of individual challenging behaviour.

Behavioural models

The dominant behavioural approach sees challenging behaviour as examples of operant behaviour, whereas classical conditioning and social learning theory play lesser roles in practice (Emerson, 2001). Historically, principles derived from learning theory were applied to clinical practice and through research soon led to the development of successful approaches, such as applied behaviour analysis and functional analysis.

In the operant conditioning paradigm environmental consequences maintain challenging behaviour. Positive reinforcement (contingent presentation of rewarding consequences) and negative reinforcement (contingent withdrawal of aversive consequences) are distinguished. Both result in increase of behaviour that they follow contingently. As reinforcement is a desired outcome for the person, challenging behaviour can be seen as functional and adaptive as it leads to the individual receiving reinforcement. This has implications for clinical practice: to reduce challenging behaviour, reinforcement contingencies need to be discovered so that they can become targets for change. The function of the behaviour should also

be identified. It will often be possible to teach the person functionally equivalent behaviours that are more socially acceptable.

Antecedents of behaviour are also important as environmental contingences. These include stimuli that immediately precede the challenging behaviour (proximal environmental factors) as well as person factors (e.g. tiredness, learning history), setting factors (e.g. lack of stimulation) and distal environmental factors (e.g. repeated refusal of attention from busy staff gradually increasing frustration and the final incidence leading to an outburst of aggression). Behavioural approaches have been criticised for focussing too much on proximal events, but recently methods for evaluating events over time have been developed (compare time series measures, Haynes & Hayes O'Brien, 2000). An important distinction between antecedents differentiates establishing conditions and discriminative stimuli. Establishing conditions refer to the motivational basis for the challenging behaviour, i.e. under what conditions is the person likely to engage in the behaviour (for example when bored). Discriminative stimuli inform the person of the likelihood that the challenging behaviour will be reinforced (for example, gaining social attention from staff but not from fellow clients). Hence it becomes important to include the context in the analysis of challenging behaviour. Moreover, environmental contexts can become the target for intervening in challenging behaviour.

As noted above, another important characteristic is the focus on functional relationships between behaviours and environmental factors. This has several implications for clinical practice: As function, that is the effect of the behaviour on the environment, is important rather than the specific form or topography of behaviour, superficially similar behaviours cannot be grouped together a priori (e.g. two stereotypic behaviours). By contrast, seemingly dissimilar behaviours may be grouped as members of the same response class, if they all serve the same function. Each challenging behaviour needs to be assessed in its own right as premature narrowing of hypotheses may lead to interventions that are not optimally helpful.

As functional analysis is a scientific method, experimental control over functional relationships between events needs to be demonstrated, such as predicted increase and decrease of behaviour upon contingent presentation and withdrawal of contextual factors. Functional control over challenging behaviour can also be demonstrated by differentially reinforcing a more socially appropriate member of the same response class, an intervention that can lead to rapid and significant reduction in a person's challenging behaviour (Emerson, 2001).

Other developments have added to the behavioural model. The issue of automatic reinforcement presents a particular challenge to practitioners. Some challenging behaviours can be seen as maintained by reinforcing stimuli that are private consequences and integral to the behaviour. Examples include the visual stimulation resulting from eye poking or stereotypic behaviour that modulates arousal. Automatic reinforcement (Emerson, 2001) is seen as a special class of operant behaviour. As neither discriminative stimuli for these behaviours can develop nor their reinforcing power be changed, interventions are limited to targeting establishing conditions, substituting functionally equivalent behaviours or differentially reinforcing other behaviour.

Other learning principles may also be relevant to challenging behaviour, such as classical conditioning, schedule induced behaviour and respondent behaviour, but play a lesser role. Theoretical assumptions and practical applications of behavioural approaches have been empirically supported. The weakness of the behavioural model does not lie in the factors that it addresses – as it does so very well, particularly with increasing dominance of non-aversive intervention methods, but in the variables it does not consider sufficiently.

Expansions of the behavioural model

Over time the scope of the behavioural model has extended and concepts from other schools of thoughts have been integrated. Whilst laudable, this expansion has remained limited. Ideas were assimilated into behavioural thinking rather than the explanatory power of alternative theoretical perspectives fully appreciated. However,

this criticism may apply more to theoretical integration rather than clinical practice, where individual psychologists are likely drawing on alternative models.

A systems approach

At one level the operant perspective itself sees behaviour as the product of a complex and dynamic behavioural system, rather than reflecting the operation of one discrete contingency on one particular behaviour (Emerson, 2001). This means at any time multiple contextual influences and reinforcement probabilities impact on which behaviour we engage in from a choice of potential behaviours.

Another way of looking at behavioural systems takes both patient and carer behaviour and their mutual impact into account. Emerson (2001) describes how the person with challenging behaviour and carers can get locked in a vicious circle or 'negative reinforcement trap'. Carers may habituate to a certain level of challenging behaviour and no longer provide social attention or allow the person to withdraw from social demands. As the person might have to show more intense or complex challenging behaviour to ensure these reinforcers again, this can perpetuate challenging behaviour. Similarly, termination of challenging behaviour may act as negative reinforcement for carers. We may expect carers to develop strategies for avoiding interaction with an individual whose challenging behaviour is maintained by negative social reinforcement.

This is a narrow behavioural view of 'systems' and does not extend to systemic thinking. However, systemic theories may have to offer additional understanding of challenging behaviour. For example, 'challenging behaviour' might be a narrative that is told about a person and perpetuated among staff or it may have a function in maintaining rigid boundaries between the 'challenging' individual and carers. Such systemic ideas highlight additional aspects of the social construction of challenging behaviour.

The role of 'verbal rules'

In recent years interest in verbal rules (instructions and self-instruction) has increased, as these can play an important role in mediating between environmental contingencies and behaviour (Emerson, 2001). Thus a cognitive component has been introduced into the behavioural model. When verbal rules guide behaviour environmental contingencies might have a lesser impact on behaviour, as cognitions might be distorted and the individual might interpret events to fit the cognition. I think that Emerson understates the potential role of cognitions when he concludes that rule-governed behaviour may have some direct relevance but has greater relevance for understanding the behaviour of carers towards people with challenging behaviour. As Emerson points out himself, verbal rules gradually emerge in early childhood. Putatively, this is both linked to language and cognitive development. A number of people with challenging behaviours have communication abilities. I think it is a challenge for our profession to consider more how cognitive processes may be influencing challenging behaviour and how we can assess these validly.

Developmental perspective

Developmental processes may play a role in other respects, too. During normal infant development repetitive movements akin to stereotypic behaviour commonly occur. Even head banging can be observed in a considerable minority of infants. In toddlers tantrums, aggression and property destruction are very common (Emerson, 2001). It has been proposed that children with severe intellectual disabilities may show such otherwise developmentally appropriate behaviours at a later chronological age and with greater frequency, severity and for longer. Additional impairments associated with a severe intellectual disability lead to the child developing only restricted behavioural and communication repertoires. Faced with a challenging situation the child may not have an adaptive behaviour alternative available.

Neurobiological models

Neuro-biological theories focus on the role different neurotransmitters (dopamine, serotonin and endorphins) may play in the development and maintenance of challenging behaviour. Neurotransmitters have been particularly implicated in self-

injurious behaviour, but also linked to aggression and arousal. An example is the presumed role of endorphins as an automatic reinforcement process in self-injuries behaviour. Neuro-biological models have gained some empirical support (Emerson, 2001).

Psychiatric disorders and challenging behaviour

The association between psychiatric disorder and challenging behaviour has been contemplated in three ways (Emerson, 2001): Challenging behaviour has been considered as atypical presentation of a psychiatric disorder, for example similarities between OCD and self-injuries behaviour have been highlighted. Challenging behaviour may also occur as a secondary feature of psychiatric disorders, for example, depression may be expressed through somatic symptoms or agitation. Finally, in some cases psychiatric disorder may function as an establishing condition for engaging in challenging behaviour. For instance, if depression is linked to an unwillingness to participate in activities and the person has learned previously that challenging behaviour will get them out of a situation, the depression may provide the motivational basis to engage in challenging behaviour.

All of the above factors should be considered when hypotheses about the challenging behaviour of a particular person are generated. To avoid incorrect conclusions we also need to bear in mind that causal and maintaining factors may be dissimilar across individuals and across different forms of challenging behaviour shown by the same individual (Emerson, 2001). Maintaining factors may also vary over time and across contexts. A complex presentation may emerge, in which operant behaviours may be controlled by more than one reinforcement contingency. Whilst this necessitates a thorough assessment, the resulting formulation and intervention will be tailored to the individual, avoid an oversimplified generic approach and has a better chance of success.

Whereas behavioural and neurobiological model have been researched most, it is likely that the merit of other models will emerge over time. However, psychoanalytic ideas have not gained empirical evidence, such as self-injurious behaviour as

expressions of autoeroticism or auto-aggression. Clinical psychologists have played a major part in the advancement of clinical practice through applied research. This has led to integration of ideas from different models. One role for clinical psychologists will be to continue developing an increasingly comprehensive framework for understanding challenging behaviour, for example investigating the role of cognitions.

Role of the clinical psychologist

Research to develop practice is only one area where clinical psychologists can assist with challenging behaviour. Clinical practice remains the main area of input. The extent of this role may depend on the way specific services are set up, for example, if other specialised professionals, such as trained challenging behaviour nurses take on much of the functional assessment and behavioural intervention or if these tasks lie within the remit of the clinical psychologist. However, psychological input will be requested for assisting with complex cases of challenging behaviour where alternative formulations are needed. Additional roles lie in the training and supervision of staff as well as consultation to other professionals.

Assisting with challenging behaviour in individual cases

The evidence favours use of behavioural approaches to assess challenging behaviour and to reduce its occurrence. Helping the person communicate effectively can be an important goal to avoid challenging behaviour, as challenging behaviour often communicates need or distress. Speech therapists are communication specialists and overlap with behaviourally trained professionals exists, but both approaches are also part of the psychologist's toolbox, especially where s/he is the main professional working with the challenging behaviour. Otherwise, clinical psychologists may get involved with cases where either approach was too limited and did not bring about the desired outcome.

A necessary first step to assisting with challenging behaviour is a comprehensive assessment and subsequent formulation of the behaviour. The favoured choice of

methods for this is functional analysis. Functional analysis is a framework for choosing multiple assessment methods (e.g. interview, observation, charts and psychometric instruments) and multiple sources of information (e.g. client, family or care staff, case notes). Though originating from behavioural approaches, functional analysis is not restricted to behavioural methods (such as ABC charts or time/event sampling). Assessment of the individual's strengths, resources and preferences should not be neglected, as this information is helpful for planning constructive interventions. In a next step, hypotheses are generated and these should be tested experimentally (Emerson, 2001, Haynes & Hayes O'Brien, 2000), although sometimes only descriptive analyses are possible. Kiernan (1993) highlighted a conspicuous lack of programmes devised by clinical psychologists in contrast to overuse of psychotropic medication despite lack of evidence. Yet, considering the high persistence of challenging behaviour in the absence of intervention, programmes would likely be cost-effective as well as improving the person's quality of life.

Through comprehensive methodological training and skills in perceiving problems from different theoretical perspectives clinical psychologists can have advantages compared to other professionals, though may be more limited in their understanding of neurobiological processes. It might therefore be that clinical psychologists' unique contribution in assisting with challenging behaviour lies in providing a formulation and enhancing understanding of challenging behaviour by integrating different aspects of the assessment completed by a number of the professionals from the multidisciplinary team. Similar functions can be fulfilled through consultation to other professionals or possibly supervisory functions. Other unique contributions may arise, when it is felt necessary that a person's cognitive abilities or developmental level were known to help understand their challenging behaviour.

Interventions should be selected that fit the formulation; different behavioural interventions have gained good empirical support. Although the clinical psychologist may carry out an intervention herself, it is more likely that she will work indirectly so that the people involved in the day-to-day care of the individual will implement

the recommended strategies. The role of the clinical psychologist may then focus on developing an appropriate programme, teaching carers and evaluating the effectiveness of the intervention.

Due to the vulnerability of the client group, many of whom do not have sufficient capacity to consent to treatment, the emergence of non-aversive intervention methods has been an important development in ethical clinical practice. These include such techniques as differential reinforcement of other behaviour or incompatible behaviour (DRO and DRI) that have been found very effective. These may be combined with teaching of a new skill or way of communicating that means the person can access the reinforcement that maintained the challenging behaviour in a more socially acceptable way, i.e. functional equivalence of alternative behaviours is important. Punitive procedures have also been found effective, but would usually only be considered, if all other strategies have failed and if the expected gains clearly outweigh the negative nature of the intervention.

Restraint measures can be considered a special case of punitive intervention. Restraint may be applied when the person's poses a considerable risk to injure himself or another person. An important distinction in this situation is the differentiation of crisis intervention measures and long-term intervention. Clearly, serious injury to individuals needs to be avoided. However, learning alternative ways of dealing with challenging situation can be a long process. To address dangerous challenging behaviour it is important to develop both intervention strategies for immediate crisis situations and intervention strategies to gradually reduce the challenging behaviour that occurs during crises.

When thinking about the timeframe of interventions it is also important to consider the long-term outcome. Whitaker (2002) reviewed when reductions in challenging behaviour had been maintained after active treatment ceased. Interestingly, he found that self-management and cognitively based self-control had an important part to play, at least with clients who have sufficient linguistic and cognitive ability. This reaffirms that the role of cognitions in challenging behaviour should not be

neglected. Stimulus fading was another important mechanism that was employed in many of the studies. Success also seems likely when appropriate behaviours in the client's repertoire can be paired with naturally occurring reinforcement. Other strategies have also been successful in individual cases, but it may be likely that frequently continued reduction in challenging behaviour could only be achieved through continued external controls.

Assisting the wider context

Earlier it was highlighted that challenging behaviours are socially constructed and defined by their impact. Often the impact on the carers of the person with challenging behaviour helps maintain that behaviour (compare 'negative reinforcement cycles'). Usually the same people are relied on to implement intervention strategies and continue such programmes over a long period of time. A discussion of challenging behaviour would be incomplete without looking at the people who perceive behaviours as challenging. Clinical psychologists have a role in assisting others with their cognitive and emotional responses to challenging behaviour, as well as behaviour response.

At a basic level, clinical psychologists can help provide education and training for carers. Cognitive and emotional responses to challenging behaviour can be diverse, but are often experienced negatively. Anxiety or feeling helpless are common responses, but likewise attributions that the individual is deliberately engaging in challenging behaviour. If these lead the carer to avoid the person or become more demanding of him, vicious cycles are quickly established. Helping carers develop informed understanding of challenging behaviour can help change attitudes and behavioural responses. Training in skills needed to deal effectively with challenging behaviours, particularly active problem solving (Hill & Dagnan, 2002), can further enhance the carer's sense of efficacy and decrease stress and negative emotional responses.

Even with increased understanding and skills in dealing with challenging behaviour, the carer's role can be a very stressful experience, for example, when faced with

daily threats of aggression. Family carers of people with challenging behaviour are at increased risk of developing mental health problems such as depression. Professional carers may experience high levels of stress, low job satisfaction and burnout (Jenkins et al., 1997). Likely outcomes are change of placement for the person with challenging behaviour or high staff turnover, both of which may be stressful for the client and have adverse effects on frequency of challenging behaviour. Providing both emotional assessments and support to carers in their own right or ensuring sufficient support structures are in place can be further contributions clinical psychologists make to the management of challenging behaviour. Monitoring carer stress is important, as highly stressed carers are unlikely to deal with challenging behaviour as well as well supported carers.

Some interventions are targeted at changing the environments in which people with challenging behaviours live. These can be targeted at the physical environment as well as the social environment, such as creating enriched living environments that provide a range of stimulating activities. Other interventions at the service level are based on the idea that challenging behaviour is a form of communication and both staff and patients can be helped to improve mutual understanding and communicate better with each other (Kevan, 2003, Nind & Kellett, 2002). Whereas such approaches are likely to improve the culture of a service and form the basis for better interactions with patients, they are unlikely to prevent the occurrence of all challenging behaviour.

As we have seen above, factors that cause and maintain challenging behaviour vary from person to person, and improved communication or increased stimulation won't necessarily be interventions that fit their formulation. In some cases they may even be counter-indicated, such as if a client shows challenging behaviour when overwhelmed by stimuli. Likewise functional communication is unlikely to make self-stimulatory behaviours disappear completely. Nevertheless, average levels of challenging behaviour might be lower in more person centred settings and clinical psychology can help research these approaches.

References

Emerson, E. (2001). Challenging behaviour. Analysis and intervention in people with severe intellectual disabilities. 2nd edition. Cambridge: Cambridge University Press.

Haynes, S. N. and Hayes O'Brien, W. (2000). Principles and practice of behavioural assessment. New York: Kluwer Academic/Plenum Publishers.

Hill, C., and Dagnan, D. (2002). Helping attributions, emotions and coping style in response to people with learning disabilities and challenging behaviour. Journal of Learning Disabilities, 6(4), 363-372.

Herbert, M. (1987). Conduct Disorders of childhood and adolescence: a social learning perspective. 2nd edn. Chichester: Wiley.

Heyman, B., Swain, J. and Gillman, M. (1998). A risk management dilemma: how day centre staff understand challenging behaviour. Disability & Society, 13 (2), 163-182.

Jenkins, R., Rose, J. and Lovell, C. (1997). Psychological well-being of staff working with people who have challenging behaviour. Journal of Intellectual Disability Research, 41 (6), 502-511.

Kevan, F. (2003). Challenging behaviour and communication difficulties. British Journal of Learning Disabilities, 31, 75-80.

Kiernan, C. (Ed.) (1993). Research to Practice. Implications of research on the challenging behaviour of people with learning disability. Clevedon: BILD Publications.

Nind, M. and Kellett, M. (2002). Responding to individuals with severe learning difficulties and stereotyped behaviour: challenges for an inclusive era. European Journal of Special Needs Education, 17 (3), 265-282.

Whitaker, S. (2002). Maintaining reductions in challenging behaviours: A review of the literature. The British Journal of Developmental Disabilities, 48 (1), 15-25.

SMALL SCALE SERVICE RELATED PROJECT

Small scale service related research project:
Audit of service use in the 16+ age group in one Child and Family
Service

Submitted by:

Marianne
Kreutz

Year 2
Doctorate in Clinical Psychology
The University of Hertfordshire

April 2004

Word count: 5000 (excluding tables)

Small scale service related research project:

Audit of service use in the 16+ age group in one Child and Family Service

Abstract

A retrospective audit was completed in a Child and Family Service on how older adolescents (16 to 18 years) made use of this service during a one year period. Data was collected from existing documents. Results highlighted a high frequency of risk to self or others as part of the clinical presentation. This placed high demands on the clinical team, especially psychiatrists, to provide a rapid response. At the same time access to the full range of services remained available to the adolescents, although many tended to engage with the service relatively briefly. Areas of need and possibilities for service development were considered.

Background

Service and Service Context

This project was completed for a community based Child and Family Service, providing tier 2 and 3 mental health services to young people (birth to 18) and their families in suburban Southeast-England. Services include assessment, a range of therapeutic interventions and consultation to primary care professionals or people involved in the care of 'Looked After Children' ('LAC' consultations). A confidential 'Young Person's Counselling Service' (YPCS), offering up to four sessions to explore current difficulties and available help, had been developed out of concern that older adolescents might sometimes 'fall through the net' of helping services.

The multidisciplinary clinical team consisted of the following professionals and trainee professionals: psychiatrists (1.8 wte (weekly time equivalent)), child

psychotherapists (2.8 wte), psychologists (1.3 wte), family therapist (1.0 wte), nurse therapist (1.0 wte), and clinical social workers (2.1 wte + 0.5 wte manager).

Professionals offered interventions from (psycho-)dynamic, systemic, cognitive-behavioural or biomedical perspectives, either on an individual basis or for flexible family groupings.

The whole team discussed referrals at a weekly intake meeting and cases were prioritised or put on waiting list based on clinical decision making processes.

However, a rapid response was offered to young people who harmed themselves or attempted suicide. Unless there was a specific reason to allocate an adolescent to a particular professional, the case might be taken on by any member of the multi-disciplinary team with free caseload capacity.

Late Adolescence

Developmental changes, status of the young person in society, confidentiality issues and nature of older adolescents' mental health problems impact on mental health service needs and appropriate provision for this group. Once aged 16 the adolescent rather than their parents has to consent to treatment and services need to be approachable in ways that allow the young person to engage. Increased independence, rights and responsibilities affect other areas of the young person's life: For example, many make a transition from education into (un-)employment, some start living on their own, and romantic relationships become increasingly important (Schulenberg et al., 1997).

Generally, it is a time when adolescents are required to make major life decisions independently for the first time, which can be experienced as challenging and often stressful. Although developmental processes play a role in the understanding the difficulties of any individual, this can be a period of particular vulnerability to develop mental health problems. Some mental health problems start to peak during late adolescence, such as psychotic breakdown, but rarely occur before this age.

A risk remains that the adolescent falls between services, for instance as community support for severe mental illness is only provided through adult services. There is also a lack of acute inpatient services for adolescents, so that a vulnerable person may be admitted to an adult ward, and responsibilities for psychiatric care have to be negotiated between inpatient and child services. National standards call for a continuum of care and seamless service provision (National Service Framework, DoH website), so that links between services should be well managed to ensure an appropriate response to the person's needs. A Children's National Service Framework is in development and transition management or specialist youth services have been identified as core themes (DoH website).

Adolescents in the Child and Family service

This age group can be more difficult to engage initially than younger children: As appointments are sent to the adolescent, attendance becomes less likely, if the young person's environment perceives a greater need for intervention than the adolescent him-/herself. However, many adolescents appreciate being taken seriously and having an opportunity to explore their difficulties without their parents' close involvement. The Child and Family service has no specific policies for this group though general policies apply.

Two changes in the service context of the Child and Family Clinic have had a likely impact on the nature of service use by the 16+ age group in recent years. Several years ago a separate self-referral youth counselling service was established in the area to provide easy access and advice to adolescents with less severe difficulties. Hence this new agency was fulfilling a similar role to the service intern YPCS. In consequence it is likely that the Child and Family service sees fewer of the less complex cases. Both agencies liaise and cross-refer, when either specific interventions from the Child & Family Clinic are required or if a more flexible and less stigmatising service can be provided by the youth counselling service. Secondly, adult services stopped seeing 16- and 17-years-old routinely, who were no longer in education, and accept under-18s only in exceptional cases. This would have meant an increase in the number of older adolescents referred to the child service.

Selection of audit focus

The project was shaped jointly by the interests of the multi-disciplinary clinic team and the researcher, improving team ownership and a better match of the project to the service. The topic was initially approved at the clinical audit meeting of the team, then more specific interests and service priorities canvassed from the individual team members (see Appendices A and B). A more developed proposal was presented at a later audit meeting and discussed by the team. A number of ideas suggested at each stage of the process were incorporated into the project, but likewise, joint decisions were taken, which interests could not be included, because they were beyond the scope of this audit.

The clinic team was more interested in understanding how older adolescents had presented to and used their service recently (from entry to discharge). As the team thought a significant proportion of recent change in service use could have been readily attributed to the creation of a youth counselling service and restricted entry criteria to adult services, they felt satisfied with this explanation and did not wish to explore this question further. However, they remained concerned about levels of self-harm in this group and high demand for psychiatric assessment on the one hand, and quick disengagement from the service on the other. To avoid leaving out long term cases with complex needs the target sample was defined as open cases rather than new referrals.

Questions about service use of this age group included concerns about (emergency) psychiatric assessments with little longer term management of the adolescent in the team, a large group of adolescents seen for relatively brief work, and a further subgroup with complex needs resulting in lengthy engagement with services and sometimes a need for a managed transfer to other agencies. Although the team would have been interested to explore these questions qualitatively as well as quantitatively, time constraints precluded in depth case studies, which would have been further

limited to use of archive material, as the team would not have supported interviewing clients.

Although the team were also very interested to think about service improvement for this age group, where gaps existed (such as no crisis service or community nurse support) or links with other agencies could be improved, this was seen as a further step in the audit cycle (Firth-Cozens, 1993), which could follow the current evaluation of service use.

Expected benefits for the service

The clinical team considered it helpful to bring this age group and their specific needs to the fore of attention, as well as how their service needs were met by the team. For example, incongruity had been noted for cases that were seen for emergency psychiatric assessments, but later were not discussed for longer term management or allocated to therapy, thus remained an 'unseen' group for most of the team. Documentation of current service use might also highlight unexpected service demands or a need for changes in service delivery. A subsequent debate on targeting service improvement and meeting service gaps remained a concern at the heart of many professional in the team.

Aim of study

The aim was to pinpoint how 16- to 18-years-old engage with the Child and Family service from their referral to discharge. This was divided into variables describing the referral stage (1.1), risk and priority (1.2), professional input from the team and length of engagement (2.1), multi-agency involvement (2.2), and the disengagement stage (3). Frequency of non-uptake among new referrals was recorded, but information on this group was insufficient to consider them further.

Audit questions

1.1 How does the 16+ age group present to the Child and Family Service?

- Described are proportion of new referrals in this age group versus adolescents who had engaged with the service from an earlier age, who had referred, and what the reasons for referral were.

1.2 Risk factors and allocation issues

- Issues of self-harm and other risk factors were addressed in more detail, as they represented a major concern for the team. Frequency of priority allocation was also considered.

2.1 How does the 16+ age group use the Child and Family Service?

- This question addresses what services the adolescents received, for how many sessions, and which professionals saw them.

2.2 Involvement of other agencies

- Describes the frequency of involvement of other agencies related to the adolescent's problems, as another specific area of interest to the team.

3.1 How does this group disengage from the Child and Family Service?

- This question addresses transition to other mental health services and discharge information.

Methodology

Design

A retrospective audit for April 2002 to March 2003 was completed. All adolescents born no later than 31. March 1987 and open cases to the Child and Family service at any point during the target period constituted the study sample. Although an electronic database of appointments existed, this was unsuitable to help with this audit. Available case materials were used as the main data source, particularly

standard sections of clinical files, such as front sheet and correspondence, and dates of appointments.

Sampling procedure

The target sample was identified by asking team members to provide names from their caseload (see Appendices C1 & C2). To minimise the risk of missing cases, new referrals during 2002/2003 were also identified from a log book in which incoming referrals were recorded. However, some cases might have been overlooked that had been seen by professionals who had since left the service. Even for these workers most cases would have been identified, either because longer term work would have been taken over by another professional, cases were seen jointly, or short term work was identified via the referral log. Some confidence can be placed in the sample, as all cases of one professional who completed his personal list late, had been identified already, and a small number of cases who had been identified through the referral log but not by their professional, turned out to be early drop-outs.

A record form was set up to transfer data from files (see appendix D) and team members were rarely asked to provide additional or missing information. The majority of data collection was completed during August and September 2003. For adolescents who continued to be seen beyond this point, only appointments up to the end of September were recorded.

Sample

74 names were identified (31 male, 42%), including 50 new referrals (20 male) and 24 adolescents (11 male) who had first engaged with the service before the age of 16, continued to be seen and met the age criterion. 14 adolescents were excluded from the final sample: 12 adolescents did not take up appointments with the Child & Adolescent service, i.e. 24% of new referrals never engaged, one case remained unallocated, as Adult services were deemed more appropriate, and no further information could be found for one tier II consultation.

No newly referred adolescent remained on the waiting list by the end of the defined period, thus all were considered as open cases. Results are based on 60 adolescents included in the final sample. Adolescents who were new referrals to the service are called ‘new cases’ in the result section, those who had engaged with services from an earlier time ‘ongoing cases’.

Variables

The following variables were explored: sex, age at referral, new referral versus ongoing case, referral source, number and type of referral reasons, presence of risk factors, priority allocation, professional involvement at allocation, main professional and additional professionals, number of team members involved, number and type of services received and number of appointments for each, involvement of outside agencies, transition referral and discharge status. Where necessary, categories used to classify data will be briefly explained in the result section or fully described in Appendix E. Additional variables recorded are not presented here, because they were tangential (waiting times), turned out to be irrelevant (requests for specific interventions), or data quality was poor (age at discharge).

Analysis

Data was analysed using descriptive statistics for continuous variables (session number) or categorical data (remaining variables). For presence of risk factors in newly referred versus ongoing cases the odds ratio was calculated.

Results

1.1 How does the 16+ age group present to the Child and Family Service?

Demographic data

Of these 60 adolescents remaining in the final sample, 36 were new referrals, 24 ‘ongoing’ cases. Mean age at referral was 15 years 9 months for all cases (new cases: 16;3; ongoing cases:14;11), and minimum age of 10 years 5 months, maximum 17 years 7 months at referral. 26 adolescents were male (43.3%), 34 female (56.7%).

Referral source

The different categories of referring professionals and agencies are detailed in Appendix E. Approximately two thirds of all referrals were made by GPs, who are thus the main referral source (table 1). During the target period no adolescent self-referred to the YPCS. Although a rapid response is offered in self-harm cases, these were either referred by GPs, hospitals or other mental health services (virtually all new referrals came from these sources), but not all hospital referrals were emergency referrals. Thus referral source did not inform on urgency of referral.

Table 1: Frequency (& percentages) of specified referral sources

	All cases N = 60		New cases N = 36		Ongoing cases N = 24	
GP	39	(65.0)	24	(66.7)	15	(62.5)
Hospital (generic/physical)	8	(13.3)	6	(16.7)	2	(8.3)
Specialist mental health	5	(8.3)	5	(13.9)	0	(0.0)
Social services	4	(6.7)	1	(2.8)	3	(12.5)
Education	2	(3.3)	0	(0.0)	2	(8.3)
Self-referral	0	(0.0)	0	(0.0)	0	(0.0)
Other	2	(3.3)	0	(0.0)	2	(8.3)

Referral reason

Recorded were the presenting problems as specified by the referrer in the referral letter. These are not equivalent to actual diagnoses, but represent very broad categories of psychological difficulties (detailed in Appendix E). The 'other' category comprised 'low self-esteem' as well as infrequent problems that did not neatly fit any other category. Both type and number of presenting problems were considered (table 2). If an adolescent presented with multiple problems, these were considered for the frequencies of each applicable category.

For half the adolescents a single presenting problem was specified at referral, for 21.6 % three or more 'comorbid' problems. The latter might implicate cases were more complex. Low mood was the most commonly described problem (38.3%), followed by self harm/ suicide attempt (25%) and behavioural problems (18.3%).

Table 2: Frequency (& percentages) of presenting problems specified at referral

	All cases N = 60		New cases N = 36		Ongoing cases N = 24	
Number of problems specified						
1	30	(50.0)	17	(47.2)	13	(54.2)
2	17	(28.3)	9	(25.0)	8	(33.3)
3	11	(18.3)	9	(25.0)	2	(8.3)
4	2	(3.3)	1	(2.8)	1	(4.2)
Type of problem specified						
Low mood	23	(38.3)	13	(36.1)	10	(41.7)
Self harm/suicide	15	(25.0)	11	(30.6)	4	(16.7)
Behaviour problems (other)	11	(18.3)	6	(16.7)	5	(20.8)
Relationship difficulties	9	(15.0)	5	(13.9)	4	(16.7)
Anxiety	7	(11.7)	4	(11.1)	3	(12.5)
School related	7	(11.7)	2	(5.6)	5	(20.8)
Adjustment	5	(8.3)	1	(2.8)	4	(16.7)
Learning difficulties	4	(6.7)	4	(11.1)	0	(0.0)
Eating disorder	4	(6.7)	4	(11.1)	0	(0.0)
Psychosis	2	(3.3)	1	(2.8)	1	(4.2)
Hyperactivity/Conduct	2	(3.3)	2	(5.6)	0	(0.0)
Substance misuse	2	(3.3)	2	(5.6)	0	(0.0)
Somatic Concerns	1	(1.7)	1	(2.8)	0	(0.0)
Other	13	(21.7)	10	(27.8)	3	(12.5)

Differences between presenting problems in new referrals and ongoing problems could either be expected (e.g. school-related problems) or might have been coincidence (learning difficulties), but differences in harmful or risky behaviours will be addressed in the following.

1.2 Frequency of risk factors and allocation issues

Risk factors

Deliberate self-harm and attempted suicide were considered as separate categories, harm to others could be physical or sexual aggression, other risks include severe eating disorder and one adolescent under child protection (table 3).

Some level of risk was reported for nearly half of all the cases. However, risk was present in 61.1 % of new referrals and less frequent in ongoing cases (29.2 %). This difference was significant ($\chi^2 = 5.88, p < 0.05$); odds ratio: 3.82 (95 % confidence

Table 3: Frequency (& percentages) of risk factors specified at referral

	All cases N = 60		New cases N = 36		Ongoing cases N = 24	
Any risk factor:	29	(48.3)	22	(61.1)	7	(29.2)
yes	31	(51.7)	14	(38.9)	17	(70.8)
no	14	(23.4)	10	(27.7)	4	(16.7)
Type risk	11	(18.4)	9	(25.0)	2	(8.4)
Attempted suicide	5	(8.3)	4	(11.1)	1	(4.2)
Self-harm	3	(5.0)	2	(5.6)	1	(4.2)
Harm to others						
Other risk						

interval: 1.26 -11.54), i.e. new referrals were nearly four times more likely to present with indication of risk. Attempted suicide was the most common risk indicator (23.4%). Four adolescents had both attempted suicide and self-harmed.

Prioritisation

The decision to prioritise a case was based on team discussions. Outcome but not decision making processes were audited. Although no direct assumption about presence of risk factors and reason for priority allocation can be made for individual cases, a link exists at policy level (rapid response to self-harm/suicide attempt). All children who had presented with risk, however, had been prioritised. Further children were prioritised, e.g. to avoid exacerbation of problems through timely intervention.

A notably greater number of new referrals (86.1%) were prioritised, compared to half of the adolescents who had become engaged at an earlier stage (table 4). A previous audit had established a prioritisation rate at the service of around 50% across all ages, a figure which was deemed too high by the team. Priority allocation in the late adolescent group was notably higher, but in part reflects an appropriate response to the high frequency of risk indication. However, high prioritisation rates might have implications for service planning and delivery.

Table 4: Frequency (& percentages) of prioritisation

		New cases N = 36		Ongoing cases N = 24		All cases N = 60	
Prioritised:	yes	31	(86.1)	12	(50.0)	43	(71.7)
	no	5	(13.9)	12	(50.0)	17	(28.3)

2.1 How does the 16+ age group use the Child and Family Service?

Involvement of different professional groups

The team was interested to know by which professionals the adolescents were seen (table 6). Involvement of the different professional groups as allocated professional, main professional for ongoing work, or additional professional (joining later for a specific purpose) were recorded. Usually, allocated professional and main professional were identical, and could also be two professionals working jointly (joint working is further detailed in table 5). The total number of cases in which a professional group became involved was also recorded. To allow some comparison, the composition of the clinical team was converted into percentages on the basis of wte for the different professional groups (see above). However, this allows only gross comparison, as particularly for psychiatrists average number of sessions per case was considerably smaller than for therapists.

At the intake stage, 20% of adolescents were already allocated to two professionals working jointly (table 5), usually a psychiatrist and another team member to meet expected assessment and therapeutic needs. In 35% of cases at least one additional worker joined at a later stage, for example, if separate therapists were needed for the adolescent and the parents. Overall, in almost half of all cases more than one professional group became involved.

Table 5: Frequency (& percentages) of single case holders and joint working

	All cases N = 60		New cases N = 36		Ongoing cases N = 24	
At allocation						
Single professional	48	(80.0)	29	(80.6)	19	(79.2)
Two professionals	12	(20.0)	7	(19.4)	5	(20.8)
Additional professional joining						
One additional	17	(28.3)	7	(19.4)	10	(41.7)
Two additional	4	(6.7)	1	(2.8)	3	(12.5)
[None]	[39]	[65.0]	[28]	[77.8]	[11]	[45.8]
Total no. of professionals involved:						
1	31	(51.7)	22	(61.1)	9	(37.5)
2	24	(40.0)	13	(36.1)	11	(45.8)
3 or 4	5	(8.3)	1	(2.8)	4	(16.7)

Note: LAC/ reflecting team counted as single allocated or additional professional in above table

Psychiatrists became involved in 50% of all cases, and were thus the most frequently represented professional group for the age group. Partly, this reflected the high number of urgent assessments always seen either by psychiatrists alone or in collaboration with another professional. The distribution of cases across other professionals was more representative of their proportional representation in the team. The over-representation of psychiatrists has to be balanced somewhat against their considerably shorter involvement with most individual cases compared to therapists' involvement (compare also table 8). This does not diminish the fact that this age group makes great demand on psychiatric input, especially as the unpredictability of urgent assessments presents greater challenges to the management of caseload than planned appointments.

Table 6: Frequency (& percentage) of involvement of different professional groups/individuals as allocated, main or additional professional, as well as total number of cases in which the professional group became involved

	Allocated		Main		Additional		Total		team* comp
All cases									
Psychiatrist	27	(45.0)	22	(36.7)	6	(10.0)	30	(50.0)	17.1
Social worker	17	(28.4)	14	(23.3)	2	(3.3)	19	(31.7)	24.8
Child Psychoth.	5	(8.4)	9	(15.0)	11	(18.3)	16	(25.0)	26.7
Psychologist	11	(18.3)	11	(18.3)	1	(1.7)	12	(20.0)	14.4
Nurse Therapist	3	(5.0)	4	(6.7)	1	(1.7)	4	(6.7)	9.5
Family Th.	6	(10.0)	6	(10.0)	1	(1.7)	7	(11.7)	9.5
LAC	3	(5.0)	3	(5.0)	0	(0.0)	3	(5.0)	
New cases									
Psychiatrist	19	(52.7)	18	(50.0)	2	(5.6)	20	(55.5)	17.1
Social worker	7	(19.4)	6	(16.7)	0	(0.0)	7	(19.4)	24.8
Child Psychoth.	2	(5.6)	2	(5.6)	4	(11.1)	6	(16.7)	26.7
Psychologist	8	(22.2)	8	(22.2)	1	(2.8)	9	(25.0)	14.4
Nurse Therapist	1	(2.8)	1	(2.8)	0	(0.0)	1	(2.8)	9.5
Family Th.	6	(16.7)	6	(16.7)	1	(2.8)	7	(19.4)	9.5
LAC	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	
Ongoing cases									
Psychiatrist	8	(33.3)	4	(16.7)	4	(16.7)	10	(41.7)	17.1
Social worker	10	(41.7)	8	(33.4)	2	(8.4)	12	(50.0)	24.8
Child Psychoth.	3	(12.5)	7	(29.2)	7	(29.2)	10	(41.7)	26.7
Psychologist	3	(12.5)	3	(12.5)	0	(0.0)	3	(12.5)	14.4
Nurse Therapist	2	(8.3)	3	(12.5)	1	(4.2)	3	(12.5)	9.5
Family Th.	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	9.5
LAC	3	(12.5)	3	(12.5)	0	(0.0)	3	(12.5)	

*team composition in % based on wte of each professional group compared to total wte for the clinical team

Services provided

Initially, service provision was considered in terms of the following broad distinctions: (1) psychiatric/ cognitive assessment alone, (2) therapy (with clinical assessment as integral part), (3) both, (4) consultation to primary care professionals (Tier II input), or (5) LAC consultation (table 8). Next, total number of services received was explored (table 8). Two or more therapeutic interventions (e.g. individual and family) were considered separately, provided at least three sessions were offered for each. As it was common practice to see adolescent and parents separately on at least one occasion, inclusion of single sessions would have

overestimated the number of services received, unless this reflected early drop-out from a single therapeutic intervention. Medication was not considered as part of this variable, as no extra clinic time was taken up in addition to psychiatric review appointments.

More than 80% of adolescents were offered a form of talking therapy; only 13.3 % were seen for assessment only (equivalent to 22.2% of new cases, as ongoing cases by definition had been involved with the service for longer). For 8.3 % services were provided through consultation to professionals involved in the adolescent's immediate care.

Table 7: Frequency (& percentages) of specified services received by the adolescent and number of different services received

	All cases N = 60		New cases N = 36		Ongoing cases N = 24	
Assessment	8	(13.3)	8	(22.2)	0	(0.0)
Intervention/s	28	(46.7)	16	(44.4)	12	(50.0)
Interv. & psychiatric assm.	21	(35.0)	12	(33.3)	9	(37.5)
Tier II consultation	2	(3.3)	1	(2.8)	1	(4.2)
LAC	3	(5.0)	0	(0.0)	3	(12.5)
Number of services received:						
1	25	(41.7)	19	(52.8)	6	(25.0)
2	23	(38.3)	15	(41.7)	8	(33.3)
3	9	(15.0)	2	(5.6)	7	(29.2)
4	3	(5.0)	0	(0.0)	3	(12.5)

In a further step, type of assessment/ therapeutic intervention and number of sessions for each were considered in more detail (table 8). Total numbers of sessions as well as separate totals for direct and indirect interventions were also calculated.

Therapeutic interventions were separated into individual, family and parent interventions, but not by theoretical orientation of the professional. No group work with this age group had taken place during the target period. Indirect work that required attendance at multi-professional meetings and care programme planning was considered, but not liaison by phone or correspondence. In contrast to table 7, single sessions of different therapy models were considered, to reflect the diversity

of sessions offered by the service and to take account of those adolescents who dropped out prematurely. Medication as an additional intervention had been offered to six adolescents (10%), but this might be an underestimate, as a separate prescription log could not be accessed in time.

The following issues should be born in mind when reported means from table 8 are considered: At the time of data collection new cases could have been engaged with the service for a maximum of six to eighteen months whereas no such time limit applied to ongoing cases. Final numbers of sessions were underestimated because a number of adolescents continued to be seen beyond September 2003. Nevertheless, it was noteworthy that the average number of sessions attended by new referrals was only just over six, although any individual could have been seen for a long enough period to be offered 15 or more sessions. Hence short term services might have suited this adolescent group. Long term therapy was more likely provided by the child psychotherapists and table 6 above showed that this professional group was more strongly represented for ongoing rather than new cases. Clinically, it may not be indicated to start long-term therapy with a 17 ½ -years-old adolescent, if a change to adult services is impending. However, this could imply that there are pockets of service provision that are more difficult to access for the older adolescent. To explore the issue of short versus long term therapy further, therapy and total session numbers were converted into categories (table 9).

The average session number was greatest for individual therapy, more than twice the average for parent or family interventions. Whereas the majority of new referral engaged with the service short term (47.2%), a significant number of ongoing cases had been engaged in long term therapy (41.7 %).

Table 8: Average number of total sessions provided to this age group by the service and average sessions for different types of intervention

	Mean	SD	Min	Max
Total sessions				
All cases (N = 60)	20.85	38.82	1	216
New cases (N = 36)	6.17	5.21	1	20
Ongoing c. (N = 24)	42.86	54.59	1	216
Direct				
All cases (N = 60)	20.08	38.35	0	216
New cases (N = 36)	6.02	5.20	1	20
Ongoing c. (N = 24)	41.17	54.40	0	216
Indirect				
All cases (N = 60)	0.58	2.17	0	12
New cases (N = 36)	0.11	0.52	0	3
Ongoing c. (N = 24)	1.29	3.29	0	12
	Mean	SD	Min	Max
Child/ adolescent individual therapy				
≥ 3 session (N = 30)	26.20	40.79	3	195
≥ 1 session (N = 35)	22.60	38.72	1	195
Family intervention				
≥ 3 session (N = 24)	9.25	9.52	3	38
≥ 1 session (N = 34)	7.00	8.71	1	38
Parent intervention				
≥ 3 session (N = 8)	10.86	13.90	3	43
≥ 1 session (N = 11)	8.27	12.46	1	43
Psychiatric assessment/ review				
≥ 1 session (N = 29)	2.93	2.59	1	11
Tier II consultation				
≥ 1 session (N = 2)	3.00	2.83	2	5
LAC consultation				
≥ 1 session (N = 3)	1.33	0.58	1	2
Other indirect				
≥ 1 session (N = 6)	5.83	4.36	1	12

Table9: Frequency of short, medium and long term engagement with the service

	All cases N = 60		New cases N = 36		Ongoing cases N = 24	
Total sessions (categories):						
1 – 2 sessions (assessment only or unengaged)	13	(21.7)	11	(30.6)	2	(8.3)
short: 3 to 9 sessions	22	(36.7)	17	(47.2)	5	(20.8)
medium: 10 to 20 sessions	15	(25.0)	8	(22.2)	7	(29.2)
longer term: > 20 sessions	10	(16.7)	0	(0.0)	10	(41.7)
	All applicable cases					
Individual therapy (N = 30)						
short: 3 to 9 sessions	17	(56.7)				
medium: 10 to 20 sessions	4	(13.3)				
longer term: > 20 sessions	9	(30.0)				
Family intervention (N = 24)						
short: 3 to 9 sessions	18	(75.0)				
medium: 10 to 20 sessions	3	(12.5)				
longer term: > 20 sessions	3	(12.5)				
Parent intervention (N = 8)						
short: 3 to 9 sessions	5					
medium: 10 to 20 sessions	2					
longer term: > 20 sessions	1					

2.2 Involvement of other agencies

Involvement of other agencies was recorded (average number of agencies, table 10), but reflected only that the adolescents had come into contact with several services due to their difficulties. Whereas this could indicate greater severity or complexity, cases varied with regard to higher demand for liaison with the other agencies. For example, police involvement would indicate severity of behavioural problems, but might not require liaison.

There was too much variability with regard to which other agencies were involved to explore this further. Other agencies included inpatient services, assertive outreach, substance misuse services, physical health, voluntary sector agencies, education, various social care agencies (‘Children, Schools and Families’, housing, benefits agency), police and youth offending services. Occasionally, multiple agencies of the same type became involved, for example, if a space in an inpatient unit needed to be found.

In more than half the cases seen at the service (53.3%) other agencies were involved. A maximum of five outside agencies had become involved in a new referral, whereas in one ‘ongoing case’ 11 agencies (including three inpatient wards approached to find a bed) had been involved at one time or another.

Table 10: Frequency (& percentages) of involvement of other agencies

	All cases N = 60		New cases N = 36		Ongoing cases N = 24	
Outside agencies involvement:						
Yes	32	(53.3)	18	(50.0)	14	(58.3)
No	28	(46.7)	18	(50.0)	10	(41.7)
Number of outside agencies involved	Mean	SD	Min	Max		
All cases (N = 60)	1.17	2.05	0	11		
New cases (N =36)	0.69	0.98	0	5		
Ongoing cases (N =24)	1.88	2.91	0	11		

3.1 How does this group disengage from the Child and Family Service?

The data intended to address this question was not always recorded well. For many adolescents it was recorded on a pre-existing form who had initiated ending contact with the service, but this had not been completed with consistency. A further problem was that cases were left open for a period to allow renewed contact, but clinicians then closed the file considerably later than stated, creating a back-log of ‘inactive’ open cases. Hence, discharge dates poorly reflect when an adolescent actually disengaged, therefore discharge ages are not reported. Other data reported here also has to be treated with caution.

Discharge

A considerable number of cases (38.3%) had remained open by the end of the data collection period (table 11), although they might no longer have been ‘active’ cases. Approximately equal numbers of case files were closed after mutual agreement between therapist and family (following improvement), or after a one-sided decision

by the family, which had been either premature (16.7%) or followed at least some improvement (10%).

Table 11: Frequency (& percentages) of discharge

	All cases N = 60		New cases N = 36		Ongoing cases N = 24	
Case remains open	23	(38.3)	14	(38.9)	9	(37.5)
Mutually agreed (improved)	17	(28.3)	9	(25)	8	(33.3)
Family/ adolescent initiated (improved/ <i>not improved</i>)	18 (6/10)	(26.7) (16.7)	11 (2/9)	(30.6) (25.0)	5 (4/1)	(20.8) (4.2)
Therapist initiated or transfer	4	(6.7)	2	(5.6)	2	(8.3)

Transition

A referral to completely transfer an adolescent to other services was made for only seven cases (table 12), one of which remained pending. This means only 16.2 % (6/37) of already discharged adolescents had made a transition into other services. For the majority of cases service involvement had ended either after successful therapy or through early drop-out. Three adolescents were referred to adult services, two to inpatient services, one to outreach services and one to learning disabilities services.

Table12: Frequency (& percentages) of transition referral

	All cases N = 60		New cases N = 36		Ongoing cases N = 24	
Transition referral:						
Yes	7	(11.7)	4	(11.1)	3	(12.5)
No or still outstanding	53	(88.3)	32	(88.9)	21	(87.5)

Summary of results

- Most adolescents were referred by their GP; none self-referred
- Common referral reasons were low mood, self-harm/ attempted suicide, and behaviour problems (including aggression)
- Many newly referred adolescents presented with risk to self or other
- 86% of new referrals were prioritised, compared to 50% in other cases
- Psychiatrists saw half the adolescents at least once, thus were involved in a disproportionate number of cases;
- In nearly half the cases two or more professionals worked jointly, reflecting true multi-disciplinary team work; principally, the full range of clinic services was accessed by the adolescents
- newly referred adolescents tended to engage short term, whereas many adolescents who had engaged from an earlier age used long term therapy
- Other agencies had been involved for just over half of the adolescents
- Among discharged adolescents approximately equal numbers disengaged after completed therapy or initiated by the family
- Only few cases were referred to other services to ensure their long-term needs would continue to be met.

Discussion

Results were presented to the clinical audit team meeting and their feedback considered. A copy of this report will be made available to the team. The team showed great interest in the findings, both the global picture and specific details of clinical presentation, risk and involvement of different professional groups. Although the high prioritisation rate was a concern, they also seemed to feel validated in their perception that this age group makes high demands of the service because of high frequency risk presentations. Likewise, the data supported that many

adolescents disengage from the service quickly, although they might have presented in crisis. This suggests the service helps to contain these situations.

Limitations of project

Some of the categories used could be considered contentious, particularly regarding the presenting problems at referral. These represent an attempt to bring together a diversity of information that has been recorded in a non-standardised way, and hence required making some judgments. However, an attempt was made to strike a balance between retaining a breadth of information and avoiding a lack of abstraction.

Validity of data related to the discharge stage was poor. This audit can only be a first stage in the audit cycle: the information available on how services were delivered should now be used to consider service developments.

Conclusions

The project was aimed to provide the clinical team with a better understanding how the 16+ age group uses their service. Although risk and demand for rapid service response as well as comparatively short periods of engagement with the service were central themes, there were also a number of less emphasised results that suggest that in other respects this group does not use services differently from other age groups. For example, low mood was the most common referral reason, the adolescents accessed all types of services available in the team, and with the exception of psychiatry, different professional groups took on cases from this group approximately proportionate to their numbers in the clinical team.

However, some issues were raised that might provide an impetus for service development. To some degree the service was accessed and used by the adolescents in a way that provided the young people with crisis intervention and short term therapeutic support. A lack of crisis services for young people had been a concern of the team. To the degree that this service is filling a gap, the team could think about how to best manage this demand, for example providing evidence for the need of crisis services or considering resources to help the team provide rapid response

without negative knock-on effects for the rest of the service. For example, prioritising nearly 9 out of 10 older adolescents means longer waiting times for less priority cases, who are usually younger children. Service-intern the team could also consider ways of providing anger management (compare team interests, Appendix B), as a sufficient number of adolescents with risk to others or less severe behaviour problems presented with anger.

Referral to other services was only an issue affecting a small number of cases and these seemed to have been handled well, for example through joint CPA meetings before transition. As the main caseworker could normally be expected to be involved in this liaison process, there might not be as great a need for increased liaison efforts at present, unless the team still considers this helpful to smooth the process.

Appendices

Appendix A:

- Form to canvass team interests

Appendix B:

- Overview of team interests

Appendix C:

- Form to identify sample

Appendix D:

- Form for recording data from files

Appendix E:

- Category descriptions

Appendix F:

- Bibliography

Appendix A: Form to Canvass Team Interests

Dear team,

I am currently preparing an audit of older adolescents (16 to 18 year olds) in transition. I wish to discuss a proposal of this project at the next audit meeting (13.06.'03). To tailor the audit to this Child & Family Clinic, I am interested to find out **what issues or questions concern you about this age group that are related to providing appropriate services for adolescents.** A few lines by you will help me gauge different priorities within the team and thus to focus my audit. Thank you very much for your help!

(Clinical Psychologist in training)

Appendix B: Overview of Team Interests

Child and Family Clinic team interests relating to adolescents in transition:

Clinical presentations of particular interest:

- ❖ Deliberate self harm
- ❖ Onset of psychosis/ other mental health problems associated with long term needs that may be better met by adult or specialist service
- ❖ Anger management

Issues/concerns of service provision and development relating to the CFC:

- ❖ Perceived increase in number of urgent referrals and/or referrals needing psychiatric assessment
- ❖ Issues of increased complexity of referrals
- ❖ Facilitating transition from childhood to adulthood, individual versus family work
- ❖ Managing tension between need/demand for immediate response and provision of containing/contained therapeutic service
- ❖ Liaison (see below A))

Issues concerning adequate service provision or service development beyond the immediate remit of the CFC:

A)

- ❖ Issues of facilitating liaison with other appropriate agencies - e.g. Youth (Counselling), Youth Services, Schools, Substance Misuse team, YOT etc. - to think about collaborative or joint work for this age group. Many would not attend a clinic, but might attend another setting.
- ❖ Linking with Adult Mental Health resources - have joint consultation re. those clients caught in the middle.

B)

- ❖ Lack of availability of crisis/respice service
- ❖ Need for some sort of adolescent 'walk-in'/emergency type service, i.e. staff team to be responsive to anxiety in adolescent + families; particularly around overdose/ self harm behaviour. Confidential/ short term service with multidisciplinary team
- ❖ Would needs of this group be best served by a separate adolescent service 16-21?

Appendix C: Form to identify sample

Dear

/ dear colleagues,

.07.03

Following the audit meeting (13.6.03) at which I presented my proposal for an audit of the 16+ age group I have also received approval for this project from the University. I am now ready to start collecting data and would greatly appreciate some help with this, as discussed at the meeting. **My target group are adolescents aged 16 to 18 + who were open cases during the April '02 to March '03 period. In the first instance, could you please identify from your own caseload those adolescents who fall into this group. Please list them below and return this sheet to me as soon as you can.** I will then collect as much information directly from the files (e.g. front sheet and letters) as I can, but might later contact you individually for further information on any cases where the necessary data is not readily accessible in the file. Please do not hesitate to talk to me, if you have any queries about this.

Many thanks for your assistance,

(Trainee Clinical Psychologist)

Please include up to DOB 31/3/87 and earlier births.

Name

DOB or other information to help identify the correct file (e.g. if 2 children have the same name)

Dear
Sep.'03

9

Several weeks ago I asked you to provide me with a list of patients aged 16 to 18 whom you have seen between April '02 and March '03 (see attached form). Unfortunately, I have not yet had this information returned to me. I would like to ask you to fill in the attached form fairly urgently, as I will have to collect the information for my audit from the files of these patients by the end of September, and occasionally will need to follow-up some detail not provided in the file.

Many thanks for your help!

Appendix D: Form for recording data from clinical files

ID	1	reason 3		additional <i>preferences</i>		agencies_B <i>which?</i>	
Surname		risk Y/N	<input type="checkbox"/>	number		agencies_C <i>number</i>	
First name		type_risk		service_a		disengage	
Case_hold		priority Y/N	<input type="checkbox"/>	duration_a		transition_ <i>referral</i>	
id number		request		interventio1		transition_ <i>to</i>	
DOB		allocation <i>date</i>		Intervention2		transition_ <i>date</i>	
age_ref	compute	allocation <i>ED</i>		Intervention3		transition_ <i>age</i>	compute
date of ref		uptake		duration_1		discharge <i>date</i>	
<i>new (6)</i> <i>ongoing (1)</i> <i>ref-ref (2)</i>		first appol		duration_2		discharge <i>age</i>	compute
source		main_prof		duration_3			
reason 1		waiting_H	compute	agencies_A	<input type="checkbox"/> Y/N		
reason 2							

ID	1	reason 3		additional	from clinic only	agencies B	
Surname	Not database	risk - yes/no	<input type="checkbox"/>	number		agencies C	
First name	Not database	type_risk	what was the specific risk	service_a		disengage	
Case_hold	Not database	priority	<input type="checkbox"/>	duration_a		transition	
id number		request	did referer make specific request e.g. (B7?)	intervention	1 - including med. individual, family etc	transition	
DOB		allocation -		intervention	2	transition	
age_ref		allocation -	(professional group)	intervention	3	transition	
date of ref	when referral received	uptake	NTU, non-response, opt-in, DNA	duration_1	No. of sessions/ n.a. for medication	discharge	
type	type of referral: new v. ongoing v. re-ref	first appointment	date first appointment offered	duration_2		discharge	
source	GP etc.	main_prof	by prof group	duration_3		agencies A	
reason 1		waiting_time		agencies A	<input type="checkbox"/> Yes/no		
reason 2							

Appendix E: Category descriptions

New versus ongoing cases

Re-referrals (N=3) were counted as new cases.

Referral source

- (1) General Practitioner
- (2) a Paediatrician or other physical health / hospital referrer
- (3) a mental health service (including specialist mental health services, psychologists, youth counselling service)
- (4) Education (school nurse, educational psychologist, home education service)
- (5) Social Services (including adoption and leaving care services)
- (6) self-referred (to YPCS: Young Persons Counselling service)
- (7) 'other': one referral by parents + one case developing from family work related to sibling's problems

Referral reason

- (1) Low mood: depression, low mood, loss of interest, sadness, associated symptoms of loss of appetite or sleep
- (2) Anxiety: phobias, OCD, any classify-able anxiety problem of any severity
- (3) Psychosis
- (4) Hyperactivity/Conduct disorder: firm diagnosis
- (5) Behaviour problems (other): including aggression, sexually inappropriate behaviour
- (6) Eating disorder: anorexia, bulimia
- (7) Somatic Concerns: psychosomatic complaints
- (8) Self harm/ attempted suicide: including any severity of deliberate self-harm, e.g. superficial scratching
- (9) Substance misuse: misuse of alcohol or illegal substances
- (10) School related: non-attendance, risk of expulsion, not further specified school problems
- (11) Relationship difficulties: family conflict, poor peer relationships, difficulties with girlfriend/boyfriend, difficulties relating to people
- (12) Adjustment: to major life events or trauma
- (13) Learning difficulties: learning disabilities (global), specific learning disabilities (dyslexia, dyspraxia), Autistic Spectrum Disorder
- (14) 'Other': 'low self-esteem' (specified alongside a number of different problems, such as depression, anxiety, difficulty relating); infrequently reported problems that were difficult to categorise: brain injury (1), being bullied

Risk factors

- (1) deliberate self-harm, e.g. cutting, of any severity
- (2) attempted suicide
- (3) any risk of harm to others due to aggression, destructiveness or sexual acts
- (4) other risk of harm to the adolescent (severe eating disorder, child protection issues)

Prioritisation

Adolescents allocated immediately or within a few weeks of referral (e.g. if additional information from the referrer was required to estimate urgency); or any adolescent for whom first appointment preceded official allocation (emergency assessments).

Note re. session numbers for individual therapy:

The session number for three adolescents in long term psychotherapy had to be estimated, as therapist's notes were kept separate from clinical notes. Although session dates were usually recorded on a special sheet in the clinical notes, it became obvious that these recordings were incomplete. Estimates were based on average monthly attendance during the longest continuously recorded period and extrapolated for length of therapy from first appointment to ending therapy. These estimates were more conservative than assuming 40 weekly sessions had been attended per year in therapy.

Length of engagement

This was somewhat arbitrarily defined by number of sessions; distinctions were set as:

- (1) Assessment only/ unengaged: adolescents seen for only one or two sessions, including early dropouts
- (2) Short-term (therapy): three to nine sessions
- (3) Medium-term (therapy): 10 to 20 sessions
- (4) Long-term (therapy): more than 20 sessions

Appendix F: Bibliography

Department of Health website. The Children's National Service Framework.
<http://www.dh.gov.uk>

Department of Health website. The Children's National Service Framework.
<http://www.dh.gov.uk>

Firth-Cozens, J. (1993). Audit in Mental Health Services. Hove: Lawrence Erlbaum Associates.

Department internal document delineating policies and description of service.

Schulenberg, J., Maggs, J. L., and Hurrelmann, K. (1997). Health risks and developmental transitions during adolescence. Cambridge: Cambridge University Press.

CRITICAL LITERATURE REVIEW

Literature Review

Executive Functioning in Mild Cognitive Impairment

submitted by:

Marianne Kreutz

Trainee Clinical Psychologist

Year 2

February 2004

Word count: 4991 (excluding reference section)

Executive Functioning in Mild Cognitive Impairment

Introduction

Mild cognitive impairment (MCI) has been identified as a significant risk factor for dementia (Bischkopf et al., 2002, Petersen, 2003). Impairment in episodic memory is evident in the vast majority of cases, but controversy about heterogeneous aetiology hampers efficient early intervention. Neuropsychological research may reveal sub-clinical decline in further cognitive functions. On theoretical grounds early decline in executive functions can be expected, as both neuropsychological theories of cognitive aging and of dementia implicate brain structures related to executive function (Craink. & Grady, 2002; Morris, 1996). This has not been researched sufficiently in MCI, but further studies may shed light on the questions of heterogeneity and early disease markers.

This paper will highlight the need to investigate the extent of executive function difficulties in mild cognitive impairment. Theoretical and methodological issues in executive function and in mild cognitive impairment are considered as well as their link to ageing and dementia. Clinical implications and benefits are discussed.

Executive Functions

Definition

Executive functions have been defined as “higher-order, meta-abilities necessary for appropriate social functioning, goal-directed behaviour, planning, insight, foresight and self-regulation” (Schmidt, 2003). Lezak (1995) differentiates four components of executive functions: volition, planning, purposive action and effective performance, which are necessary for “appropriate, socially responsible, and effectively self-serving adult conduct.” Other authors stress the importance of executive functions in novel problem-solving situations (Sbordone, 2000). Sbordone

(2000) speaks of “the complex process by which an individual goes about performing a novel problem-solving task from its inception to its completion”, whilst Phillips (1997) talks of executive function consisting of a number of interconnecting control processes.

Theories of executive function

Theoretical understanding of executive function has not yet developed sufficiently to know whether executive functioning is a unitary system with a single ‘production system architecture’ (Burgess, 1997; Rabbit, 1997) or otherwise a system of different processes (Collette et al., 1999). Collette and colleagues suggest that executive functioning might be best thought of as a collection of related abilities, comparable to the way we understand the different components of the memory system.

Theoretical debate and research attempts continue to establish, if fractionation of the executive function can be demonstrated (Burgess, 1997; Stuss & Knight, 2002).

Over time it would be possible that evidence will emerge for the dissociability of various executive functions. This could lead to the conclusion that the grouping of deficits together as a syndrome is inappropriate (Collette et al., 1999).

Historically, executive function has been associated with the frontal lobe region of the brain, following clinical observations of people with known pathology of the frontal lobes. Frequently observed were behaviour changes and deficits in higher-level cognitive processes that require executive control (e.g. Morris, 1997; Phillips, 1997). Validity of neuropsychological tests of ‘frontal lobe function’ has been assessed by their ability to differentiate between groups of subjects with and without frontal lobe pathology. However, this approach has been criticised for its circularity (Bryan & Luszcz, 2000) as well as because executive function difficulties can also be observed in patients whose brain injury is localised in other regions (Baddeley & Wilson, 1988). Hence, functional definitions and cognitive theories of executive function have developed alongside continuing interest in neuropsychological models.

Brain pathology such as lesions, tumours, neurodegenerative, neurochemical and metabolic changes in the frontal and prefrontal cortex has been implicated (Morris

1996). Support for such theories comes from neuroimaging and functional neuroimaging studies (Rabbitt, 1997; Stuss & Knight, 2002). Damage to neural pathways connecting the frontal cortex with other areas of the brain has also been implicated in deficits of executive functions (Morris 1996). As there is lack of evidence that frontal lobe damage causes impairment on tests that use a dual task paradigm, Morris (1997) has speculated on a different explanation for executive functioning. Dual tasks require the coordination of more than one activity at the same time and a shifting of attention between these activities. This is an area of executive function research that cannot be neglected. It lead Morris (1997) to suggest a 'connectionist' viewpoint, in which he thinks of the Central Executive System as involving the synchronous activity of the association areas of the whole of the cortex.

Although cognitive theories have been developed separately, they have often been linked with neuropsychological understanding. Cognitive models include Norman & Shallice's 'Supervisory Activating System' (SAS) model of executive control (Shallice, 1982). In Shallice's model the SAS intervenes and initiates an appropriate response when routine activities do not suffice, typically in tasks that are novel and require planning or where a strong response tendency needs to be inhibited (Parkin, 1997). Thus the SAS exerts an executive function. Shallice proposes that deficits in supervisory attentional control reflect the executive dysfunction found. Baddeley sees the SAS as analogue to the 'central executive component' of his working memory model (Baddeley, 1986; Baddeley and Hitch, 1974). Furthermore, Baddeley sees the central executive as associated with the frontal lobe (Morris, 1996), whereas Goldman-Rakic (Phillips 1997) has proposed that the frontal cortex acts as a working memory system that provides cohesion between the various elements of any complex task, without postulating a central executive component.

Both Shallice's and Baddeley's model propose an involvement of executive processes in memory processes. Shallice has proposed that executive processes are involved in the encoding and retrieval phase of memory processes. Some authors understand aspects of working memory and prospective memory as executive

functions. Others have claimed that memory processes may be governed by executive functions (Craik & Grady, 2002).

Methodological issues in executive function research

Methodological issues complicate the quest to understand executive function or empirically lend support to one of the theoretical models. No prototypical executive functioning task is available at present (Burgess, 1997). Moreover, a number of patients who show dysexecutive functioning in everyday life still pass many of these tests (Burgess, 1997). Patients showing reversed patterns of success on one task of executive function, but failure on another test can be commonly observed. At the level of group research such dissociations in performance could reveal fractionation of the executive system. However, Burgess argues that in executive functioning the search for double dissociation in individuals is futile. As some aspects of executive functioning rely sequentially on each other only single dissociation is achievable, e.g. the ability to execute a plan relies on the ability to formulate a plan beforehand.

Even individual executive function tests often capture more than one aspect of executive functioning. For example, the Wisconsin Card Sorting Test (WCST) relies on concept formation, monitoring abilities and cognitive flexibility. Further methodological issues arise from the need for novelty in tasks, which affects test-retest reliability, and from the potential of structured assessments to compensate for executive functioning deficits that would be more readily apparent in unstructured situations.

Usually, performance on executive function tests is also affected by specific as well as general cognitive abilities. This task impurity affects the validity of executive function tests. On the other hand, as executive functions are defined as higher order cognitive processes, they necessarily entail management of subordinate cognitive processes. Hence, task impurity cannot feasibly be avoided entirely.

A related issue is the problem of cognitive congruence, i.e. virtually all cognitive tasks are positively correlated with each other (Bryan and Luszcz, 2000). This is a

particularly pertinent problem in executive function research. Executive function and intelligence are correlated and some authors have argued that the common factor between different tests of executive function can be entirely accounted for by their common loading on intelligence (Bryan and Luszcz, 2000). Yet, other authors found that their data could not be entirely accounted for by global cognitive ability. Lowe & Rabbit (1997) found that age-related variance on executive tasks remained after controlling for intelligence. And Burgess (1997) concluded that tasks of executive performance share greater relationships with each other than could be explained merely by cognitive congruence.

To deal with this issue Burgess (1997) suggests comparing performance on a range of tasks that rely differentially on peripheral skills. This would allow crystallising the impact of executive control from other cognitive skills. External control over peripheral cognitive skills can also help to unpick the impact of executive function independent of other skills.

Many widely used 'classical' tests of executive function have been criticised because of validity issues. For example, deficits in memory can impair performance on the WCST and the relationship between test performance and everyday performance is not readily apparent. This has led some authors to dismiss the value of the WCST, whilst others continue to see it as one of the best available tests (Kliegel, 2003, Nagahama, 2003). Other examples are verbal fluency tests, which are sometimes employed as tests of executive functioning or tests of language ability (Phillips et al., 1996), and Trail Making Tests that measure attention and psychomotor speed as well as executive functions.

Executive functions and everyday functioning

Frontal lobe lesions can result in the paradoxical pattern of severely impaired problems solving in real-life situations, but intact ability to carry out many complex cognitive tests (Burgess, 1997). The ecological validity (relationship between test performance and behaviour in real-world settings'; Sbordone, 1996) of many tests of executive function has remained unclear, despite their ability to differentiate between

different patient groups. Deficits in executive function, however, can lead to considerable functional impairment on activities of daily living. Instrumental activities of daily living (IADL) have been defined as complex, real-world adaptive human behaviours that require independence, volition, organizational ability, judgement, and sequencing (Bell McGinty et al., 2002). Thus they bear the hallmark components of executive functions (compare the definition by Lezak, 1995). Examples of IADL include running a household or managing finances. Without executive functions coordinating the component behaviours of these complex goal-directed behaviours they can be expected to break down into their basic actions, movements or simple ideas (Willis et al., 1998). Clinically, it has been observed that people often come to seek professional advice when they experience difficulties with such IADLs (Nagahama, 2003).

Aging and cognition

Normal aging

Aging processes affect the brain and its functions, particularly the frontal region of the brain (Piguet et al., 2002). Three areas of functioning have become prominent in discussion of cognitive aging processes: memory, executive functioning and processing speed. Changes in these abilities along with changes in visual and auditory capacity, account for a significant amount of variance in decreased performance on other tests of cognitive function, such as intelligence test subscales (Morris, 1997).

Studies have supported the common complaint of older adults that their memory is poorer (Craik & Grady, 2002; Morris, 1997). Performance is differentially affected on different memory tasks: Greatest age-related decline can be observed on recall, source memory, working memory and prospective memory, whereas recognition, semantic memory, procedural memory and 'implicit' memory performance show little change. To account for this differential pattern Craik & Grady (2002) propose that memory loss associated with normal aging can be understood as a consequence

of age-related decline in frontal lobe functioning (“frontal lobe hypothesis” of cognitive aging). Available data (e.g. Kliegel et al., 2003) supports the notion that memory tasks requiring considerable self-initiated processing show greatest decline. Further support comes from neurological findings that volume changes in the frontal lobes are associated with age. However, the validity of the ‘frontal aging hypothesis’ has been challenged by other authors (Piguet et al., 2000).

Studies into normal aging commonly report that executive function is one of the first cognitive abilities to decline with increasing age (Piguet et al., 2002). Bryan and Luszcz (2000) reviewed the evidence for this from neurobiological and neuropsychological studies: Relative consistent age-related decline has been observed on some common tests of executive function (WCST, semantic fluency, Tower of London, ‘uses of objects’ and self-ordered pointing task) whereas mixed or negative results have been reported for others (design fluency, Stroop, phonemic fluency and Cognitive Estimates). Neuroanatomical and neurochemical changes of the brain were more evident in the frontal lobes. Bryan and Luszcz conclude the evidence suggests a subclinical executive decline in older adults compared to young people. This is very mild compared to impairment in clinical groups, so that tests need to be sufficiently sensitive.

However, these authors also raise an alternative possibility, namely deterioration in executive function may be linked with age-related decline in speed of information processing (Bryan & Luszcz, 2000). Older adults regularly perform less well on tests that emphasize speed (Morris, 1997). Speed and efficiency of cognition decline with age and reaction times increase. Although individual differences exist, overall the evidence for slowing is substantial (Salthouse, 1986). Complex processing of information as well as complex attentional tasks also show decline with age (Morris, 1997). Notably, attention and executive function are also closely related (Crawford, 1998; Perry & Hodges, 1999).

Piguet et al. (2002) challenge the idea that cognitive decline is associated with age. They see age as a proxy variable mediating the impact of neurodegenerative

processes associated with age. Their research found cognitive markers associated with AD explained the greatest variance on tests of executive functions.

Normal aging, pathological aging and Mild Cognitive Impairment

Only relative mild cognitive deficits are associated with aging alone, compared to the marked neuropsychological deficits observed in pathological aging processes, such as in the dementias (Morris, 1997). Heterogeneity in decline between individuals exists. However, the presence of changes associated with aging processes raises the question of the relationship between ‘normal’ aging and dementia (Piguet et al., 2002). Research into cognitive aging has been criticised for failing to take into account variables that are implicated in the development of neurodegenerative disorder (Piguet et al., 2002; Ritchie et. al, 2001). Thus some researchers argue that a large portion of cognitive decline with age can in fact be explained by the presence of pathological processes rather than resulting from ‘normal’ aging (Piguet et al., 2002). Cognitive functions showing the greatest decline in dementia, are often the same functions that are most affected in normal aging, i.e. memory and executive function. This complicates the question, what degree of decline could be normal and at what point would it become clinically significant. The use of psychometric tests with appropriate age norms can address this issue to some degree. However, some authors express caution, as standardisation samples themselves may have included a number of individuals in preclinical stages of neurodegenerative processes, thus affecting mean scores (Peterson, 2003).

The transition phase between normal aging and pathological processes itself has found much theoretical and research interest. A number of different concepts and terms have been suggested First by Kral (1962) who suggested the term ‘benign senescent forgetfulness’, viewing decline as harmless. Later concepts include ‘age-associated memory impairment’ and ‘incipient dementia’. These terms had been criticised for their theoretical or methodological assumptions (Collie & Maruff, 2002), such as making assumptions about whether decline is benign or in fact the earliest stage of a disease process. In recent years the concept of Mild Cognitive

Impairment has found increasing interest. Issues relating to this concept are discussed in the following.

Mild Cognitive Impairment

Mild Cognitive Impairment (MCI) refers to decline in cognitive functioning that is greater than can be expected for the person's age, but does not fulfil clinical criteria for dementia (Petersen, 2000). Memory is most commonly impaired, but impairment in a single non-memory domain or subtle decline in several cognitive functions can be observed in some individuals. This has lead Petersen (2003) to suggest that we should discriminate between these three subgroups. As MCI is associated with an increased risk to develop dementia (Bischkopf et al., 2002, Collie & Maruff, 2000; Petersen, 2003), it has gained increasing research interest in recent years. It has largely replaced previously used concepts.

Many authors see MCI as a transitional stage between normal aging and dementia, which those individuals go through who go on to develop the disease (Petersen, 2003). Hence, it assumes a continuum between normal and abnormal function. However, other authors argue that mild cognitive impairment is etiologically heterogeneous. A group of people with MCI would likely include individuals whose impairment is non-progressive, people with depression or normal aging, as well as those with preclinical dementia (Collie & Maruff, 2002). Different selection criteria and operationalisations in MCI research explain some of the observed variance in prevalence and transition rates to dementia. Clinical criteria proposed by Petersen in 1999 (Petersen, 2000) have been adopted widely. Petersen (2003) has recently proposed that amnesic MCI and Alzheimer type dementia (AD) show the highest association and conversion rate.

Epidemiological research has identified a risk of 1% to 2% in the healthy older adult population to develop dementia (Bischkopf et al., 2002, Petersen, 2003), and this risk increases with increasing age. By contrast, studies using Petersen criteria report

average conversion rates of 12% per year, identifying MCI as a risk factor as significant as genetic risk factors for dementia (e.g. the ApoE 4 allele; Collie & Maruff, 2000). Estimates vary what percentage of people with MCI will eventually progress to dementia: whereas a number of studies report conversion rates around 50% (reviewed by Collie & Maruff, 2000), Petersen (2003) suggests this may be as high as 80-90%. This figure has been challenged by Ritchie et al. (2001).

As treatments for dementing illnesses become increasingly available, early intervention holds the greatest promise of maintaining cognitive function (Patterson et al., 1996). Therefore, early identification becomes highly desirable. Differentiation between individuals in a heterogeneous at risk group is important, to be able to weigh the risk of side effects and availability of limited resources against likely treatment benefits for the individual. Whilst only longitudinal studies are able to identify the best early predictors, cross-sectional designs can identify profiles of neuropsychological signs. These early signs can then become targets for longitudinal research (Collie & Maruff, 2000).

Relationship between MCI and AD

The significant association between MCI and AD provides the rationale for neuropsychological studies that look for similar profiles of cognitive functioning in both. A diagnosis of probable Alzheimer's Disease requires impairment in memory as well as at least one other cognitive domain (e.g. language, executive function, visuo-spatial abilities or global intellectual decline), whilst consciousness remains unclouded. Impairment affects everyday functioning, represents a decline from previous attainment, onset had been insidious and decline is progressive (ICD-10, DSM-IV). A gradual increase in characteristic brain pathology (neurofibrillary tangles and plaques) is correlated.

Impairment in episodic memory is characteristic for both amnesic MCI and AD (Collie & Maruff, 2000; Morris, 1996). In MCI, other cognitive domains are thought to be unaffected or show only minimal decline (Petersen, 2003). However, this view has been challenged, sparking research into other possible early signs, notably in

cognitive domains commonly affected later in the course of AD. Clinical opinion stated that after memory impairment either language or visuo-spatial problems would develop next in AD (Collette et al., 1999), so that research interest into executive functions increased only recently.

Executive function research in AD and MCI

Neurobiological basis

Several brain structures have been implicated in the development of dementia and its associated neuropsychological deficits, such as degenerative changes in the pathways linking the neural substrate of memory to other brain areas (Morris, 1996; Perry & Hodges, 1999). With regard to executive function in dementia, two hypotheses have been deliberated: i) lesions to the prefrontal cortex due to higher density of neuropathological markers (plaques, neurofibrillary tangles) in the association areas of the brain, and ii) Morris' 'connectionist' model (1997, see above). Both hypotheses are consistent with brain pathology in dementia, as the association areas of the brain concerned with the high-level multimodal integration of information as well as cortical frontal and parietal association areas are affected by pathological changes (Morris, 1996).

Neuropsychological evidence on executive problems in Alzheimer's disease

There is increasing evidence that dysexecutive problems can be detected early in the disease process, and in fact for most AD patients seem to occur before language impairment and visuo-spatial problems (Patterson et al., 1996; Perry & Hodges, 1999). Several authors (Arnaiz & Almkvist, 2003; Patterson et al., 1996; Perry & Hodges, 1999) have reviewed the research literature on executive functioning in AD.

The work of Lafleche & Albert (1995) and Collette et al. (1999) is some of the best available research. Both studies used a range of tasks covering different aspects of executive function, whereas many other studies can be criticised for relying on single measures. Lafleche & Albert (1995) found patients with AD impaired on those executive function tasks that required the concurrent manipulation of information,

but not on attention, cue-directed behaviour or simple concept formation. Collette et al. (1999) on the other hand found the performance of their AD patients significantly impaired on all tasks, including the ability to divide attentional resources, to manipulate information stored in working memory, performance on a delayed alternation task, phonemic fluency, inhibition capacity and the monitoring of self-generated responses. Collette and colleagues consider their data consistent with Shallice's hypothesis (1994) on fractionation of executive function.

Although there is increasing evidence from group studies that individuals with AD perform less well on tests of executive function, Patterson et al. (1996) point out that executive dysfunction is not ubiquitous in AD and incidence rates are not known. However, there is evidence to suggest that executive function deficits may be detected quite early in the disease. Use of different executive function tasks has had an impact on outcome, and has rendered comparisons between different studies more difficult. Yet, a number of studies have demonstrated that people with AD show major decline in their ability to divide and shift attention when two tasks have to be performed concurrently (Patterson et al., 1996; Perry & Hodges, 1999). Furthermore, psychometric studies have found AD patients to experience difficulties carrying behaviour out in sequence, while symptoms of disinhibition or apathy have emerged in research using observer rated scales (Patterson et al., 1996).

Research evidence on executive functioning in MCI

Few studies to date have investigated executive functions in MCI patients (Crowell et al., 2002; Nagahama et al., 2003; Ready et al., 2003). However, Collie and Maruff (2000) have reviewed earlier studies that had selected groups on the basis of similar concepts, such as age-associated memory impairment (AAMI) and incipient dementia. Although the theoretical assumptions or clinical usefulness of these concepts have been challenged, they share some common features with MCI. As this results in some overlap between the groups studied previous research remains informative, if considered with caution.

Controversy exists regarding executive function deficits in mild cognitive impairment. Whereas Collie and Maruff (2000) maintained that executive problems could not be found in MCI, Crowell et al. (2002) concluded that executive functioning is the only non-memory domain affected in MCI. Moreover, they reported similar performance patterns, but less severe deficits on tests of executive functions in both MCI and dementia. Neither argument seems sufficiently supported by the data cited by either author group.

Collie and Maruff's (2000) generic review of the neuropsychology of MCI included only a few studies that had used any measure of executive function, while most had focussed on other cognitive abilities, such as memory. However, with the exception of verbal fluency tasks, performance on all other executive function tasks had been affected when such measures were included. Verbal fluency tasks on the other hand have been criticised for being used as either language or executive function tests, and furthermore do not appear to be sensitive enough to detect mild impairment (Phillips et al., 1996). It would appear that Collie and Maruff are only justified to conclude that the evidence is insufficient to decide on the role of executive function in MCI. Their argument for dismissing the reviewed studies is that cross-sectional designs select participants on the basis of a risk factor. Therefore, it is likely that observed deficits are associated with the risk factor and thus cannot be said to indicate preclinical AD.

Crowell and colleagues (2002) on the other hand acknowledge that future studies must include a wider range of executive measures. Their own research included only Trail Making and Digit Span Backwards, a slim basis to build their broad generalisation on, as these tasks also rely on other cognitive skills that are affected by age-related decline.

However, results from several other studies indicate that executive function is a promising area of future research in MCI that may lead to detection of mild executive deficits in this group. Ready et al. (2003) found increased apathy and executive dysfunction in both AD and MCI, whilst disinhibition remained at a normal level. This research used informant-completed ratings, thus may be criticised

for its vulnerability to observer bias. As the WCST is a complex task, Nagahama et al. (2003) suggest that performance deficit in their MCI patients might be reflective of combined aspects of memory and executive dysfunctions. Hänninen et al. (1997) compared AAMI subjects and matched controls; finding impaired executive performance on Trail Making, modified WCST, and Stroop, but not verbal fluency. These authors also considered the influence of non-executive abilities on performance on executive tasks. Research that assesses executive function with multiple tasks and tests sensitive to mild impairment in a MCI sample remains outstanding.

Evidence from research into everyday functioning

Collateral information regarding executive function deficits in AD and MCI comes from research into functional status on activities of daily living (ADL). Bell-McGinty et al.'s (2002) data suggests that executive function tests are able to predict functional status on independent ADLs in healthy and cognitively declining individuals. Barberger-Gateau and Fabrigoule (2003) support the notion that early limitations in ADL at the preclinical stage of dementia could be explained by progressive executive dyscontrol. Willis et al. (1998) found that executive functions made an independent contribution to explaining variance in IADL in their AD sample, beyond variance explained by global level of cognitive functioning.

The need for further research on executive functions in MCI

Notwithstanding the merits of initial research on executive functions in MCI, several issues have not been addressed to date. One of the general challenges that executive function research needs to meet is that no prototypical executive function task exists. Although individual tasks often capture more than one aspect of executive functioning, performance is also influenced by subordinate or peripheral skills. Hence, studies should preferably include multiple measures of executive function that relay to differing degrees on peripheral skills (Burgess, 1997). Although some studies have employed multiple measures with AAMI or AD samples (e.g. Collette

et al., 1999; Hänninen et al., 1997, Lafleche and Albert, 1995), comparable research remains to be completed with MCI patients.

To capture a level of functioning expected to fall between healthy older adults and demented patients, measures need to be sensitive even to mild impairment and availability of age-standardised norms would be beneficial. Furthermore, it would seem indicated to include a task that requires the coordination of more than one activity at the same time and the shifting of attention between these activities. This would be important for two reasons: dual tasks have been found to be particularly sensitive to executive function decline in AD, and unlike for other executive function tests, there is a lack of evidence that frontal lobe damage causes impairment on dual tasks (Morris, 1996). Although comparability of different tasks is a lesser issue, if these are completed by the same sample, direct comparability can be enhanced, if a test battery is used, that can provide standardised scores on a uniform scale for all subtests.

An additional advantage of a standardised test battery over a collection of otherwise selected tasks would lie in the availability of total scores, which should allow for better differentiation of overall ability or impairment in executive function. Even if actual results would not bear this out, a battery of tests would still allow to select those subtests which are most sensitive to impairment in early AD and MCI. One battery of executive function tests meets many of the challenges raised: the Behavioural Assessment of the Dysexecutive Syndrome (BADS) (Wilson et al., 1996). This battery has the additional advantage of good ecological validity, narrowing the gap between test demands and demands of everyday functioning. Hence a study is proposed to assess executive function deficits in patients with MCI and early AD with the BADS. Additional cognitive and affective measures will be included to control for confounding variables.

Clinical Implications

Expected benefits of this research include a better understanding of the role of executive function in the preclinical (MCI) and early stages of dementia. This in turn could inform clinical practice regarding neuropsychological assessments: If mild, but significant executive difficulties can be detected reliably in a number of people with MCI, appropriate early assessment and monitoring of these functions would be indicated. However, whether this would improve prediction of who progresses to dementia, would have to be left to longitudinal research. Nonetheless, monitoring of executive function deficits would be indicated in its own right, as they have been implicated in impairment in independent living skills, higher service need and carer burden (Nagahama, 2003 Patterson et al., 1996). Timely monitoring would allow for early and more appropriate planning for interventions.

It is hoped that the BADS will prove to be a useful clinical tool for assessing executive dysfunction in MCI and early dementia. Individual subtests may emerge as particularly useful, and thus may inform clinicians' choice where constraints do not allow administration of the whole battery. Subtests of the BADS are expected to be more sensitive to mild impairment than frequently used screening tasks, such as fluency tests.

Conclusion

It has been demonstrated that little research into executive function in MCI is available to date and that a number of methodological challenges have not been met by existing studies. However, decline in executive function can be expected on the basis of current understanding of aging and degenerative processes and the theoretical conception of MCI. Despite limitations, existing studies have started to reveal executive functions in MCI as a promising research area. A framework for a proposed study has been delineated, which considers a number of the issues arising in executive function research. Clinical benefits have been outlined.

References

American Psychiatric Association (1994). Diagnostic and Statistical Manual of Mental Disorders (4th edn.) (DSM - IV). Washington, DC: American Psychiatric Press.

Arnaiz, E., and Almkvist, O. (2003). Neuropsychological features of mild cognitive impairment and preclinical Alzheimer's disease. Acta Neurologica Scandinavica, 107 (S. 179), 34-41.

Baddeley, A. D. (1986). Working Memory. Oxford: Oxford University Press.

Baddeley, A. D., & Wilson B. A. (1988). Frontal amnesia and the dysexecutive syndrome. Brain and Cognition, 7, 212-230.

Baddeley, A.D., and Hitch, G. (1974). Working Memory. In G. H. Bower (Ed.), The psychology of learning and motivation, Vol.8, pp. 47-89. New York: Academic Press.

Barberger-Gateau, P. and Fabrigoule, C. (2003). Re: Bell-McGinty et al. Standard measures of executive function in predicting instrumental activities of daily living in older adults. International Journal of Geriatric Psychiatry, 18, 459-460.

Bell-McGinty, S., Podell, K., Franzen, M., Baird, A. D. and Williams, M. J. (2002). Standard measures of executive function in predicting instrumental activities of daily living in older adults. International Journal of Geriatric Psychiatry, 17, 828-834.

Bischkopf, J., Busse, A., and Angermeyer, M. C. (2002). Mild cognitive impairment – a review of prevalence, incidence and outcome according to current approaches. Acta Psychiatrica Scandinavica, 106, 403-414.

Bryan, J. & Luszcz, M. A. (2000). Measurement of executive function: considerations for detecting adult age differences. Journal of Clinical and Experimental Neuropsychology, 22(1), 40-55.

Burgess, P. W. (1997). Theory and Methodology in Executive Function Research. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Collette, F., Van der Linden M., and Salmon, E. (1999). Executive Dysfunction in Alzheimers's Disease. Cortex, 35, 57-72.

Collie, A. and Maruff, P. (2002). An analysis of systems of classifying mild cognitive impairment in older people. Australian and New Zealand Journal of Psychiatry, 36,133-140.

Collie, A. and Maruff, P. (2000). The Neuropsychology of preclinical Alzheimer's disease and mild cognitive impairment. Neuroscience and Biobehavioral Review, 24, 365-374.

Craik, F. I M & Grady, C. L. (2002). Aging, Memory, and Frontal Lobe Functioning. In: D. T. Stuss. & R. T. Knight (eds.), Principles of Frontal Lobe Function. Oxford: Oxford University Press.

Crawford, J. R. (1998). Introduction to the assessment of attention and executive functioning. Neuropsychological Rehabilitation, 8 (3), 209-211.

Crowell, T. A., Luis, C. A., Vanderploeg, R. D., Schinka, J. A. & Mullan, M. (2002). Memory patterns and executive functioning in Mild Cognitive Impairment and Alzheimer's Disease. Aging, Neuropsychology and Cognition, 9 (4), 288-297.

Hänninen, T., Hallikainen, M., Koivisto, K., Partanen, K., Laakso, M.P., Riekkinen, P.J. and Soininen, H. (1997). Decline of frontal lobe functions in subjects with age-associated memory impairment. Neurology, 48, 148-153.

Kliegel, M., Ramuschat, G. & Martin, M. (2003). Exekutive Funktionen und prospektive Gedächtnisleistung im Alter – Eine differentielle Analyse von ereignis- und zeitbasierter prospektiver Gedächtnisleistung. Zeitschrift fuer Gerontologie und Geriatrie, 36, 35 – 41.

Kral, V. A. (1962). Senescent forgetfulness: Benign malignant. Canadian Medical Association Journal, 86, 257-260.

Lafleche, G., and Albert, M. S. (1995). Executive function deficits in mild Alzheimer's disease. Neuropsychology, 9 (3), 313-320.

Lezak, M. D. (1995). Neuropsychological assessment (3rd ed.). New York: Oxford University Press.

Morris, R. G. (1997). Cognition and ageing. In R. Jacoby and C. Oppenheimer (eds.): Psychiatry in the Elderly. Oxford, Oxford University Press.

Morris, R. G. (1996). The Neuropsychology of Alzheimer's Disease and Related Dementias. In: R. T. Woods (ed.). Handbook of the clinical psychology of ageing. Chichester: Wiley.

Nagahama, Y., Okina, T., Suzuki, N. Matsuzaki, S., Yamauchi, H., Nabatame, H. and Matsuda, M. (2003). Factor Structure of a Modified Version of the Wisconsin Card Sorting Test: An Analysis of Executive Deficit in Alzheimer's Disease and Mild Cognitive Impairment. Dementia and Geriatric Cognitive Disorders, 15, 103-112.

Parkin A. J. (1997). Normal age-related memory loss and its relation to frontal lobe dysfunction. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Patterson, M. B., Mack, J. L., Geldmacher, D. S., and Whitehouse, P. J. (1996). Executive functions and Alzheimers's disease: problems and prospects. European Journal of Neurology, 3, 5-15.

Perry, R. J., and Hodges, J. R. (1999). Attention and executive deficits in Alzheimer's disease. Brain, 122, 383-404.

Petersen, R. C.(Ed.) (2003). Mild Cognitive Impairment. Aging to Alzheimer's Disease. New York: Oxford University Press.

Petersen, R. C., Doody, R., Kurz, A., Mohs, R. C., Morris, J. C., Rabins, P. V., Ritchie, K., Rossor, M., Thal, L., and Winblad, B. (2001). Current concepts in Mild Cognitive Impairment. Archives of Neurology, 58, 1985-1992.

Petersen, R. C. (2000). Aging, Mild Cognitive Impairment, and Alzheimer's Disease. Neurologic clinics, 18 (4), 789-805.

Phillips, L. H. (1997). Do "frontal tests" measure executive function? Issues of assessment and evidence from fluency tests. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Phillips, L. H., Della Sala S., and Trivelli, C. (1996). Fluency deficits in patients with Alzheimer's disease and frontal lobe lesions. European Journal of Neurology, 3, 102-106.

Piguet, O., Grayson, D. A., Broe, G. A., Tate, R. L., Bennett, H. P., Lye, T. C., Creasey, H. & Ridley L. (2002). Normal aging and executive functions in "old-old"

community dwellers: poor performance is not an inevitable outcome. International Psychogeriatrics, 14 (2), 139-159.

Rabbitt, P. (Ed.) (1997). Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Rabbitt, P. (1997). Introduction: Methodologies and Models in the Study of Executive Function. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Ready, R. E., Ott, B. R., Grace, J. and Cahn-Weiner, D. A. (2003). Apathy and Executive Dysfunction in Mild Cognitive Impairment and Alzheimer Disease. American Journal of Geriatric Psychiatry, 11 (2), 222-228.

Ritchie, K., Artero, S., & Touchon, J. (2001). Classification criteria for mild cognitive impairment. A population-based validation study. Neurology, 56, 37-42.

Salthouse, T. A. (1985). A theory of cognitive aging. Amsterdam: North Holland.

Sbordone, (2000). The Executive Functions of the Brain. In: G. Groth-Marnat (Ed.), Neuropsychological assessment in clinical practice. A guide to test interpretation and integration. New York: John Wiley.

Schmidt, M. (2003). Hit or Miss? Insight into Executive Functions. Journal of the International Neuropsychological society, 9 (6), 962-964.

Shallice, T. (1982). Specific impairments of planning. Philosophical Transactions of the Royal Society London, B, 298, 199-209.

Stuss, D. T. & Knight, R. T. (Eds.) (2002). Principles of Frontal Lobe Function. Oxford: Oxford University Press.

Willis, S. L., Allen-Burge, R., Dolan, M. M., Bertrand, R. M., Yesavage, J., and Taylor, J. L. (1998). Everyday problem solving among individuals with Alzheimer's Disease. The Gerontologist 38 (5), 569-577.

Wilson B. A., Alderman, N., Burgess, P., Emslie, H., and Evans, J. (1996). Behavioural Assessment of the Dysexecutive Syndrome. Bury St. Edmunds: Thames Valley Test Company.

World Health Organisation (1992). The Tenth Revision of the International Classification of Diseases and Related Health Problems (ICD-10). Geneva: WHO.

THESIS

Performance of People with Mild Cognitive Impairment or early Alzheimer's
Disease on the Behavioural Assessment of the Dysexecutive Syndrome Test Battery

MARIANNE KREUTZ

A Thesis submitted in partial fulfilment of the
requirements of the University of Hertfordshire
for the degree of Degree of Doctor of Clinical Psychology

The programme of study was carried out in the Department of Psychology,
University of Hertfordshire
November 2004

Contents page for Thesis

1. Abstract	p. 112
2. Introduction	p. 114
2.1 General Introduction	p. 114
2.2 Aging and Cognition	p. 115
2.2.1 Theories of normal aging	p. 115
2.2.2 Dementia	p. 119
2.2.3 Mild cognitive impairment and related concepts	p. 120
2.2.4 Relationship between MCI and AD	p. 122
2.3 Relationship between depression and cognitive impairment	p. 124
2.4 Executive Functioning theory	p. 125
2.4.1 Definition	p. 125
2.4.2 Theories of executive function	p. 126
2.4.3 Methodological issues in executive functioning research	p. 127
2.4.4 Choice of executive function tasks for the study	p. 128
2.5 Executive functioning research in AD and MCI	p. 129
2.5.1 Neurobiological basis	p. 129
2.5.2 Neuropsychological evidence of executive deficits in Alzheimer's disease	p. 130
2.5.3 Research evidence on executive functioning in MCI	p. 131
2.6 The need for further research on executive functioning in MCI	p. 132
2.7 Rationale for the current study and aims	p. 134
2.8 Clinical Implications	p. 134
2.9 Research questions	p. 135
2.9.1 Research question 1	p. 135
2.9.2 Research question 2	p. 136
2.9.3 Research question 3	p. 136

2.9.4	Research question 4	p. 137
2.9.5	Summary of research questions	p. 137
3.	Methodology	p. 138
3.1	Design	p. 138
3.2	Participants	p. 138
3.2.1	Recruitment	p. 138
3.2.2	Procedure	p. 139
3.2.3	MCI Group	p. 140
3.2.4	Early Alzheimer's Disease Group	p. 141
3.2.5	Common exclusion criteria for the MCI and early AD groups	p. 141
3.2.6	Standardisation sample of the BADS	p. 142
3.2.7	Further considerations	p. 142
3.2.8	Effect size calculation	p. 142
3.3	Measures	p. 143
3.3.1	Socio-demographic Data	p. 143
3.3.2	Executive Function Tasks	p. 143
3.3.2.1	Rule Shift Cards Test	p. 144
3.3.2.2	Action Program Test	p. 144
3.3.2.3	Key Search Test	p. 144
3.3.2.4	Temporal Judgement Test	p. 144
3.3.2.5	Zoo Map Test	p. 145
3.3.2.6	Modified Six Elements Test	p. 145
3.3.2.7	BADS total scores	p. 146
3.3.3	Memory	p. 146
3.3.4	Estimate of Premorbid Cognitive Functioning	p. 146
3.3.5	Depression	p. 147
3.3.6	Additional information from medical files	p. 147
3.4	Ethical issues	p. 147
3.4.1	Ethical approval	p. 147

3.4.2	Ethical considerations	p. 148
3.5	Data analysis	p. 149
4.	Results	p. 150
4.1	Socio-demographic features of the sample	p. 150
4.2	Clinical features of the sample	p. 153
4.3	Control variables	p. 153
4.4	Executive Functioning	p. 157
4.4.1	Descriptive statistics of the BADS	p. 157
4.4.2	Research question 1	p. 157
4.4.2.2	Control of confounding variables	p. 163
4.4.3	Research question 2	p. 165
4.4.3.2	Control of confounding variables	p. 167
4.4.4	Research question 3	p. 167
4.4.5	Research question 4	p. 170
5	Discussion	p. 173
5.1	Executive function impairment in early Alzheimer's disease	p. 173
5.1.1	Level of decline on BADS total scores	p. 173
5.1.2	Level of decline on subtests	p. 174
5.1.3	Stability of results after controlling for confounding variables	p. 175
5.2	Executive function impairment in Mild Cognitive Impairment	p. 175
5.2.1	Level of decline on BADS total scores	p. 175
5.2.2	Level of decline on subtests	p. 176
5.2.3	Stability of results after controlling for confounding variables	p. 177
5.3	Implications for test performance of individuals	p. 177
5.4	Performance patterns on tasks of executive function	p. 178

5.5	Discriminative power of subtests	p. 179
5.6	Interpretation of age effects	p. 181
5.6.1	Impact of age as a covariate	p. 181
5.6.2	‘Age’ effects and other confounders in previous research on executive functioning in MCI and AD	p. 181
5.6.3.	Interpretation of age effects	p. 183
5.6.4	Questions raised by age effects	p. 184
5.7	Issues relating to the diagnosis of MCI and AD	p. 185
5.7.1	Age and diagnosis of dementia	p. 185
5.7.2	Diagnostic issues in relation to the MCI diagnosis	p. 186
5.7.3	Diagnosis and premorbid level of functioning	p. 189
5.8	Findings in the context of theories on cognition and aging	p. 190
5.8.1	Findings and source theories	p. 190
5.9	Implications of the study for research and clinical practice	p. 190
5.10	Limitations of the current study and recommendations for future research	p. 192
5.11	Conclusion	p. 193
	References	p. 194
	Appendices	p. 204
	Appendix A: Letter confirming ethical approval	p. 205
	Appendix B: Introductory letter (consent to contact letter)	p. 208
	Appendix C: Patient Information Sheet	p. 211
	Appendix D: Consent Form	p. 214
	Appendix E: Supplementary Results	p. 216
	i) Boxplots for control variables	p. 217
	ii) Results of regression analysis and control for influences of covariates	p. 220

1. Abstract

Performance of People with Mild Cognitive Impairment or early Alzheimer's Disease on the Behavioural Assessment of the Dysexecutive Syndrome Test Battery

Aim: Decline in executive functioning in Mild Cognitive Impairment has only been investigated with single tests to date. A battery of executive function tasks (BADS: Behavioural Assessment of the Dysexecutive Syndrome) was used to investigate and compare the extent of executive function difficulties in people with Mild Cognitive Impairment and early Alzheimer Disease. Degree and prevalence of decline were examined for each of the groups, and performance patterns compared between the two groups.

Participants: 37 Participants (19 MCI, 18 early AD) were recruited from one urban, one suburban and one rural centre. Participants were selected on the basis of clinical judgments made by local psychiatrists, and for the MCI group checked against Petersen criteria (1999) as far as information was accessible to the main researcher. Probable Alzheimer's disease had been diagnosed either according to ICD-10 criteria (centres 1 and 3) or NINCDS-ADRDA criteria (centre 2). Groups did not differ significantly on socio-demographic variables.

Design: A mixed cross-sectional exploratory design was employed, examining performance on executive function tasks within each of two clinical groups separately, and comparing performance between the two clinical groups. Effects of confounding variables were examined, and subsequently effects of 'age' were controlled for.

Main results: Both groups showed decline on executive functioning tasks, but this was mild in the MCI group compared to normative data, whereas significantly poorer performance was observed in the early AD group. Impairment was not ubiquitous in either group. Whereas patterns of performance across subtests were

similar for both groups, performance levels for different subtests differed. Hence different tasks might be differentially suited to assess executive function deficits in each group.

2. Introduction

2.1 General Introduction

In the context of an aging population interest in normal and pathological changes with increasing age has remained an active and important area of research as well as theoretical development (e.g. Morris, 1996a; Park, 2000; Petersen, 2003). In the health and social care sector dementia has been a major concern due to the significant consequences this disorder has for affected individuals, their relatives or carers, and high demands that are made on nursing facilities, medical services and voluntary agencies. The past decade has seen the introduction of pharmacological treatments for Alzheimer's disease, such as acetylcholinesterase inhibitors, which can help alleviate the impact of pathological changes on cognition and behaviour temporarily. Still, development of further treatments remains a valuable goal, as a gap between the availability of and the need for psychological, social and medical intervention remains (National Service Framework for Older Adults, Department of Health, 2001).

Early and correct identification of individuals who stand to benefit from pharmacological treatment is aimed for to target resources and intervention to best effect, as it is hoped that timely intervention will lead to the best response. Early identification may delay or even prevent onset of the disease process (Collie & Maruff, 2000), or in the worst case it allows for the planning of patient care. In recent years, the concept of Mild Cognitive Impairment (MCI) has emerged to describe people who show memory loss of greater magnitude than would be expected for their chronological age. However, the nosological status of MCI remains debated, although it is increasingly believed to be a transitional stage between normal aging and dementia (e.g. Petersen, 2003) for those individuals who go on to develop this degenerative disease. Yet, there are also a considerable number of people who show mild cognitive impairment without subsequently progressing to a dementia.

To help identify and differentiate individuals for treatment at an early point, a number of biological and neuropsychological ‘markers’ have become the focus of investigation (Crowell et al., 2002). Following promising but limited results of recent research into executive functions in MCI (Crowell et al., 2002, Nagahama et al., 2003, Ready et al., 2003.), the present study sets out to explore executive function further in the earliest clinical and preclinical stages of dementia.

Additionally, the role of executive functions can also be considered from the perspective of developing psychological intervention: although there is a history of developing and teaching strategies aimed at improving memory (or at least compensating for memory difficulties), executive functions have been targeted less frequently or directly. Yet, their role in everyday functioning has been documented (Barberger-Gateau and Fabrigoule, 2003; Bell-McGinty et al., 2002; Willis et al., 1998) and there may be a need for development of strategies that specifically target impairment in executive functioning (Honda, 1999).

Development of theoretical models has gone hand in hand with research on different cognitive and neuropathological processes. Many of the issues raised above will be discussed in further detail in the following.

2.2 Aging and Cognition

2.2.1 Theories of normal aging

What constitutes normal cognitive function with age is not well understood: most people believe that some loss of cognitive facility is part of “normal” aging, while other authors contend that, in the absence of disease, there should be virtually no loss of function (Piguet et al., 2002). However, it has long been a ‘folk wisdom’ that older adults are slower at performing many tasks and have poorer memory for events than younger people, and scientific evidence has concurred with this observation (Craik & Grady, 2002; Park, 2000; Morris, 1997).

Aging processes affect the brain and its functions, particularly the frontal region of the brain (Piguet et al., 2002). However, a life-time’s worth of experience and

knowledge also allow older adults to demonstrate cognitive strength in other domains (Park, 2000). An evaluation of pathological changes with aging, that occur in degenerative disorders such as dementia, can only be made in the context of understanding normal changes of functioning with increasing age.

A number of cognitive models have been developed to account for patterns of observed changes and stability of performance on different cognitive tasks. In this endeavour, cognitive psychologists have strived to find a single, fundamental cognitive mechanism that may account for all observed age-related decline on different cognitive tasks (Park, 2000). Theoretical models differ in the cognitive mechanisms that they suggest as primary, i.e. what they postulate as “fundamental bases for age differences in cognitive function” (Craik, 2000; Luszcz and Bryan, 1999; Morris, 1997b; Park, 2000). However, Park (2000) argues that all major models share a commonality: the mechanisms suggested can all be considered as indices of cognitive resources.

Cognitive resources refers to “the quantity of mental processing power or mental energy that an individual has available to use when performing a cognitive task” (Park, 2000). Resource models propose that with increasing age mental resources to draw on quickly diminish and hence limit the person’s ability to perform mental tasks. Park (2000) provides an overview of four different, but related main cognitive resource models: i) processing speed theory (Salthouse, 1991), ii) working memory function (Craik & Byrd, 1982), iii) inhibition (Hasher & Zacks, 1988), and iv) sensory function (changes in visual and auditory capacity) (Lindenberger & Baltes, 1997). More recently, Craik & Grady (2002) have suggested executive function as the primary cognitive mechanism, a model that has been termed the “frontal lobe hypothesis of cognitive aging”.

Changes in the four cognitive functions mentioned above account for a significant amount of variance in decreased performance on tests of other cognitive function, such as intelligence test subscales (Morris, 1997), and the different models have

received varying degrees of empirical support (Park, 2000). Combinations may be even better estimates of cognitive resources than any single measure (Park, 2000).

Salthouse (1991, 1996) suggests that a generalized decreased speed of performing mental operations accounts for age-related variance in performance. He hypothesised that performance on cognitive tasks deteriorates, because older people are slow to perform early stages of complex cognitive tasks. This can result in not reaching later stages, because products of earlier operations are not available.

Craik and Byrd (1982) suggested that older adults were deficient in the ability to engage in “self-initiated processing”. Craik & Byrd’s “processing resource” is best measured by working memory tasks (Park, 2000). Working memory can be conceptualised as the total amount of mental energy available to perform on-line mental operations, and can involve storage, retrieval and transformation of information (Baddeley, 1986).

Craik & Grady’s (2002) later developed a related model. They proposed that memory loss associated with normal aging can be understood as a consequence of age-related decline in frontal lobe functioning. Available data (e.g. Kliegel et al., 2003) supports the notion that memory tasks requiring considerable self-initiated processing show greatest decline. Studies into normal aging also commonly report that executive function is one of the first cognitive abilities to decline with increasing age (Piguet et al., 2002), although consistent decline has only been observed for some common tests (such as Wisconsin Card Sorting Test, Tower of London), but not others (e.g. Cognitive Estimates) (Bryan and Luszcz, 2000). However, the validity of the ‘frontal aging hypothesis’ has been challenged by other authors (Piguet et al., 2000).

However, these authors also raise an alternative possibility: namely, deterioration in executive function may be linked with age-related decline in speed of information processing (Bryan & Luszcz, 2000). Older adults regularly perform less well on tests

that emphasize speed (Morris, 1997), and overall the evidence for this slowing is substantial (Morris, 1997, Salthouse, 1986).

Park (2000) states that the importance of Hasher & Zacks' theory (1988) for cognitive aging phenomena remains unclear at present. These authors suggested that with increasing age people have more trouble focussing on target information and inhibiting attention to irrelevant material.

However, Lindenberger & Baltes (1997) reported compelling evidence from the Berlin Aging Study indicating that nearly all of their age-related variance in a range of cognitive ability tests was mediated by sensory functioning. The sensory measures appeared to be a more fundamental index of cognitive resource even than speed of processing, and Lindenberger & Baltes argued that it is a crude measure of brain integrity.

Piguet et al. (2002) challenge the idea that cognitive decline is associated with age. They see age as a proxy variable mediating the impact of neurodegenerative processes associated with age. They and other authors (Ritchie et. al, 2001) have criticised cognitive aging research for failing to take into account variables that are implicated in the development of neurodegenerative disorder. Hence they argue that a large portion of cognitive decline with age can in fact be explained by the presence of pathological processes rather than resulting from 'normal' aging.

Cognitive functions showing the greatest decline in dementia are often the same functions that are most affected in normal aging (i.e. memory and executive function). This complicates the question what degree of decline could be normal and at what point would it become clinically significant. Only relative mild cognitive deficits are associated with aging alone compared to the marked neuropsychological deficits observed in pathological aging processes, such as in the dementias (Morris, 1997).

The use of psychometric tests with appropriate age norms can address this issue to some degree. However, sampling of normative data for older populations presents a number of challenges. A representative cross-section of the population would include a number of people who may already experience the earliest, but sub-clinical and undetected stages of a degenerative process as well as a number of people whose physical ailments prevent them from showing optimal performance on cognitive tasks. Hence depressed mean scores would result, rendering it harder to detect mild impairment (Peterson, 2003). On the other hand, it is also plausible that research might underestimate age-related decline due to selective survival of healthier and cognitively more elite individuals (Park, 2000; Petersen, 2003). Longitudinal performance measures are rare and it may not be readily apparent what constitutes a meaningful change over time, whereas there is likely a continuum between normal and abnormal function in those subjects destined to develop dementia (Petersen, 2003). However, comparison with younger adults is even more problematic, as most elderly subjects will have 'abnormal' performance when measured against younger adults (Petersen, 2003).

2.2.2 Dementia

A diagnosis of probable Alzheimer's Disease (AD) requires impairment in memory as well as at least one other cognitive domain (e.g. language, executive function, visuo-spatial abilities or global intellectual decline), whilst consciousness remains unclouded. Impairment affects everyday functioning, represents a decline from previous attainment, onset had been insidious and decline is progressive (ICD-10, DSM-IV). A gradual increase in characteristic brain pathology (neurofibrillary tangles and plaques) is correlated.

However, pathological changes are also associated with aging, and this raises the question of the relationship between 'normal' aging and dementia (Piguet et al., 2002). The transition phase between normal aging and pathological processes itself has been the focus of much theoretical and research interest.

2.2.3 Mild cognitive impairment and related concepts

A small proportion of older adults show relatively isolated cognitive deficits, usually on tests of episodic memory (Collie & Maruff, 2000; Petersen, 2003). These are significantly greater than would be expected for the person's age, but do not meet clinical criteria for any neurodegenerative disease. This phenomenon was first discussed in greater detail by Kral in 1962 (Bischkopf et al., 2002) who termed it 'benign senescent forgetfulness'. A number of alternative concepts have been suggested since, such as 'incipient dementia', 'subjective memory impairment' and 'cognitive impairment, not demented'. Reviews of many of these concepts can be found in Collie & Maruff (2000) and Bischkopf et al. (2002). In recent years, the concepts of 'mild cognitive impairment' (MCI) and, previously, 'age-associated memory impairment' (AAMI) have dominated the research literature. Major differences between these two concepts lie in different theoretical assumptions about pathological processes (MCI) versus normal aging (AAMI), and in comparing deficits compared to age-matched controls (MCI) versus younger adults (AAMI), leading to different prevalence rates. Mild cognitive impairment has also been used as clinically defined by Petersen et al. (1999) or as an umbrella term for the range of related concepts used in research.

Collie & Maruff's (2000) evaluation found that different concepts reflected different theoretical and aetiological assumptions. While some view mild cognitive impairment as the earliest stage of AD, others propose that they are benign changes associated with normal aging. Collie & Maruff suggest that both subgroups exist, hence that mild cognitive impairment is a heterogeneous disorder with multiple possible outcomes. Different classification systems agree on memory deficit as an inclusion criterion, but differ whether this need be objective, whether individuals should have insight into the impairment, and whether age-matched controls or younger adults serve as comparison. People with mild deficits in other cognitive domains and/or with impaired activities of daily living (ADL) are included or excluded by different classification systems, whereas all specify that individuals with a history of medical or psychiatric illness that could account for the observed cognitive impairment should be excluded.

These conceptual differences have had considerable impact on research outcomes: For example, the same mildly impaired individual could be rated as normal or dementing depending on which classification system is employed (Collie & Maruff, 2000). Classification systems which require impairment in either multiple cognitive domains or ADL are likely to identify individuals in whom a neurodegenerative disease process is already more advanced. Classification systems with more stringent criteria lead to lower estimates of prevalence rates, but also tend to show higher conversion rates to AD in long term follow-up, leading some authors to argue that these identify people in whom the disease process has already progressed considerably. By contrast, less well defined criteria lead to the inclusion of people whose cognitive impairment originates from depression or is so mild that it reflects normal aging processes.

Collie and Maruff (2000) postulate that an ideal system must be able to differentiate impairment associated with aging and impairment associated with neurodegenerative processes. However, as Petersen (2003) highlights, there is likely a continuum between normal and abnormal function in those subjects destined to develop dementia. Collie and Maruff (2000) have identified the main correlates of mild cognitive impairment as episodic memory impairment, hippocampal atrophy and the ApoE e4 allele. They recommend as optimal criteria for identifying older individuals at high risk for AD: at least moderate episodic memory impairment determined with measures sensitive to subtle changes and compared to age-appropriate norms as well as showing objective decline from a previous level. This memory impairment does not need to occur concurrently with deficits in other cognitive domains, and individuals should be excluded from the sample, if their observed impairment is thought to be a consequence solely of their depressive symptomatology (Collie and Maruff, 2000). However, the last point may be contested in future, as first episodes of depression in late life are increasingly considered as harbingers of cognitive impairment in their own right (reviewed by Petersen, 2003).

Petersen and his colleagues at the Mayo Alzheimer Disease Centre (1999) defined clinical criteria for Mild Cognitive Impairment (MCI), which have been widely adopted: (1) Memory complaint, preferably corroborated by an informant, (2) objective memory impairment (approx. 1.5 SD below age- and education- matched normal controls), (3) largely intact general cognitive function (non-memory domains may be very mildly impaired, perhaps less than 0.5 SD below appropriate comparison subjects), (4) essentially preserved activities of daily living, and (5) does not meet criteria for dementia. Diagnosis remains a matter of clinical judgment.

Petersen (2003) has since expanded the concept of MCI, differentiating three subtypes: amnesic MCI (the most common form), single non-memory-domain MCI (characterised by isolated impairment in another cognitive domain), and multiple-domain MCI (slight impairment in multiple cognitive domains insufficient to meet criteria for dementia). This further development of the concept takes greater account of heterogeneity in clinical presentation and in possible aetiology of the condition. Petersen proposes that people meeting criteria for any of the subtypes are at increased risk of conversion to dementia, postulating the strongest link between amnesic MCI and Alzheimer's disease. The relationship between mild cognitive impairment and Alzheimer's disease will be explored in greater detail in the following.

2.2.4 Relationship between MCI and AD

Mild cognitive impairment has been associated with an increased risk to develop dementia and hence gained increasing research interest (Bischof et al., 2002, Collie & Maruff, 2000; Petersen, 2003). However, other authors argue that mild cognitive impairment is etiologically heterogeneous. A group of people with MCI would likely include individuals whose impairment is non-progressive, people with depression or normal aging, as well as those with preclinical dementia (Collie & Maruff, 2002).

Epidemiological research has identified a 1% to 2% risk in the healthy older adult population of developing dementia (Bischof et al., 2002, Petersen, 2003), and this

risk increases with increasing age. By contrast, studies using Petersen criteria report average conversion rates of 12% per year, identifying MCI as a risk factor as significant as genetic risk factors for dementia (e.g. the ApoE e4 allele; Collie & Maruff, 2000). Estimates vary as to what percentage of people with MCI will eventually progress to dementia: whereas a number of studies report conversion rates around 50% (reviewed by Collie & Maruff, 2000), Petersen (2003) suggests this may be as high as 80-90%, with an annual conversion rate around 12%. This figure has been challenged by Ritchie et al. (2001), who only found an 11% conversion rate over three years.

Differentiation between individuals in a heterogeneous at-risk group is important, to be able to weigh the risk of side effects and availability of limited resources against likely treatment benefits for the individual. Early identification becomes highly desirable, as treatments for dementing illnesses become increasingly available, early intervention holds the greatest promise of maintaining cognitive function (Patterson et al., 1996). It is also an ethical imperative to treat people both with medication and rehabilitation, when this approach works well in early dementia.

Whilst only longitudinal studies are able to identify the best early predictors, cross-sectional designs can identify profiles of neuropsychological signs. These early signs can then become targets for longitudinal research (Collie & Maruff, 2000). The identification of MCI as a risk factor for AD has stimulated research comparing neuropsychological profiles of both groups to identify similarities and differences in cognitive functioning. Impairment in episodic memory is characteristic for both amnesic MCI and AD (Collie & Maruff, 2000; Morris, 1996). In MCI, other cognitive domains are thought to be unaffected or show only minimal decline (Petersen, 2003). However, this view has been challenged, sparking research into other cognitive domains, notably those commonly affected later in the course of AD. Research interest into executive functions increased only recently, as clinical lore stated for a long time that after memory impairment either language or visuo-spatial problems would develop next in AD (Collette et al., 1999).

2.3 Relationship between depression and cognitive impairment

The relationships between depression, mild cognitive impairment and dementia are complex. Many people who suffer from depression show lowered performance on neuropsychological tests (Reischies & Neu, 2000) and the concept of depressive pseudodementia has been debated for some time (Caine, 1986). The magnitude of decrease in performance for groups of depressed people has been estimated to fall between 0.5 and 1 standard deviation below that of normal controls (Reischies & Neu, 2000), whilst about a fifth perform in the impaired range. Notably this is only slightly less impairment than would be expected in a group of people with MCI whose impairment should fall around 1.5 SD below age- and education matched norms (Petersen, 2003).

However, clinicians felt they could differentiate people with depression from people in the earliest stages of dementia, partially because a positive response to antidepressant medication was expected. Cognitive performance was also expected to normalise, once depressive symptoms had lifted. This view has been challenged by Reishies & Neu (2000) who found that after improvement of affective symptoms cognitive performance did not improve considerably. They pointed out that small gains were no bigger than training effects in their control group. Heterogeneity of groups of people with mild cognitive impairment has been highlighted repeatedly (Bischkopf et al., 2002; Collie and Maruff, 2002) and in the context of Reishies & Neu's findings it remains prudent to assume that people with depression contribute to the subgroup whose impairment remains non-progressive. An evaluation of depressive symptoms should therefore form part of the assessment of people with suspected MCI, not least to identify people who are likely to benefit from psychological and medical treatments of depression.

However, the question can also be posed, whether there are neuropsychological differences between people with mild cognitive decline due to depression and people whose mild cognitive impairment is likely a harbinger of dementia. "Recall of episodic memory and speeded retrieval from semantic memory seem to be regularly impaired in depression" (Reishies & Neu, 2000). This has been linked to white

matter lesions in the hippocampal region and/or basal ganglia lesions found in depressed subjects, but notably, the hippocampal region has also been implicated as showing pathological changes early in the course of dementia (Morris, 1997a; Collie & Maruff, 2000). However, Reishies & Neu (2000) have also found small, but potentially significant differences: they found decrease on a non-verbal memory test but not on list learning, i.e. a verbal episodic memory test. By contrast, patients with MCI and early dementia are expected to show impaired performance on (verbal) episodic memory and new learning. The relevance of these interesting small differences remains a question for future research.

Poor performance on cognitive tasks during an episode of major depression is not the only association between depression and cognitive impairment. Depression is a possible, but not necessary symptom of dementia, i.e. a proportion of people with diagnosed dementia will develop mood disturbances as part of their clinical presentation (DSM-IV, American Psychiatric Association, 1995; ICD-10, World Health Organisation, 1992). Furthermore, it would be feasible for depression to develop secondary to cognitive decline, e.g. as a grieving reaction to awareness of loss of function.

2.4 Executive Functioning theory

2.4.1 Definition

Executive functions have been defined as “higher-order, meta-abilities necessary for appropriate social functioning, goal-directed behaviour, planning, insight, foresight and self-regulation” (Schmidt, 2003), and some authors stress their importance in novel problem-solving situations (Sbordone, 2000). Executive functions guide the brain through novel learning situations; when tasks are familiar, brain areas associated with executive function are considerably less active. Lezak (1995) differentiates volition, planning, purposive action and effective performance as components of executive function, and Phillips (1997) suggests that a number of interconnecting control processes constitute executive function.

2.4.2 Theories of executive function

Theoretical understanding of executive function is not developed sufficiently to know whether it is a unitary system with a single ‘production system architecture’ (Burgess, 1997; Rabbit, 1997), or, as Collette and colleagues suggest (1999), a system of related abilities, comparable to the way we understand different memory functions. Research into fractionation of executive functions might demonstrate dissociations between different aspects of executive function (Burgess, 1997; Stuss & Knight, 2002). This could challenge the idea of grouping all executive function deficits as a single syndrome (Collette et al., 1999).

Executive function has become associated with the frontal lobe regions of the brain, following observations of deficits in higher-level cognitive processes that require executive control and behaviour changes in people with frontal lobe pathology (e.g. Morris, 1997; Phillips, 1997). However, executive function difficulties can also arise from lesions in other regions of the brain (Baddeley & Wilson, 1988), and both neuropsychological and cognitive models of executive function continue to develop. Support for neuroscience models of executive function have come from lesion studies and neuroimaging research, implicating the frontal and prefrontal cortex as well as neural pathways connecting frontal and non-frontal brain structures (Morris 1996; Rabbitt, 1997; Stuss & Knight, 2002).

Prominent cognitive models are Norman & Shallice’s ‘Supervisory Activating System’ (SAS) model (Shallice, 1982) and the ‘central executive component’ of Baddeley & Hitch’s working memory model (1974; Baddeley, 1986). A more detailed discussion of both can be found in the literature review (Kreutz, 2004, unpublished manuscript). Baddeley ‘locates’ the central executive in the frontal lobe (Morris, 1996), but Goldman-Rakic (Phillips 1997) challenges the need to postulate a central executive component, and proposes that the frontal cortex itself could function as a working memory system providing cohesion between elements of complex tasks. A ‘connectionist’ model has also been suggested by Morris (1997), but he thinks of the Central Executive System as synchronous activity of all cortical association areas. Morris’ challenge to a sole focus on the frontal regions of the brain

arises from lack of evidence that frontal lobe damage causes impairment on tests that use a dual task paradigm (1997), i.e. on tasks that require the coordination of more than one activity at the same time and a shifting of attention between these activities.

2.4.3 Methodological issues in executive functioning research

Beyond a hotly debated theoretical basis, executive function research also faces a number of additional challenges. No prototypical executive functioning task exists (Burgess, 1997), individual tests often capture more than one aspect of executive functioning, and general as well as specific other cognitive abilities affect test performance (task impurity). To deal with the issue of task impurity, Burgess (1997) suggests comparing performance on a range of tasks that rely to different degrees on peripheral skills. The validation of executive function tasks on groups of subjects with frontal lobe pathology has been criticised as circular (Bryan & Luszcz, 2000). The need for task novelty limits retesting, and structure provided by test instructions and task demands might compensate for deficits more readily apparent in unstructured situations. Hence a number of patients who show executive function deficits in everyday life still pass many of the tests (Burgess, 1997). These issues affect the validity and reliability of individual tests.

Patients might show reversed patterns of success on one task of executive function, but failure on another test. Whereas such results could reveal fractionation of the executive system at group level, Burgess (1997) argues that the search for the 'holy grail' of double dissociation is unachievable at the level of the individual, as some aspects of executive functioning rely sequentially on each other. Neither can task impurity be avoided entirely, as executive functions are defined as higher order cognitive processes, hence necessarily entail subordinate cognitive processes. A related problem is cognitive congruence, i.e. virtually all cognitive tasks are positively correlated with each other (Bryan and Luszcz, 2000). Some authors have argued that the common factor between different tests of executive function can be entirely accounted for by their common loading on intelligence (Bryan and Luszcz, 2000), but Burgess (1997) concluded this is not the case. He argues that tasks of executive performance share greater relationships with each other than could be

explained by cognitive congruence and research has found differences in executive function after the effects of intelligence have been controlled for (e.g. Lowe & Rabbit, 1997).

Of particular interest for the current study is cognitive congruence and task impurity between memory performance and executive function tasks. Some executive function tasks, such as the Wisconsin Card Sorting Test (WCST), draw on memory abilities as well as executive function abilities (Nagahama, 2003). However, a number of authors (e.g. Craik & Grady, 2002) support the view that at least some memory processes are under executive control, particularly working memory, encoding and retrieval processes, and prospective memory. These processes have been linked to Baddeley's 'central executive' (1974, 1986) and Shallice's SAS (1982).

2.4.4 Choice of executive function tasks for the study

Many widely used 'classical' tests of executive function have been criticised because of validity issues. For example, deficits in memory can impair performance on the WCST and the relationship between test performance and everyday performance is not readily apparent (Kliegel, 2003, Nagahama, 2003). Verbal fluency and Trail Making tests have frequently been employed in community studies or studies investigating neuropsychological profiles (Arnaiz and Almkvist, 2003; Collie and Maruff, 2000), because of their ease and speed of administration. Neither test is a 'pure' test of executive function. Verbal fluency tests are variably used as a measure of language difficulties or a measure of executive function (Phillips et al., 1996), whilst Trail Making tests measure attention and psychomotor speed as well as executive functions. Hence it becomes difficult to disentangle the impact of cognitive slowing and of executive function difficulties. Moreover, processing speed reduces with increasing age and has been considered a factor both in normal and abnormal aging (Bryan and Luszcz, 2000; Salthouse, 1991).

In line with Burgess's (1997) recommendation a battery of executive function tasks was considered to have advantages over the use of a single test. Moreover, a

standardised battery that would allow for the calculation of total scores and hence for better differentiation of overall ability or impairment in executive function was considered preferable to a collection of otherwise unrelated tasks. Three standardised batteries are currently available to clinicians (in the UK): The Behavioural Assessment of the Dysexecutive Syndrome (BADS; Wilson et al. 1996), the Delis-Kaplan Executive Function System (D-KFES, Delis et al., 2001) and the Hayling & Brixton tests (Burgess and Shallice, 1997).

The Delis-Kaplan battery consists mostly of adaptations of existing procedures (including a category task, verbal fluency and trail making), and hence is vulnerable to the same criticisms, many of which have also been reviewed by Schmidt (2003). Although the D-KFES would meet Burgess' suggestion that different subtests should rely on different peripheral skills, Schmidt (2003) highlights as a major shortcoming the lack of data for direct comparison of performances across tests, which would usually be a major benefit of co-normed tests. Moreover, the battery was not developed in accordance with any explicit model of executive functions and a number of core components of executive function are missing from the D-KFES (ibid). Theoretical underpinnings of the BADS and Hayling & Brixton seem more explicit. The Hayling & Brixton however consists of only two subtests, one of which is difficult to complete (sentence completion). Whilst this makes the test sensitive to mild impairment, floor effects on this test seemed likely. Hence the BADS was considered a more useful battery, including a number of different subtests of potentially different difficulty level, and seeming to draw to different degrees on peripheral skills. Additionally, the BADS has the advantage of being constructed to increase ecological validity of the tasks (Wilson et al., 1996).

2.5 Executive functioning research in AD and MCI

2.5.1 Neurobiological basis

Several brain structures have been implicated in the development of dementia and its associated neuropsychological deficits, such as degenerative changes in the pathways linking the neural substrate of memory to other brain areas (Morris, 1996; Perry & Hodges, 1999). With regard to executive function in dementia, two hypotheses have

been deliberated: i) lesions to the prefrontal cortex due to higher density of neuropathological markers (plaques, neurofibrillary tangles) in the association areas of the brain, and ii) Morris' 'connectionist' model (1997, see above). Both hypotheses are consistent with brain pathology in dementia, as the association areas of the brain concerned with the higher-level multimodal integration of information as well as cortical frontal and parietal association areas are affected by pathological changes (Morris, 1996).

2.5.2 Neuropsychological evidence of executive deficits in Alzheimer's disease

There is increasing evidence that dysexecutive problems can be detected early in the disease process, and for most AD patients these problems seem to occur before language impairment or visuo-spatial problems (Patterson et al., 1996; Perry & Hodges, 1999). Several authors (Arnaiz & Almkvist, 2003; Patterson et al., 1996; Perry & Hodges, 1999) have reviewed the research literature on executive functioning in AD.

The work of Lafleche & Albert (1995) and Collette et al. (1999) is some of the best available research. Both studies used a range of tasks covering different aspects of executive function, whereas many other studies can be criticised for relying on single measures. Lafleche & Albert (1995) found patients with AD impaired on those executive function tasks that required the concurrent manipulation of information, but not on attention, cue-directed behaviour or simple concept formation. Collette et al. (1999) on the other hand found the performance of their AD patients significantly impaired on all tasks, including the ability to divide attentional resources, to manipulate information stored in working memory, performance on a delayed alternation task, phonemic fluency, inhibition capacity and the monitoring of self-generated responses. Collette and colleagues consider their data consistent with Shallice's hypothesis (1994) regarding fractionation of executive function.

Although there is increasing evidence from group studies that individuals with AD perform less well on tests of executive function and deficits may be detected quite early on in the disease, Patterson et al. (1996) point out that executive dysfunction is

not ubiquitous and incidence rates are not known. Use of different executive function tasks has had an impact on outcome, and has rendered comparisons between different studies more difficult. Yet, a number of studies have demonstrated that people with AD show major decline in their ability to divide and shift attention when two tasks have to be performed concurrently (Patterson et al., 1996; Perry & Hodges, 1999). Furthermore, psychometric studies have found that AD patients experience difficulties carrying out behaviour in sequence, while symptoms of disinhibition or apathy have emerged in research using observer rated scales (Patterson et al., 1996).

2.5.3 Research evidence on executive functioning in MCI

Few studies to date have investigated executive functions in MCI patients (Crowell et al., 2002; Nagahama et al., 2003; Ready et al., 2003). However, Collie and Maruff (2000) have reviewed earlier studies that had selected groups on the basis of similar concepts, such as age-associated memory impairment (AAMI) and incipient dementia. Although the theoretical assumptions or clinical usefulness of these concepts have been challenged, they share some common features with MCI. As this results in some overlap between the groups studied, previous research remains informative if considered with caution.

Controversy exists regarding executive function deficits in mild cognitive impairment. Whereas Collie and Maruff (2000) maintained that executive problems could not be found in MCI, Crowell et al. (2002) concluded that executive functioning is the only non-memory domain affected in MCI. Moreover, they reported similar performance patterns, but less severe deficits on tests of executive functions in MCI compared to dementia. Neither argument seems sufficiently supported by the data cited by these authors.

Collie and Maruff's (2000) generic review of the neuropsychology of MCI included only a few studies that had used any measure of executive function. However, with the exception of verbal fluency tasks, performance on other executive function tasks had been affected when such measures were included. Verbal fluency tasks on the other hand have been criticised for being used as either language or executive

function tests, and furthermore do not appear to be sensitive to detect mild impairment (Phillips et al., 1996). It would appear that Collie and Maruff are only justified to conclude that the evidence is insufficient to decide on the role of executive function in MCI. Their argument for dismissing the reviewed studies is that cross-sectional designs select participants on the basis of a risk factor. Therefore, they see it as likely that observed deficits are associated with the risk factor and thus cannot be said to indicate preclinical AD.

Crowell and colleagues (2002) on the other hand acknowledge that future studies must include a wider range of executive measures. Their research included only Trail Making and Digit Span Backwards, a slim basis to build their broad generalisation on, as these tasks also rely on other cognitive skills affected by age-related decline.

However, results from several other studies indicate that executive function is a promising area for future research in MCI that may lead to detection of mild executive deficits in this group. Ready et al. (2003) found increased apathy and executive dysfunction in both AD and MCI, whilst disinhibition remained at a normal level. This research used informant-completed ratings, thus may be criticised for its vulnerability to observer bias. As the WCST is a complex task, Nagahama et al. (2003) suggest that performance deficits in their MCI patients might reflect combined aspects of memory and executive dysfunctions. Hänninen et al. (1997) compared AAMI subjects and matched controls; finding impaired executive performance on Trail Making, modified WCST, and Stroop, but not verbal fluency. These authors also considered the influence of non-executive abilities on performance on executive tasks. Research that assesses executive function with multiple tasks and tests sensitive to mild impairment in a MCI sample remains outstanding.

2.6 The need for further research on executive functioning in MCI

Notwithstanding the merits of initial research on executive functions in MCI, several issues have not been addressed to date. Studies should preferably include multiple measures of executive function that rely to differing degrees on peripheral skills

(Burgess, 1997). Although some studies have employed multiple measures with AAMI or AD samples (e.g. Collette et al., 1999; Hänninen et al., 1997, Lafleche and Albert, 1995), comparable research remains to be completed with MCI patients.

To capture a level of functioning expected to fall between healthy older adults and demented patients measures need to be sensitive to mild impairment, and availability of age-standardised norms would be beneficial. Furthermore, it would seem indicated to include a task that requires the coordination of more than one activity at the same time and the shifting of attention between these activities. This would be important for two reasons: dual tasks have been found to be particularly sensitive to executive function decline in AD, and, unlike for other executive function tests, there is a lack of evidence that frontal lobe damage causes impairment on dual tasks (Morris, 1996). Although comparability of different tasks is a lesser issue, if these are completed by the same sample, direct comparability can be enhanced, if a test battery is used that can provide standardised scores on a uniform scale for all subtests.

An additional advantage of a standardised test battery over a collection of otherwise selected tasks would lie in the availability of total scores, which should allow for better differentiation of overall ability. Even if actual results would not bear this out, a battery of tests would still allow selecting those subtests which are most sensitive to impairment in early AD and MCI. One battery of executive function tests meets many of the challenges raised: the Behavioural Assessment of the Dysexecutive Syndrome (BADS) (Wilson et al., 1996). Some of its advantages over other batteries of executive function tasks have been discussed above, including its good ecological validity. Additionally, subtests of the BADS assess planning, organising, and novel problem solving, important aspects of executive functioning not covered, or only tangentially, by other executive function tests, and a test requiring dual tasking is included in the battery.

2.7 Rationale for the current study and aims

This study sets out to explore executive function deficits in patients with early AD or MCI with the aim to increase understanding of the extent of executive function difficulties in both groups. A battery of executive function tests (BADS) assessing planning, organising, novel problem solving, as well as dividing attention between two aspects of a task will be used. This will allow extending existing knowledge in several ways: by assessing different aspects of executive function to previous studies; and both by providing directly comparable multiple measures and achieving greater sensitivity to mild impairment or different levels of functioning by deriving total scores. Both degree of functional decline in either group and proportion of people experiencing difficulties will be assessed, as decline is not expected to be ubiquitous in either group and prevalence rates are not known. Performance patterns of both groups will also be compared, as similarities and differences between the groups might provide useful information for clinical practice, where questions of uncertainty arise regarding clinical presentation. Additionally, the usefulness of individual subtests for assessing executive function in either group will be evaluated, as different difficulty levels and floor or ceiling effects may render them differentially suited. Memory abilities, premorbid IQ and depression will be considered as confounding variables, due to their potential impact on test performance. The specific research questions are stated below, after describing potential clinical benefits.

2.8 Clinical Implications

It was hoped that the BADS would prove to be a useful clinical tool for assessing executive dysfunction in MCI and early dementia. It was anticipated that individual subtests might emerge as particularly valuable and could help inform clinicians' choice of tests where constraints do not allow for administration of the whole battery. Such subtests might prove more sensitive to mild impairment than frequently used screening tasks, such as fluency tests, on which many people with MCI and dementia perform adequately.

If mild, but significant executive function difficulties can be shown for at least a proportion of people with MCI or early AD, appropriate early assessment and monitoring of these functions would be indicated. Executive function deficits have been implicated in impairment in independent living skills, higher service need and carer burden (Nagahama, 2003 Patterson et al., 1996). Timely monitoring would allow for early and more appropriate planning for interventions (compensatory strategies, education, reduction of carer burden).

2.9 Research questions

2.9.1 Research question 1

Although evidence of executive function deficits in Alzheimer's disease has been accumulating, some questions remain of interest. Whilst previous researchers (cp. Lafleche et al., 1995, Collette et al., 1999) have used a range of executive function tasks, these have largely not assessed the person's ability to make and implement plans or organise carrying out a number of simple activities. As these are executive functioning skills which have an important impact on independent everyday living, it seems valuable to evaluate, in what way these executive functioning skills are affected in AD. Thus the first research question is: In what way is executive functioning (as measured by the BADS) impaired in Alzheimer's disease? As task demands of different BADS subtests seem to vary in difficulty and task complexity has previously been shown to have an impact on the degree of executive function deficits (Collette et al., 1999), executive functioning might not be uniformly impaired across the different subtests.

One subtest requires set shifting and inhibition of a previously correct response, cognitive skills on which people with AD have previously shown decline, hence, similar impairment can be expected on this task. None of the reviewed literature has assessed ability to solve a novel problem solving task, nor used a judgment test, thus no predictions can be made about these subtests. The remaining three subtests require planning, organising a number of activities, and monitoring ones own performance. Tasks differ in demands on memory and the need to shift from one item to the next. As people with AD have been shown to have difficulties with tasks that require

developing, following and monitoring of a strategy, such as the Self-ordered Pointing task (Lafleche et al., 1995, Collette et al., 1999), they might also be expected to show impairment on planning tasks that are similar to everyday situations. Impairment might be particularly noticeable on BADS subtests of greater complexity.

Additionally, as executive function difficulties are not ubiquitous in the early stages of Alzheimer's disease (Patterson et al., 1996), but only limited information has been published on what percentage of people remain unaffected this question will also be of interest. Number of people performing in the average range based on their overall performance on the test battery as well as performing adequately on each of the subtests will be assessed.

2.9.2 Research question 2

Little is known about executive functioning in Mild Cognitive Impairment. Although some authors (Crowell et al., 2002; Nagahama et al., 2003; Ready et al., 2003) have suggested that mild executive dysfunction might be found in this group, insufficient evidence is available to date. Hence, the following exploratory research question will be addressed: Is there evidence of executive function deficits in Mild Cognitive Impairment, and if so, is there a pattern of impairment across the subtests (research question 2)? Analogous to research question one, it will be of interest, if people with MCI as a group show deficits in executive functioning, and, if there is evidence of decline, what proportion of people are affected, as well as if presence or degree of deficit differ across the different subtests of the BADS.

2.9.3 Research question 3

A comparison of neuropsychological test profiles can be important to help detect differences and similarities between different clinical presentations. Such information can be valuable when clinical judgments are asked for in cases of uncertainty. Hence, a comparison will be made between the patterns of performance on the BADS for the MCI and early AD group (research question 3). Proponents of the view that MCI is the earliest stage of dementia might expect a similar pattern of performance in both groups,

but a lesser degree of impairment in the MCI group, however, this view remains debated and differences between the groups will be equally important to be established.

2.9.4 Research question 4

Additionally, it will be examined, if different subtests might have differential ability to detect impairment in the two groups (research question 4). As the subtests of the BADS vary in their difficulty, some may lead to floor effects, particularly in the dementia group, whilst the easiest subtest may lead to a ceiling effect in the MCI group. Only more difficult subtests may be sensitive enough to detect impairment in the MCI group.

2.9.5 Summary of research questions

In summary, the following research questions will be addressed:

1. In what way is executive functioning (measured by the BADS) impaired in Alzheimer's disease?
2. Is there evidence of executive function deficits in Mild Cognitive Impairment, and if so, is there a pattern of impairment across the subtests?
3. A comparison will be made between the patterns of performance on the BADS for the MCI and early AD group.
4. Different subtests might have differential ability to detect impairment in the two groups.

Observed effects should not be fully accounted for by differences in other variables (memory, premorbid IQ, depression).

3. Methodology

3.1 Design

Participants were recruited into two clinical groups (1) people with Mild Cognitive Impairment (MCI) and (2) people with early Alzheimer's disease (AD). A mixed cross-sectional exploratory design was employed, examining performance on executive function tasks within each of two clinical groups separately, and comparing performance between the two clinical groups. Executive function tests were considered as outcome measures, and socio-demographic information, memory, premorbid intelligence and depression measures were included to ensure comparability between groups. As all main measures used (specified below) had published age-adjusted standardised norms, no additional control group was included in the design. For the main outcome measures (BADs scores) the standardisation sample was used as the control group.

3.2 Participants

3.2.1 Recruitment

Participants were recruited from three centres that provided mental health services to older adults in their local Trust region, covering both urban and rural communities. Participating Trusts were (1) Barnet, Enfield and Haringey Mental Health NHS Trust (centre 1: Colindale Hospital, North London), (2) North East Essex Mental Health Partnership NHS Trust (centre 2: St. Margaret's Hospital, Epping/Essex), and (3) North East London Mental Health NHS Trust (The Petersfield Centre, Harrold Hill). Most participants were recruited from patients seen at memory clinics, but some participants were recruited from referrals to psychology (centre 1).

Mental health services for older adults usually provide services to people aged 65 or above, but often accept younger people, if a diagnosis of dementia is suspected. Hence, the lower age limit for participation in the present study was set to 60 years, to avoid creating too much variation based on different practices between the different participating services. No upper age limit was set, but upper ages for available norms (BADs: 87 years; Wechsler memory scale, Verbal Paired

Associates subtest, and Wechsler Test of Adult Reading: 89 years) were considered a disadvantage for the inclusion of people in their nineties.

11 people with mild cognitive impairment were recruited through centre 2, five through centre 1, and three through centre 3. Most people with early dementia were recruited through centre 1 (N = 15), three further through centre 2. Reasons for this difference in recruitment related to somewhat different clinical practices and policies in the three memory clinics. People with early Alzheimer's disease were followed up for a longer period by the North London memory clinic, until pharmacological treatment (with cholinesterase inhibitors) was well established. By contrast, the Essex memory clinic focussed on people with unclear diagnosis. Once an appropriate diagnosis had been established, pharmacological management was then handed to the local psycho-geriatric service. Additionally, some Essex and North East London patients with early AD were already being approached for another study, and hence for ethical reasons could not be included in the current research project.

Administrative systems in the centres also differed, so that people with mild cognitive impairment could be more easily identified in centres 2 and 3. At centre 1 people with mild cognitive impairment could only be identified, if they had already been referred to the memory clinic for future treatment or if they were awaiting further neuropsychological assessment, but were likely missed, if they were monitored by outpatient follow-up. The issue of diagnosis of mild cognitive impairment at the two centres will be discussed below.

3.2.2 Procedure

To take part in the research participants were visited in their homes and all testing was completed in their familiar environment. Unfamiliar surroundings can be experienced as disorientating by older adults and increase anxiety levels (Woods, 1999), hence it was thought beneficial to assess cognitive function of participants in their naturalistic setting. The preferred order of assessment was to start with socio-demographic questions (to put participants at ease), then complete the first part of the memory test. Next, four or five BADS subtests were completed, before memory

recall was assessed. The last BADS subtest, the Wechsler Test of Adult Reading and the Geriatric Depression scale were given last. This order was sometimes varied, for example, if a participant felt particularly anxious about the memory task. All but one participant were assessed in a single session.

3.2.3 MCI Group

Criteria for Mild Cognitive Impairment have been suggested by Petersen (1999, 2003). In agreement with these criteria, people recruited into the MCI group were expected to have a memory complaint, preferably corroborated by a person who knows the patient well, as well as objective memory impairment. Additionally, they had to have largely intact general cognitive function, essentially preserved activities of daily living, and should not be demented. Although memory is the cognitive domain most frequently affected, Petersen acknowledges that some people show impairment in another single cognitive domain (2003).

Although attempts were made to select an ‘amnesic’ MCI group, neither this concept nor MCI in general is an official nosological category, hence identification of participants had to be based on clinical judgments made by psychiatrists, in combination with additional information available on file. Clinical judgments seemed in two cases based on mild impairment in a non-memory domain. Furthermore, some authors found that MCI is not a stable diagnosis (Ritchie et al., 2001), and two people seemed to have improved since they were clinically assessed. However, as this reflects issues arising in everyday clinical practice with regards to diagnosing MCI, both pairs were kept in the sample. In the present study ‘largely intact general cognitive function’ was operationalised as a Mini Mental State Examination score (MMSE, Folstein and Folstein, 1975) of 24 or above (i.e. the widely used cut-off of 23/24 to indicate dementia; Anthony et al., 1982), based on the score the participant had obtained in their most recent clinical assessment prior to recruitment.

Practices regarding diagnosis of mild cognitive impairment differed somewhat between the centres. At centres 2 and 3 the clinical teams jointly made a diagnosis of

mild cognitive impairment, based on mental state examination, clinical interview and results on a standardised test battery. Diagnostic practice at centre 1 varied more, reflecting that MCI has not been included as a category in the major classification systems (ICD-10; DSM-IV). Patients were often described interchangeably as having mild cognitive impairment or ‘Mild Cognitive Disorder’ (an ICD-10 diagnosis that most closely approximates mild cognitive impairment). One participant remained undiagnosed, but showed evidence of memory loss without functional loss in other areas and met none of the exclusion criteria, and was accepted into the study, as this also reflected different current practice with regard to diagnosing MCI.

3.2.4 Early Alzheimer’s Disease Group

All participants recruited into the early Alzheimer’s group had received a diagnosis of probable Alzheimer’s disease. Centre 1 used ICD-10 criteria for diagnosis, centre 2 diagnosed according to NINCDS-ADRDA criteria (no participants came from centre 3). For a clinical diagnosis of dementia of the Alzheimer type both systems require deficits in at least two areas of cognitive function, which affect everyday functioning and represent a decline from previous attainment. Onset had been insidious, decline progressive, and there was no clouding of consciousness. People whose clinical presentation included behavioural features, such as apathy, were not excluded from participating. NINCDS-ADRDA criteria are considered to be the gold standard and specify explicitly what tests need to be carried out before diagnosis, but this standard was also approximated by centre 1. Additionally, a cut-off score of 20 or higher on the MMSE was used to denote a milder degree of the disorder (Mini Mental State Examination, Folstein, 1975; Anthony et al. 1982). No distinction was made whether this level of functioning was maintained with or without the help of cholinesterase inhibitors (anti-dementia drugs).

3.2.5 Common exclusion criteria for the MCI and early AD groups

Common exclusion criteria for both groups were checked against available information in the participants’ medical files. Participants should have no neuropathology that may account for the deficits (other than neuropathology compatible with a diagnosis of AD), no current episode of major psychiatric

disorder, no significant history of brain injury, and no known history of significant substance abuse. Not all participants had had either MRI or CT scans at the time of recruitment, either because they were still awaiting assessment or the patient or clinician had decided against undertaking this investigation. However, in some cases evidence of minor strokes was not considered incompatible with a diagnosis of MCI or early AD by the clinicians, hence the sample might be less 'pure' in this respect than expected of an ideal research sample, but again typical of the challenges faced in clinical practice.

3.2.6 Standardisation sample of the BADS

Wilson et al.'s (1996) norms are based on a sample of adults aged 16 to 87, stratified by gender, four age groups and three ability bands. Norms for total profile scores are available for the subsample of 65 to 87 years old, whereas for each subscale mean scores are only provided for the whole sample.

3.2.7 Further considerations

All participants should have been clinically reviewed no earlier than six months prior to the start of recruitment to minimise the risk that they might have deteriorated significantly in the interval and might no longer meet criteria. Unforeseen delays during the recruitment phase might have lengthened this interval for some participants, however, others were not approached, if significant decline had become apparent during this delay.

It was considered preferable, if English was the first language of research participants, but second language speakers were accepted, if they had either been in part educated in an English speaking country or there was another indication of competency in the language, for example based on previous occupation in the UK.

3.2.8 Effect size calculation

Based on previous publications (Crowell et al., 2002; Petersen, 2003) it was anticipated that people in the MCI group would perform between 0.5 SD and 1.0 SD below age-standardised norms on tests of executive functioning. Based on an

estimated mean effect size (Cohen's d) of 0.75, a required sample size of $N = 23$ in each group was calculated for a power of 0.80 at an α -level of 0.05 (Cohen, 1992).

3.3 Measures

3.3.1 Socio-demographic Data

Socio-demographic data relating to age, sex, current living status, education and former occupation were collected. Current living status was classified as independent-alone (1), independent-with partner (2), independent-other (3), receiving community support (4) or residential (5). 'Education' was classified by years in education. Former occupation was classified according to the Registrar General's Scale (Office of Population Censuses and Surveys, 1990) into 'I' 'Professional', 'II' 'Managerial/technical', 'IIN' 'Skilled non-manual', 'IIM' 'Skilled manual', 'IV' 'Partly skilled occupations', 'V' 'Unskilled occupation', and 'VI' 'Other'. The Registrar General's Scale was used in preference of the updated National Statistics Socio-economic Classifications (OPCS, 2001), because most participants had retired a long time ago and the older scales were considered appropriate to the time the participants would have worked.

3.3.2 Executive Function Tasks

To assess executive function of participants the Behavioural Assessment of the Dysexecutive Syndrome (BADS) was used. This test battery has been developed by Wilson and colleagues (1996), "to capture different aspects of the dysexecutive syndrome using tasks analogous to those required in everyday life activities involving executive functioning" (1998). Subtests are described in the following, summarising information from Wilson et al.'s manual and later publication (1996, 1998). Subtest scores as well as total scores were calculated, using the conversion to profile scores described in the manual. As the Dysexecutive Questionnaire (DEX) does not contribute to BADS total scores and available norms for it are not very differentiated, this questionnaire was not included.

3.3.2.1 Rule Shift Cards Test

This test examines a person's ability to respond correctly to a rule (part 1) and to shift from one rule to another (part 2). The first part of the test is set up to establish a pattern of responding that increases the likelihood of perseverative errors in the second part of the test when the rule is changed. To reduce demands on memory each rule is printed and left in view of the participant. Number of errors and time taken were recorded for calculating profile scores, and these were considered in the analysis.

3.3.2.2 Action Program Test

The Action Program Test was designed as a novel, practical task that requires the development of a plan of action in order to solve a problem (originally devised by Klosowka in 1976, cp. Wilson et al., 1996). This subtest requires five simple steps for its solution, but participants need to work backwards to solve the problem, hence need to work out what needs to be done before concentrating on how the end can be achieved. The number of steps needed for successful solution that were completed independently were recorded and converted to standardised profile scores.

3.3.2.3 Key Search Test

For this paper-and-pencil task a person is asked to imagine that a square is a large field in which they have lost their keys. The person is requested to draw how they would search the field to find their keys. As well as being analogous to real-live situations of losing or misplacing items, this task requires the ability to plan an effective and efficient course of action and to monitor, if all of the area has been searched (cp. Wilson et al., 1996). Performance was rated according to the marking system devised by Wilson et al. and converted to a standardised profile score.

3.3.2.4 Temporal Judgement Test

For this test participants were asked to estimate the answer to four questions, and each correct answer corresponded to one profile point. This test is described as comparable to, but shorter than Shallice and Evan's Cognitive Estimates Test (1978, cp. Wilson et al., 1996). Again, profile scores were used for analysis.

3.3.2.5 Zoo Map Test

The zoo map test is a test of planning. It includes a high-demand trial that is presented first as well as a second trial that is a low-demand condition. In the high-demand condition the participant must plan a route around a map of a zoo to visit a number of places whilst respecting specific rules, such as using a number of paths only once. Errors will occur if the person visits the different places in the order given in the instructions, so the participant must plan in advance to avoid errors. In the low-demand trial the person is simply required to follow the instructions to produce an error-free performance. Performances were rated according to the standardised marking system and converted to profile scores.

3.3.2.6 Modified Six Elements Test

The modified six elements test is a simplified version of a test developed by Shallice and Burgess (1991). It requires participants to organize themselves so that during the allocated 10-minute-period they spent some time on each of six different parts of the task. These six parts include two dictation exercises, two picture naming tasks and two sets of arithmetic problems, but participants are instructed not to attempt two parts of the same kind one after the other. This subtest is arguably the most demanding from the BADS battery as the participants have to divide their attention between completing the parts of the task without making an error on the rule about the order of parts, and monitoring total time allocated to the task so that all six parts are attempted. Wilson et al. (1998) quote research by Burgess & Taylor (in Burgess 1997) that this task “makes demands on a person’s ability to plan, organise, and monitor behaviour” as well as on their “prospective memory”. Again, standardised profile scores were calculated for each participant’s performance.

It was anticipated that not all participants, especially in the early dementia group would want to attempt this subtest, because of its level of difficulty. However, instructions for the tasks were given to (nearly) all participants and the task was only discontinued, if a participant looked overtaxed by the task or clearly expressed a

wish not to attempt it. Only five participants did not attempt this task and the missing data was not included in subtest analysis.

3.3.2.7 BADS total scores

Total profile scores for each participant were also recorded. These were pro-rated, as described in the manual, if participants attempted only five subtests, which was the case for five participants who did not complete the Modified Six Elements task.

Total profile scores were converted to age-corrected standardised scores. These were also classified into broad descriptive categories of level of performance (e.g. “average”).

3.3.3 Memory

To assess memory abilities of participants the Verbal Paired Associates subtest from the Wechsler Memory Scales, 3rd edition, was used (1997). Participants were required to learn a list of word pairs which was read to them repeatedly. The words that make up a word pair are not semantically or phonetically related. This test provides a measure of verbal episodic memory, which has been found to differentiate best between normal aging and memory problems typical of mild cognitive impairment and early dementia (Arnaiz and Almkvist, 2003). The test has the additional advantage that it provides participants with an opportunity of learning through repeated exposure. Age-scaled scores were obtained for immediate recall and delayed recall, and raw scores were recorded for the recognition trial. Two participants discontinued this test prematurely. Missing data was replaced with the median for the group to which the participant belonged.

3.3.4 Estimate of Premorbid Cognitive Functioning

To control for differences in expected levels of premorbid intelligence, the Wechsler Test of Adult Reading (WTAR, 2001) was included, as general intellectual abilities and executive function abilities correlate in the normal population (Burgess, 1997). The WTAR is based on the principle that familiarity with irregular pronunciation and educational attainment are correlated. The ability to read irregular words does not diminish significantly after brain injury (Lezak, 1995), however some authors have

questioned whether the same can be assumed for degenerative diseases, such as dementia (O'Carroll, 1992), but other methods to estimate premorbid IQ also rely on cognitive skills that might deteriorate early in dementia. Age-scaled standardised scores were recorded. Demographics based estimate WTAR scores were used for one participant who discontinued the task and one participant whose first language was not English.

3.3.5 Depression

The 15-item version of the Geriatric Depression Scale (GDS, Yesavage et al. 1983) was included to control for level of depression. The GDS has been specifically developed for use with the older adult population. It is a screening instrument and a cut-off score of 5/6 is commonly adopted to indicate depression. Although many normal controls could be expected to score '0', a number of participants in the current sample were expected to endorse the item 'Do you feel you have more problems with memory than most?' without any indication of depressed mood.

3.3.6 Additional information from medical files

Last recorded MMSE scores were noted down to ensure fidelity of the groups (MMSE \geq 24 for the MCI group, and \geq 20 for the early AD group) and to allow for comparison between the groups. One person's score was checked against criteria at recruitment, but not accurately recorded later, and is therefore excluded from descriptive analysis. Information relating to exclusion criteria was also gathered from the participants' medical files, as far as such information was explicitly recorded.

3.4. Ethical issues

3.4.1 Ethical approval

Ethical approval has been obtained from all participating Trusts: Barnet, Enfield & Haringey Local Research Ethics Committee, West Essex Local Research Ethics Committee, and through COREC procedures for North East London MH NHS Trust. The project has also been registered with the respective Research and Development departments: Barnet, Enfield & Haringey Mental Health Trust R&D Department,

North Essex Mental Health Partnership NHS Trust Research and Development Committee, and NELMHT Research and Development Directorate. The letter granting ethical approval for the principal research trust (Barnet, Enfield & Haringey) has been included in appendix A.

The ethics committee also approved an introductory letter (consent to contact letter, appendix B), patient information sheet (appendix C) and consent form (appendix D). The introductory letter had been simplified on request of collaborating psychiatrists. First the introductory letter and then the patient information sheet were sent out to participants in advance, and opportunity for questions was offered, before any research tasks were commenced. Understanding of the main points was clarified with participants, and summaries or repetition provided as necessary, e.g. looking through the patient information sheet together with participants who had forgotten its content. Participants were informed verbally and in writing that they could withdraw from study at any time without prejudice, and their consent to participate was obtained.

3.4.2 Ethical considerations

The application for ethical approval included the following ethical considerations and specified procedures for dealing with participant distress, which the researcher abided by. The researcher anticipated that some of the assessment tasks might confront participants directly with aspects of their lives in which they experience difficulties. Although it was anticipated that this could be experienced as unpleasant, it was also expected that for most participants any discomfort would be transitory and no greater than any distress they might experience in their everyday lives when they notice problems with activities they were previously able to complete without difficulty. At the same time, it was anticipated that some participants may wish to discontinue their participation, if they experienced the assessment as unpleasant. As participants were recruited from a group considered vulnerable, the researcher also looked for nonverbal signs of distress and encouraged participants to voice, whether they wanted to discontinue. In some cases, the researcher decided to discontinue, when participants seemed distressed but still wanted to be helpful. In total, nine subtests were not completed (5 x Modified Six Elements test, 2 x memory test, 2 x

WTAR). In many cases, the discontinued task was the last one to be given to the participant, so that loss of additional data was minimal, in other cases, participants did not like the specific task, but did not mind continuing with a different task, which then often provided them an opportunity to succeed. Participants were assured that it was fine to discontinue, and efforts were made to help them overcome unpleasant feelings, such as by focusing on strengths shown earlier and stressing that their participation had been helpful. Most people cheered up very quickly and seemed no longer upset by the time the researcher left. Distress seemed to have been experienced by two people who wanted to discontinue the memory test. Any such concerns were not project or test specific. As part of ethical procedures cases were discussed with supervisors, including a person where the researcher had concerns about this person living independently, and only in two instances was it felt appropriate or necessary to pass this information on to an additional professional from their clinical team.

3.5 Data analysis

Parametric and nonparametric statistical procedures were used to test hypotheses against an accepted α -level of 0.05. Individual procedures and their rationale are described in greater detail in the relevant sections of the results chapter.

4. Results

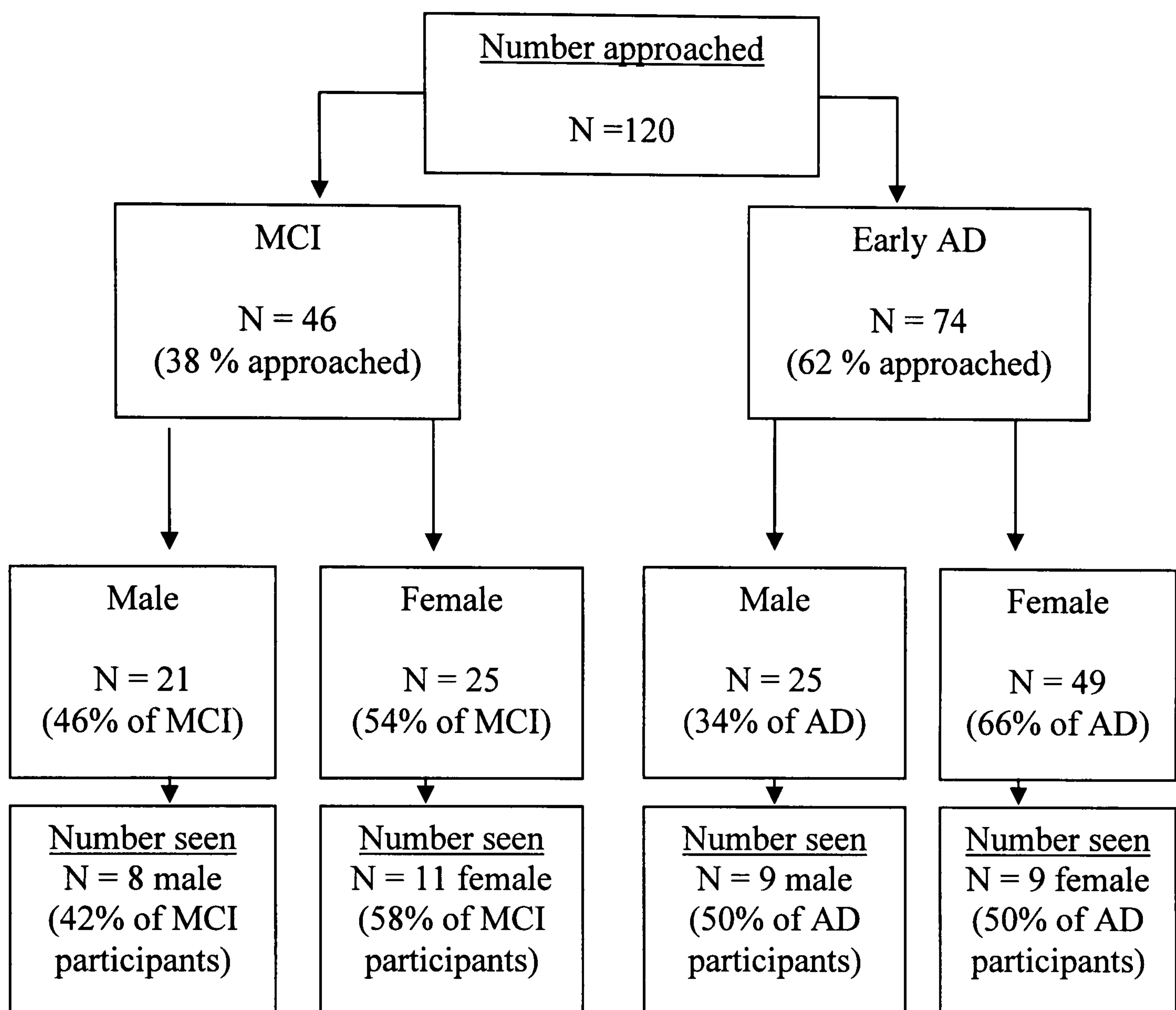
Main outcomes as well as demographic information will be discussed in detail in the following. Both the MCI group and the early AD group showed decline on executive functioning. Compared to the AD group, impairment was mild in the MCI group, but still fell more than 1 standard deviation below norms for the older adult population. Nonetheless, impairment in executive functioning was not ubiquitous in either group. Patterns of performance across BADS subtests were similar in both groups. Despite availability of age-corrected norms 'age' had a considerable influence on executive functioning. Other control variables (memory, premorbid functioning) contributed little to regression models or were non-contributory (depression).

In the following, socio-demographic information and comparative statistics for control variables will be reported first. Then each of the main research questions will be addressed in turn. Effects of confounding variables will be examined for each clinical group separately, as the final part of analysis for research questions 1 and 2. In each section descriptive information and treatment of the data will be discussed before results of inferential statistics. The α -level was set at 0.05, and results of t-tests are based on two-tailed assumptions.

4.1 Socio-demographic features of the sample

37 people (45.9% male) agreed to take part in the study: 19 people (42.1% male) with mild cognitive impairment (MCI group) and 18 people (50.0 % male) with early Alzheimer's disease (early AD group). This does not reflect the distribution of gender or clinical group at the recruitment stage (see figure 1). Women with a diagnosis of Alzheimer's disease were less likely to participate. Although recruitment success was relatively low (31% of people approached), this could be expected, as people were initially approached by letter and had to opt in. No follow-up letter was sent despite all potential participants suffering memory problems.

Figure 1: Recruitment



Summary participant demographic information for age, years in education, and social class based on former occupation is presented in table 1. Participants were aged between 68 and 92, with a mean age of 78.76 (SD 5.25), including a number of participants aged 80 and older. The MCI group and the early AD group did not differ significantly in mean age ($t(35) = -1.16$; $p = 0.26$) or mean number of years in education ($t(35) = -0.72$; $p = 0.48$). In the MCI group two people with university education had shown up as statistical outliers, but were not removed from analysis. To compare both groups on socioeconomic status, data was dichotomised by collapsing social classes 1 to 3n, and social classes 3m to 5 respectively. No differences in social class between the two groups were observed ($\chi^2 = 0.23$; Fisher exact test: $p = 1.0$).

Table 1: Participant Demographic Information

	MCI (N = 19)		Early AD (N = 18)			
	Mean	SD	Mean	SD		
Age	77.79	(4.96)	79.78	(5.49)		
Years in education	11.03	(2.78)	11.67	(2.61)		
	MCI (N = 19)		Early AD (N = 18)		Total (N = 37)	
SES (Registrar General's Scale)	N	%	N	%	N	%
I observed count (expected count)	2 (1.5)	10.5	1 (1.5)	5.6	3	8.1
II observed count (expected count)	6 (6.7)	31.6	7 (6.3)	38.9	13	35.1
III N observed (expected count)	8 (7.7)	42.1	7 (7.3)	38.9	15	40.5
III M observed (expected count)	0 (1.0)	0.0	2 (1.0)	11.1	2	5.4
IV observed count (expected count)	2 (1.0)	10.5	0 (1.0)	0.0	1	2.7
V observed count (expected count)	0 (0.5)	0.0	1 (0.5)	5.6	1	2.7
Not classified observed count (expected count)	1 (0.5)	5.3	0 (0.5)	0.0	1	2.7
Total	20	100.0	17	100.0	37	100.0

Nine participants were living on their own, 25 with their partner, and three with other relations. Only two participants had moved to warden controlled accommodation by choice, but seemed to continue living at similar levels of independent functioning

compared to the other participants. Very few people in the dementia group had started to receive professional services, such as attending day centres part-time or occasional respite. However, many other participants in both groups felt supported in everyday activities by relatives or friends, and sometimes private domestic help arrangements.

4.2 Clinical features of the sample

All 18 participants in the early AD group had a diagnosis of dementia of probable Alzheimer's type. Additionally, all had had an MMSE score (Mini Mental State Examination, Folstein, 1995) of 20 or more at their last clinic appointment prior to participation, which indicated mild degree of Alzheimer's disease severity. Of the 19 people in the MCI group 16 had been clinically diagnosed with mild cognitive impairment, 2 with mild cognitive disorder and one had no formal diagnosis. In accordance with selection criteria for the MCI group, all participants in this group achieved an MMSE score of 24 or higher, compared to only eight people in the AD group (44%). Descriptive information on this variable is provided in table 2, and boxplots have been included in appendix E i. One person in the dementia group with a score of 27 showed up as a statistical outlier, but was not removed from analysis, as this outlier would have rendered the group comparison more conservative. As expected, mean scores on the MMSE differed significantly between the two groups ($t(34) = 7.66, p < 0.001$; Cohen's $D: 2.52$). This indicated that people in the early AD group showed greater global decline in cognitive functioning.

4.3 Control variables

Measures of premorbid IQ estimates, current memory abilities and level of depression had been included to control for potentially confounding influences. Summary statistics for these variables are reported in table 2 and boxplots for all measures can be found in appendix E i. The Wechsler Test of Adult Reading (WTAR) estimates premorbid IQ. A statistical outlier in the MCI group was not removed, as a distribution in levels of premorbid functioning is expected. A small difference in mean WTAR scores between the two groups did not become significant.

Because equal variances could not be assumed for the distribution of scores on Verbal Paired Associates, the non-parametric Mann-Whitney U test was used to test for differences on immediate memory, delayed recall and recognition memory. The issue raised by a few participants showing memory performance in the average range will be considered in the discussion. The MCI and early AD groups differed significantly on immediate recall (VPA I: $U = 84.5$, $p = 0.007$) and delayed recall (VPA II: $U = 69.5$, $p = 0.001$), but not in their performance on recognition memory (VPA recognition trial $U = 138.0$, $p = 0.31$). T-tests with adjusted degrees of freedom for equal variances not assumed led to similar results with effect sizes of 0.90 (Cohen's D) for VPA I, 0.88 for VPA II, and 0.42 for VPA recognition trial. Whereas the MCI groups performed better on memory recall, both groups performed equally well on the easier recognition memory task.

The Geriatric Depression Scale (GDS) normally has a cut-off score of 5/6, however item 10 ("Do you feel you have more problems with memory than most?") will be endorsed by a number of people with memory problems who are not depressed, hence a score of '6' was still considered normal for the current population. Because homogeneity with respect to this variable was high in the sample, some scores showed up as statistical extreme cases although clinically they still indicated that the person was not depressed. Hence all scores were retained for analysis. Only one person from the early AD group achieved a score that indicated a significant level of depression, and for this person depressed mood was one of the clinical features of the dementia. MCI and early AD participants did not differ significantly on mean GDS scores.

Table 2: Descriptive statistics of psychometric results on non-executive tests

	Mean	SD	95% C.I.	Median	Min	Max	Skewness	T-value	df	P-value	Cohen's D
Mini Mental State											
MCI (N = 19)	27.11	1.20	26.53 - 27.68	27	25	29	-0.22				
AD (N = 17)	23.18	1.85	22.23 - 24.13	23	20	27	0.11	7.66	34	<0.001	2.52
Wechsler Test of Adult Reading											
MCI (N = 19)	108.84	10.10	103.97 - 113.71	108	84	125	-0.51				
AD (N = 18)	102.61	13.35	95.97-109.25	104	71	118	-0.87	1.61	35	0.12	0.52
Geriatric Depression Scale											
MCI (N = 19)	2.21	1.58	1.45 – 2.97	2	0	6	0.65				
AD (N = 18)	1.94	2.41	0.74 – 3.14	1	0	9	1.94	0.40		0.69	0.13

Table 2 continued: Descriptive statistics of psychometric results on non-executive tests

	Mean	SD	95% C.I.	Median	Min	Max	Skewness	MWU*	P-value	Cohen's D
VPA immediate recall scaled scores										
MCI (N = 18)	7.47	2.44	6.30 – 8.64	7	5	13	0.80	(23.55)		
AD (N = 17)	5.50	1.34	4.83 – 6.17	5	4	8	0.91	(14.19)	0.007*	(0.90)
VPA delayed recall scaled scores										
MCI (N = 18)	8.26	2.62	7.00 - 9.53	7	6	16	1.60	(24.34)		
AD (N = 17)	6.22	1.31	5.57 – 6.87	6	5	10	2.02	(13.36)	0.001*	(0.88)
VPA recognition trial raw scores										
MCI (N = 18)	21.63	3.13	20.12 – 23.14	23	13	24	-1.83	(20.74)		
AD (N = 17)	20.6	4.32	17.91 – 22.20	22	11	24	-0.95	(17.17)	0.33*	(0.42)

MWU: mean ranks for groups in brackets, * exact test

4.4 Executive Functioning

4.4.1 Descriptive statistics of the BADS

Descriptive information on BADS total scores and subtest scores is provided in table 3, and Figure 2 to Figure 4 show boxplots of the score distributions. A floor effect occurred for the early AD group on the Zoo Map test, but score distribution on other subtests was acceptable. Statistical outliers and extreme cases were not removed from analysis, as performance scores across the score range from zero to four were expected.

4.4.2 Research question 1

Research question 1 investigates in what way executive functioning is impaired in AD, as measured by the BADS. Total scores were converted to age-corrected standardised scores and compared against a mean of 100 and a SD of 15. Confidence intervals of subtest scores were compared against confidence intervals of the Wilson et al. (1996) total sample (reported in table 3), as separate information on the older adult participants of the validation study was not available.

Figure 2: Boxplots of BADS total profile scores in the MCI and early AD groups

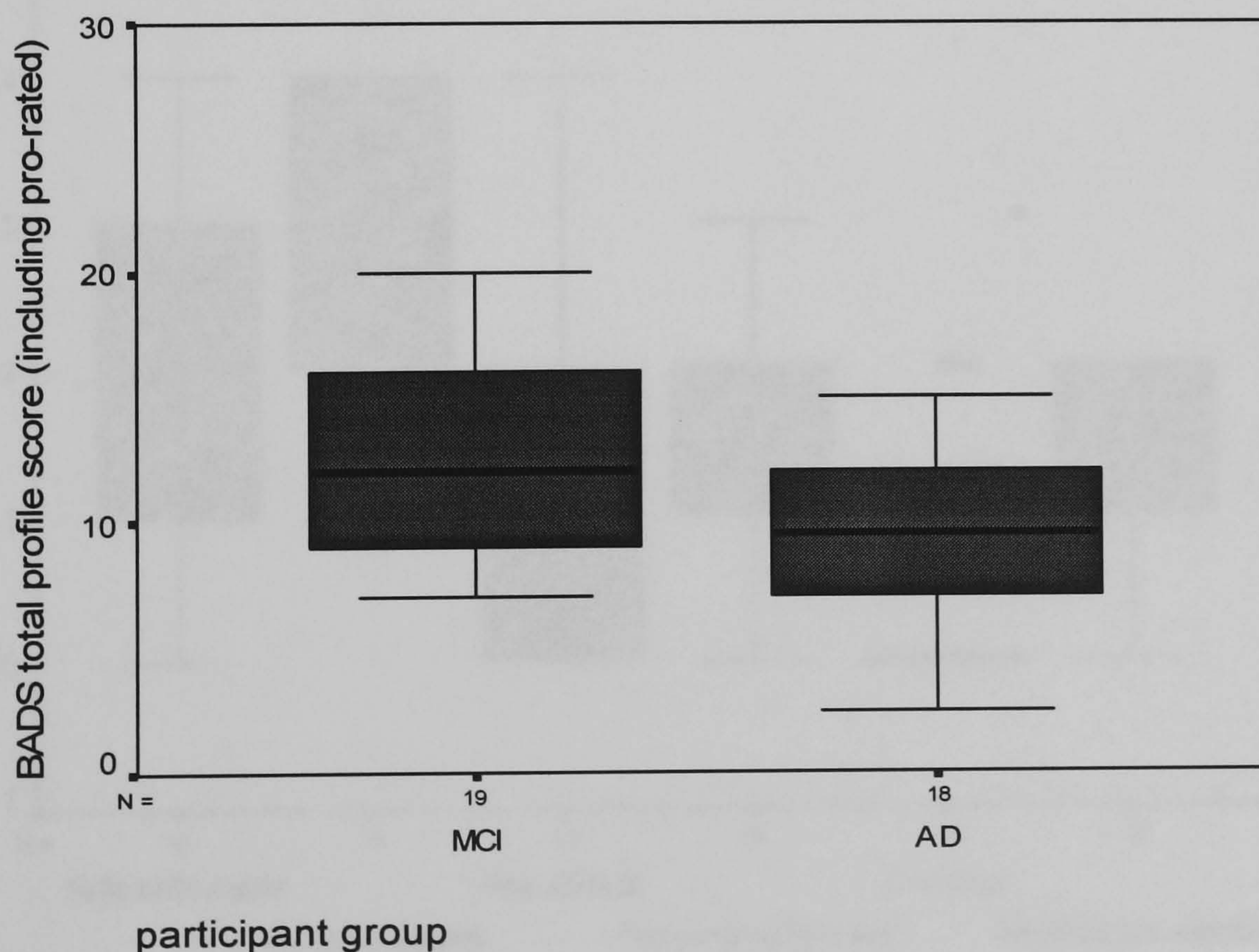


Figure 3: Boxplots of BADS subtest profile scores in the MCI group

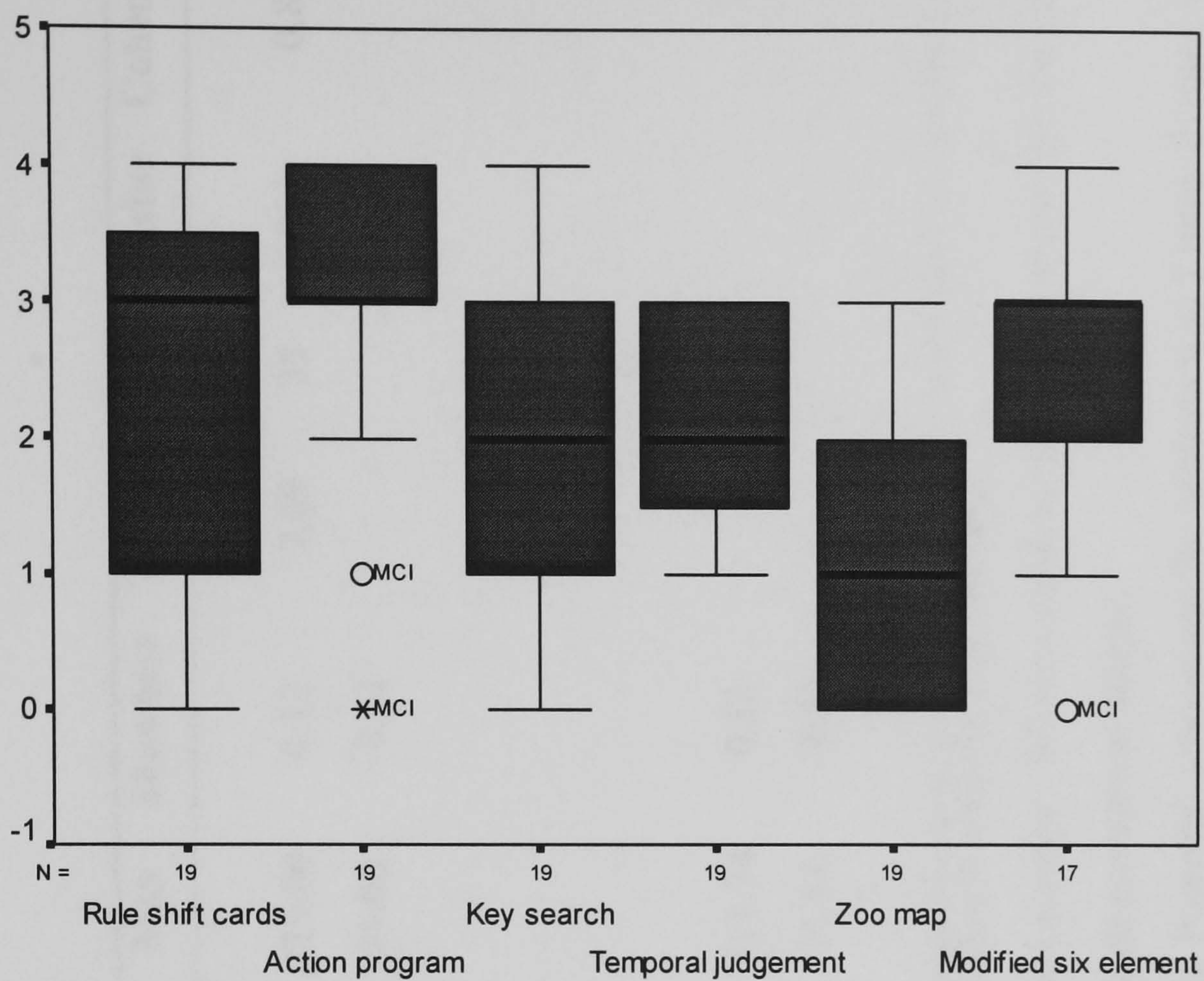


Figure 4: Boxplots of BADS subtest profile scores in the early AD group

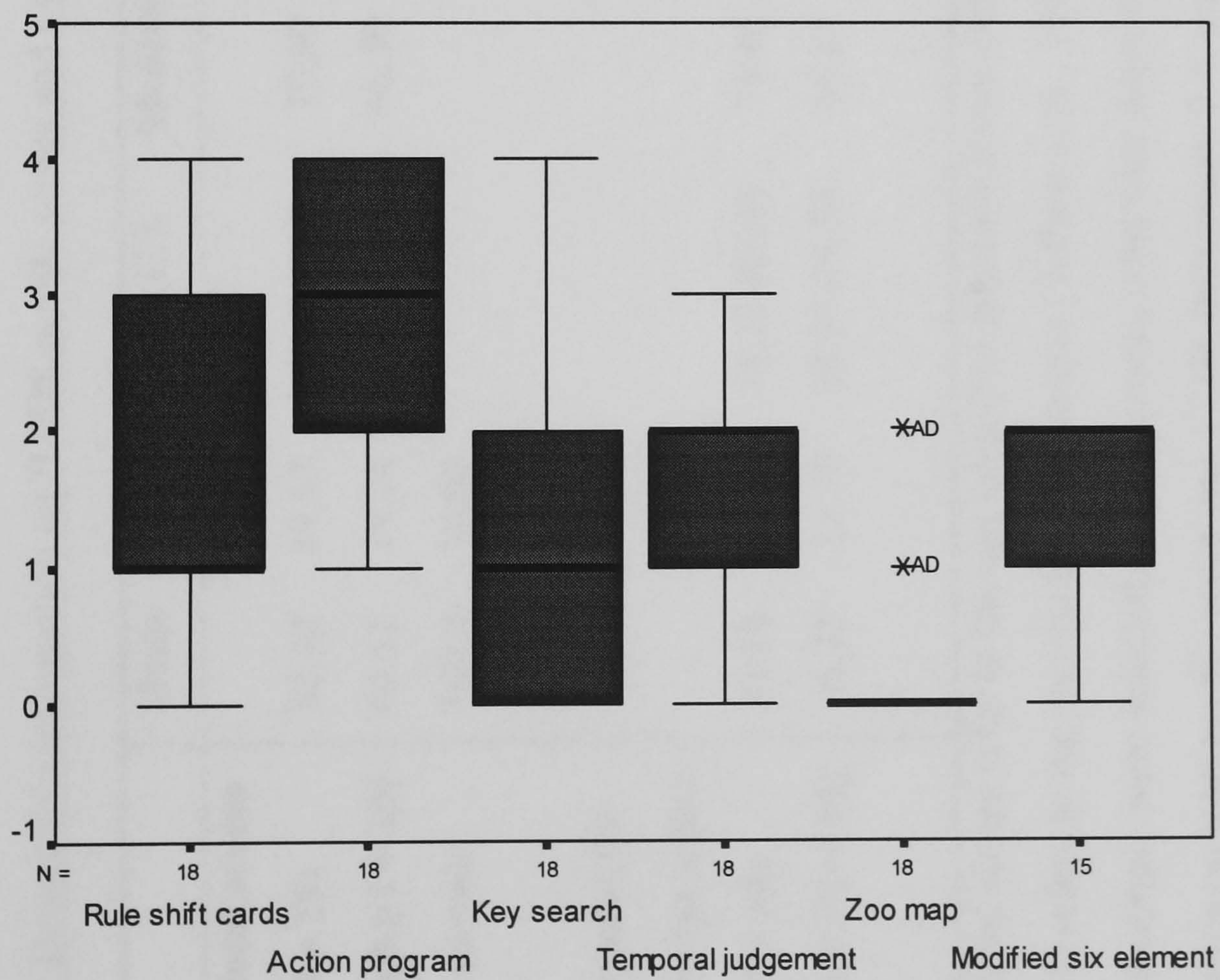


Table 3: Descriptive information on BADS profile scores and t-test results

	Mean	SD	95% C.I.	Median	Min	Max	Skewness	T-value	df	P-value	Cohen's D
BADS total scores											
MCI (N = 19)	82.42	19.58	72.98-91.86	79.00	54.00	119.00	0.12	2.69	35	0.012	0.82
Early AD (N = 18)	65.11	19.24	55.36-74.86	66.50	29.00	94.00	-0.41				
Wilson sample	100.0	15.00									
data corrected for observed age effect:											
MCI (N = 19)	81.88	14.84	74.73-89.03	79.48	59.00	111.74	0.33				
Early AD (N = 18)	66.78	15.70	58.97-74.58	66.84	35.42	91.84	-0.28				

BADS total scores refer to the age corrected standard scores derived in accordance with the test manual.

The table refers to the standardisation sample (Wilson et al., 1996) as 'Wilson sample'. Where available, normative scores for the older adult subsample were selected as comparison, otherwise those of the total adult normative sample.

Score range on total profile score was 17.60, (minimum: 2.4, maximum: 20). Potential score range for subtests was 5 (min: 0; max: 4; however, highest achieved score on temporal judgement was 3).

For each of the subtests, corrected scores refer to scores additionally corrected for the effect of 'age' as a covariate.

Table 3 continued: Descriptive information on BADS profile scores and t-test results

	Mean	SD	95% C.I.	Median	Skewness	T-value	df	P-value	Cohen's D
Rule shift cards									
MCI (N = 19)	2.32	1.42	1.63-3.00	3.00	-0.24	1.03	35	0.32	0.34
Early AD (N = 18)	1.83	1.42	1.12-2.54	1.00	0.33				
Wilson sample	3.56	0.78	3.46-3.66						
corrected RS MCI	2.31	1.41	1.63-2.98	2.68	-0.35				
corrected RS AD	1.86	1.41	1.15-2.56	1.09	0.36				
Action Program									
MCI (N = 19)	3.00	1.11	2.47-3.53	3.00	-1.38	0.60	35	0.56	0.18
Early AD (N = 18)	2.78	1.17	2.20-3.36	3.00	-0.52				
Wilson sample	3.77	0.52	3.70-3.84						
corrected AP MCI	2.99	1.07	2.47-3.50	3.18	-1.47				
corrected AP AD	2.82	1.12	2.27-3.38	2.88	-0.32				
Key Search									
MCI (N = 19)	2.00	1.53	1.26-2.74	2.00	0.00	1.31	35	0.20	0.43
Early AD (N = 18)	1.39	1.29	0.75-2.03	1.00	0.46				
Wilson sample	2.60	1.32	2.42-2.78						
corrected KS MCI	1.97	1.37	1.31-2.63	1.84	0.09				
corrected KS AD	1.48	1.11	0.93-2.03	1.64	-0.46				

Table 3 continued: Descriptive information on BADS profile scores and t-test results

	Mean	SD	95% C.I.	Median	Skewness	T-value	df	P-value	Cohen's D
Temporal judgment.									
MCI (N = 19)	2.05	0.78	1.68-2.43	2.00	-0.10	2.05	35	0.048	0.65
Early AD (N = 18)	1.50	0.86	1.07-1.93	2.00	-0.63				
Wilson sample	2.15	0.91	2.03-2.27						
corrected TJ MCI	2.05	0.76	1.68-2.41	2.03	0.06				
corrected TJ AD	1.57	0.70	1.22-1.92	1.60	-0.55				
Zoo Map Test									
MCI (N = 19)	1.11	0.99	0.63-1.58	1.00	0.53	3.12	29.1*	0.008	0.91
Early AD (N = 18)	0.28	0.59	-0.01-0.56	0.00	2.07				
Wilson sample	2.44	1.13	2.29-2.49						
corrected ZM MCI	1.07	0.54	0.81-1.33	1.00	0.55				
corrected ZM AD	0.30	0.56	0.02-0.58	0.08	1.67				
Mod. Six Elements									
MCI (N= 17)	2.35	1.11	1.78-2.93	3.00	-0.50	2.58	26*	0.032	0.82
Early AD (N = 15)	1.53	0.64	1.18-1.89	2.00	-1.09				
Wilson sample	3.52	0.80	3.41-3.63						
corrected SE MCI	2.30	1.06	1.76-2.85	2.30	-0.79				
corrected SE AD	1.52	0.51	1.24-1.80	1.60	0.42				

* adjusted for equal variances not assumed

A mean total score of 65.11 for the early AD group falls more than two standard deviation standard scores in the normal older adult population (Wilson et al., 1996). Results of a one sample t-test against a test value of 100 were highly significant ($t(17) = -7.55, p < 0.001, \text{Cohen's } D: -2.02$). This means mean performance of the early AD group on executive functioning fell into the impaired range.

Next, the level of impairment on the individual subtests was examined. Results have to be interpreted with caution, as no separate comparative data for the older adult group of Wilson's (1996) normative sample has been published, and comparison with data for the total adult normative sample bears a risk of overestimating impairment. Nonetheless, the early AD group showed notable deficits on all six subtests of the BADS, and confidence intervals for the early AD group and the published data for the validation sample did not overlap for any subtest. Although the early AD group achieved their highest average score on the Action Program subtest, their score still fell around two standard deviations below the mean of the standardisation sample. Performance scores on three further subtests (rule shift cards, zoo map, modified six elements test) also showed an equally high level of decline. On the Zoo Map test a floor effect was observed for the early AD group. By contrast, although average scores on the temporal judgement and key search subtests were low, these still fell less than one SD below published norms. In summary, reduced performance on all individual subtests could be observed, but varied both in average level of performance between the subtests and in degree of decline compared to normative data.

A second issue, which pertains to the question how executive functioning is impaired in early AD, addresses what proportions of people perform average versus show impairment on the test battery. At group level, reduced performance scores could result either from milder decline in the majority of participants or from greater impairment in a proportion of participants. Different ranges of BADS standardised total scores are assigned to broad clinical classifications, e.g. scores between 90 and 109 are classified as 'average', scores below 70 as 'impaired'. Although this is a coarser way to reflect overall performance of an individual, it allows quick

identification of the proportion of people performing in the impaired range. The number (and percentages) of participants in the early AD group whose performance falls into different clinical categories is presented in table 4a.

Four people (22.2 %) in the early AD group still performed at least in the low average range, whereas over half showed performance in the clinically impaired range, whilst the remaining four participants showed intermediate performance. However, six of the eight individuals with average to borderline performance on executive functioning had estimated premorbid IQ scores that were substantially higher (1.5 SD or more) than their performance scores on the BADS, suggesting impairment in executive functioning for these individuals as well, whilst this decline was less for one of the remaining two participants, and only one participant achieved a borderline score on both executive functioning and estimated premorbid IQ.

Table 4b shows the distribution of profile scores on the individual subtests. Although there is no a-priori classification of performance on individual subtests, a score of “3” or “4” can be assumed to indicate that the task has been passed or only small deficits have been observed, whereas a score of “0” or “1” can be assumed to signify significant difficulties, whilst in-between performances (a score of “2”) are less readily interpretable. Using this division, the task that was passed by the highest percentage of participants was the Rule Shift Cards test (38.9%), whereas none of the AD participants passed either the Zoo Map or the Modified Six Elements test. The Zoo Map test was almost universally failed (94.5%), whereas the lowest failure rate occurred on the Temporal Judgment test (38.9%), a task on which the majority of individuals showed intermediate performance.

4.4.2.2 Control of confounding variables

Although decline in executive functioning could be observed, it was possible that the impact of other variables, such as memory impairment, could account for this. To explore which variables had a significant impact on observed scores, regression analysis using a stepwise method of entering variables was used (reported in greater

Table 4a: Classification categories of performance on the BADS

	MCI (N = 19)	Early AD (N = 18)
impaired	7 (36.8%)	10 (55.6%)
borderline	3 (15.8%)	4 (22.2%)
low average	1 (5.3%)	3 (16.7%)
average	7 (36.8%)	1 (5.6%)
high average	1 (5.3%)	0 (0%)

Table 4b: Score distribution for each subtest in the early AD group

	4	3	2	1	0
Rule Shift Cards	3 (16.7%)	4 (22.2%)	1 (5.6%)	7 (38.9%)	3 (16.7%)
Action Program	0 (0.0%)	4 (22.2%)	2 (11.1%)	6 (33.3%)	6 (33.3%)
Key Search	1 (5.6%)	3 (16.7%)	4 (22.2%)	4 (22.2%)	6 (33.3%)
Temporal Judgment	0 (0.0%)	1 (5.6%)	10 (55.6%)	4 (22.2%)	3 (16.7%)
Zoo Map	0 (0.0%)	0 (0.0%)	1 (5.6%)	3 (16.7%)	14 (77.8%)
Mod. Six Elements	0 (0.0%)	0 (0.0%)	9 (60.0%)	5 (33.3%)	1 (6.7%)

Table 4c: Score distribution for each subtest in the MCI group

	4	3	2	1	0
Rule Shift Cards	5 (26.3%)	5 (26.3%)	2 (10.5%)	5 (26.3%)	2 (10.5%)
Action Program	7 (36.8%)	8 (42.1%)	2 (10.5%)	1 (5.3%)	1 (5.3%)
Key Search	4 (21.1%)	5 (26.3%)	1 (5.3%)	5 (26.3%)	4 (21.1%)
Temporal Judgment	0 (0.0%)	6 (31.6%)	8 (42.1%)	5 (26.3%)	0 (0.0%)
Zoo Map	0 (0.0%)	2 (10.5%)	4 (21.1%)	7 (36.8%)	6 (31.6%)
Mod. Six Elements	2 (11.8%)	7 (41.2%)	4 (23.5%)	3 (17.6%)	1 (5.9%)

detail in appendix E ii). Scores relating to memory function, premorbid functioning, MMSE, and depression, as well as age of participant were entered to predict BADS total scores and subtest scores.

The models for the BADS total scores, Key Search, Temporal Judgment and Modified Six Elements subtests became significant, with 'age' being a significant predictor for all models. The model for the modified six elements test revealed further significant contributions from recognition memory and estimated premorbid level of functioning. To control for the influence of 'age' on executive function scores, scores corrected for 'age' were calculated for each participant (for detailed procedure see appendix E ii).

Descriptive statistics of corrected scores are reported in table 3: as would be expected, this reduced the standard deviation of scores, however, it did not have any significant impact on whether scores fell into the impaired range. Where differences to the standardisation sample had existed, these became more apparent. Scores were not corrected for other covariates. It does warrant further discussion that 'age' still made a significant contribution to BADS total scores, despite prior age-correction of these, in line with procedures described in the manual.

4.4.3 Research Question 2

The second research question addresses whether there is evidence of executive function deficits in Mild Cognitive Impairment, and if so, whether there is a pattern of impairment across the subtests. This question was addressed in a parallel way to question 1.

Compared to standard scores (Wilson et al., 1996) a mean total score of 82.45 on the BADS for the MCI group falls more than one standard deviation below the population mean (see table 3). Results of a one sample t-test against a test value of 100 were significant ($t(18) = -3.91$, $p = 0.001$, Cohen's $D: -1.01$). This means the MCI group showed significantly reduced performance on executive functioning compared to expected performance in the normal older adult population, although, clinically, the performance level still falls at the lower end of the low average range.

Comparison of subtest scores against mean scores of the Wilson et al. total sample (table 4) provided a more varied picture. As mentioned in the previous section, results

have to be interpreted with caution. The MCI group performed at similar level to the standardisation sample on the Key Search and Temporal Judgement tests (overlapping confidence intervals), hence were not noticeably impaired on these subtests. Although the MCI group performed less well on the Action Program subtest than the standardisation sample (around 1.5 SD below the mean of the normative group), the mean performance scores on this subtest was highest compared to those on other subtests. However, the MCI group performed poorer on the Rule Shift Cards test, on which a number of people failed to shift rules and hence made a large number of errors, as well as on the Modified Six elements test (performance on both subtests around 1.5 SD below the standardisation sample; confidence intervals not overlapping). The MCI group achieved their lowest mean on the Zoo Map Test (confidence intervals not overlapping). Although this mean score fell only around 1 SD below that of the normative sample, many participants in the MCI group performed quite poorly. In summary, reduced performance on four out of six individual subtests could also be observed for the MCI group, although decline was milder at around 1 to 1.5 SD below the population norm

Next, the proportion of individuals whose performance fell into different clinical classification ranges was inspected (table 4a). Although MCI group mean scores on the BADS would suggest that this group shows mild decline in executive functioning, examination of broad performance categories paints a different picture: Nearly half (47.4%) of all participants in this group showed unimpaired performance (“low average” or better), although level of premorbid functioning still needs to be taken into account. At the same time, just over a third showed performance in the clinically impaired range, whereas actually mildly impaired performances (“borderline”) were rare.

Table 4c shows the distribution of profile scores on the individual subtests. As for the early AD group, scores of “3” or “4” were assumed to indicate unimpaired performance, whereas scores of “0” or “1” were assumed to signify significant difficulties with a task. The task that was passed by highest percentage of participants was the Action Program test (78.9%), and pass rates for the Rule Shift

Cards, Key Search, and Modified Six Elements were at least comparable to rates of unimpaired performance on total scores. However, twice as many people failed the Key Search test than failed the Modified Six Elements test (with the Rule Shift Cards falling between the two). Responses on the Temporal Judgment task clustered around intermediate performances. The highest fail rate occurred on the Zoo Map test (68.4%), and even those people who passed the test had some deduction on scores. This means that even people whose overall performance was average seemed to find this task difficult, and it is important to ask, if other factors, such as memory, played a role.

4.4.3.2 Control of confounding variables

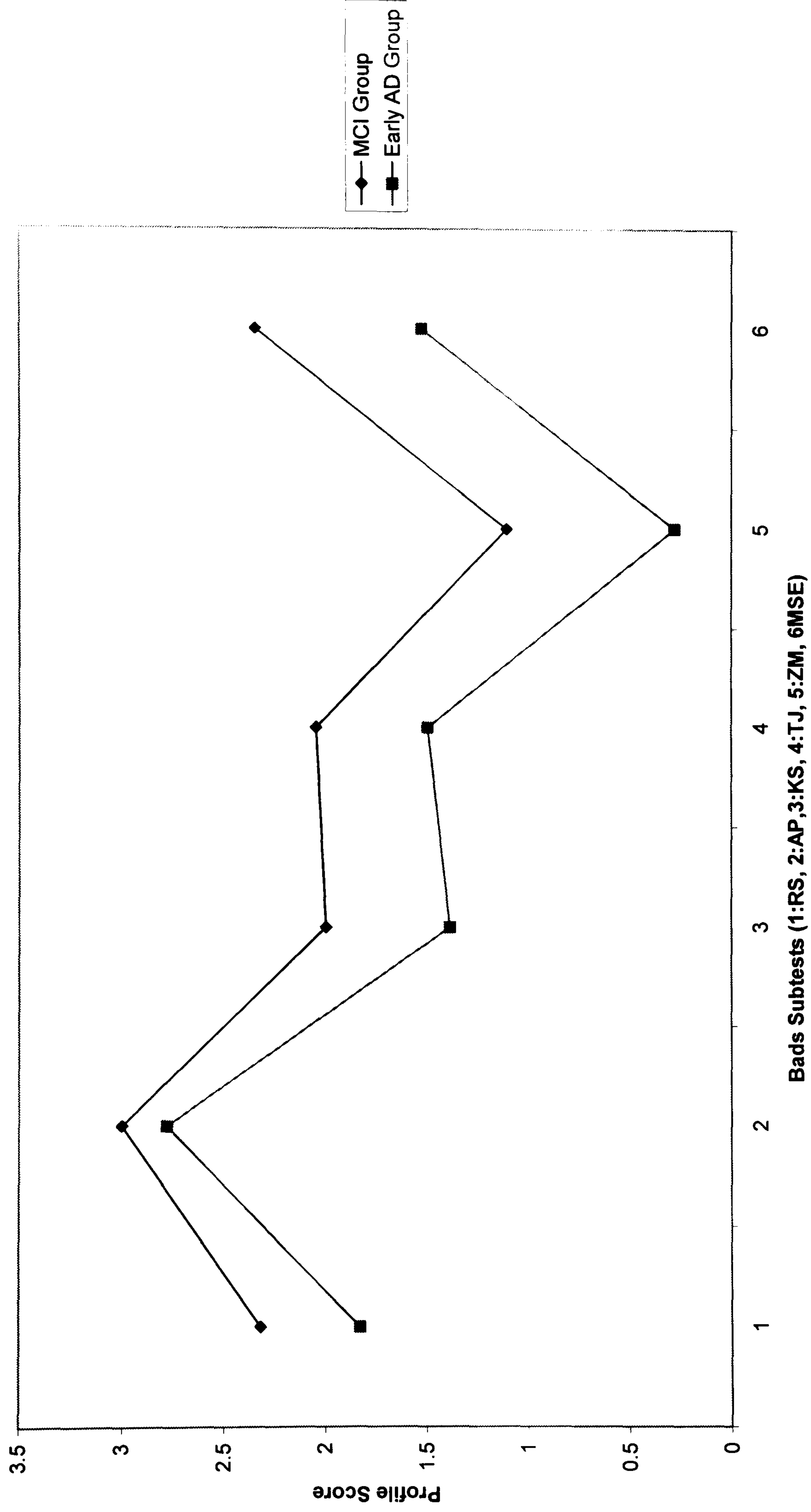
A procedure analogous to that described in 4.3.2.2 was followed for estimating the influence of any covariate on the dependent variable in the MCI group. A regression model for BADS total scores became significant, with ‘age’, ‘premorbid IQ’ (WTAR scores) and ‘recognition memory’ scores as significant predictors (see appendix E ii). Only two of the subtest models became significant: the model for Rule Shift cards showed that ‘premorbid IQ’ scores made a significant contribution, whereas the model for the Zoo Map subtest had ‘age’ and ‘recognition memory’ as significant predictors.

Subsequently, scores were adjusted for ‘age’ for all subtests and descriptive statistics for adjusted scores are reported in table 4. Again, this had no observable effect on whether performance scores could be identified as impaired compared to the normative sample or not. It can therefore be concluded that this confounding variable could not fully explain the observed decline in scores on executive function tests.

4.4.4 Research Question 3

Research question 3 undertakes to make a comparison between the patterns of performance on the BADS for the MCI and early AD groups, to explore similarities and differences between the two clinical presentations. Figure 5 graphically depicts patterns of mean scores on the different subtests for both groups. Visual inspection shows similar patterns of performance across subtests. To support this

Figure 5: BADS subtest group profiles



Note: BADS subtests: 1 Rule shift cards (RS); 2 Action Program (AP); 3 Key search (KS); 4 Temporal judgement (TJ); 5 Zoo Map Test (ZM), 6 Modified Six Elements test (MSE).

observation statistically, a repeated measures ‘subtest’ by ‘group’ 6 x 2 ANOVA was calculated, with the expectation that there would be no significant interaction between ‘group’ and ‘BADS subtest’, i.e. the interaction term would not become significant, if performance patterns in the two groups were indeed similar. Results of this analysis are presented in table 5.

Table 5: 6 x 2 (‘subtest’ by ‘group’) ANOVA

	Sum of Squares	df	Mean Square	F-value	P-value	Partial η^2	Observed Power
BADS_subtests	92.48	3.70*	18.50	17.79	<0.001	0.37	1.00
Interaction	3.77	3.70*	1.02	0.73	0.57	0.02	0.22
Error	155.94	111.02	1.41				
Group	15.00	1	15.00	7.62	0.01	0.20	0.76
Error	59.08	30	1.97				

*Greenhouse-Geisser (sphericity not assumed); power at $\alpha = 0.05$

The interaction term did not become significant, however, significant main effects were observed for ‘BADS subtest’ and for ‘group’. Average scores of the two groups differed significantly (main effect for ‘group’: higher mean scores for MCI), and for both groups mean scores across the different BADS subtests differed significantly at least on some subtests, whilst there was no significant difference in the pattern in which the two groups performed across the different subtests. Sensitivity testing based on the multivariate test concurred with this result.

Inspected in closer detail, the combination of similar patterns of performance, but lesser degree of impairment in the MCI group turns out as follows (t-test results reported in table 3): On three subtests, differences between the two groups were not large enough to become statistically significant: the Rule Shift Cards, Action Program and Key Search subtests. Furthermore, across both groups scores on the Rule Shift Cards subtest looked bi-modally distributed (graph not provided). Both groups achieved their highest mean scores on the Action Program subtest. By contrast, although group differences on the Key Search test were not large enough to

become significant, the MCI group actually performed at similar levels to the standardisation sample (Wilson et al., 1996) whereas the early AD group performed at a significantly lower level than the normative sample.

The MCI group also performed at a similar level to the normative sample on the Key Search test, whereas the early AD performed poorer. For this subtest the difference between the groups was significant. Group differences were also significant on the Zoo Map test and the Modified Six Elements test, on which both groups had performed below the normative sample, with both groups obtaining lowest scores on the Zoo Map test.

4.4.5 Research question 4

The possibility had been anticipated that different subtests might have differential ability to detect impairment in the two groups (research question 4), as there might be differences in the level of difficulty between the subtests. This is closely related to outcomes reported in the previous sections, but also to validity aspects of tests. Hence the different tests are appraised in a more qualitative and holistic fashion.

Table 6: Pearson correlations between BADS total scores and subtest scores

	RS (N = 37)	AP (N = 37)	KS (N = 37)	TJ (N = 37)	ZM (N = 37)	MSE^o (N = 32)
BADS total profile score	0.57** < 0.001	0.59** < 0.001	0.72** < 0.001	0.50** 0.002	0.64** < 0.001	0.61** < 0.001
Rule Shift Cards (RS)		0.27 0.11	0.26 0.12	0.02 0.93	0.30 0.07	-0.14 0.46
Action Program (AP)			0.24 0.16	0.06 0.72	0.24 0.15	0.16 0.37
Key Search (KS)				0.36* 0.03	0.23 0.17	0.37* 0.04
Temporal Judgement (TJ)					0.24 0.16	0.40* 0.02
Zoo Map (ZM)						0.51** 0.003

^o Modified Six Elements test

Pearson correlations between subtest scores and between each subtest and total scores are also reported here (table 6; Spearman correlations produced similar results). All subtests correlated moderately high with the BADS total scores, but only few subtests correlated modestly, but significantly with each other.

Although both groups showed reduced performance on the Rule Shift Cards test, the bimodal distribution of scores indicates that this test is sensitive to perseveration, but not to mild decline in executive functioning, as people either managed or failed to shift rules. If the person has managed to shift rules, an error score of one or two cannot be interpreted as indicative of executive function difficulties, but failure in attention or concentration. Time penalties, which would be more indicative of mild executive function difficulties, were rare and occurred in people who failed to shift rules, too.

Reduced performance on the Action Program test was comparatively mild in both groups, and approximately one third of participants performed this problem solving task completely independently. Only some of the most impaired participants failed this test. Qualitative differences in the way people approached this task are reported in the critical review paper.

As reported above, differences between the MCI group and the standardisation sample on the Key Search and Temporal Judgement tests were too small to assume significance, although they might have been, if a more direct comparison had been possible. By contrast, performance levels of the early AD group were reduced. The Temporal Judgement test generally seemed a poor test to make predictions from an individual's score, as median performance on this test was two of four items answered correctly, and individual differences from this score are difficult to interpret. By contrast, greater variability in performance could be observed on the Key Search test, especially in raw scores, and this subtest was most highly correlated with BADS total scores. Hence this test seemed sensitive to different degrees of decline in executive functioning and was not too difficult for the early AD group to complete.

The Zoo Map Test and Modified Six Elements test seemed sensitive to decline in executive functioning in both groups. However, a floor effect on the Zoo Map test for the early AD group makes this test redundant for this group. By contrast, many people in the MCI group seemed to do poorly in the unstructured part one of the test, but improved their performance on the highly structured part two of the test. This observation is relevant to clinical rehabilitation, and the possibility to quantify this observation will be explored, but cannot be covered within the limits of this thesis. Many participants from both groups had difficulties understanding the instructions for the Modified Six Elements test sufficiently, which impacts on the validity of test performance scores reflecting executive functioning rather than other factors. This issue is discussed in greater detail in the discussion chapter.

5. Discussion

This study was designed to investigate further the question of executive functioning in Mild Cognitive Impairment and early Alzheimer's disease and consider clinical implications of findings. Mild Cognitive Impairment is considered a risk factor for Alzheimer's disease. Whilst executive functioning has been relatively well researched in early AD, only little is known about planning, organising, and novel problem solving as specific aspects of executive functioning. By contrast, very little is known about executive functioning in MCI in general, although initial research suggests that some decline in executive functioning can be observed. A battery of executive function tasks was employed (the Behavioural Assessment of the Dysexecutive Syndrome (BADS), Wilson et al., 1996) to explore presence and degree of decline, as well as performance patterns in the two groups. As would be expected, total scores on the BADS were more sensitive to individual differences in level of executive functioning than subtest scores. On total scores, both groups showed decline, the MCI and early AD groups differed in degree of decline, but patterns of performance across subtests were similar in both groups. Although 'age' of a participant had an impact on executive functioning scores, this variable did not explain the observed effects, which held after statistical control for age. Each result will be discussed in turn, as well as their general theoretical context, clinical implications, and limitations of the research.

5.1 Executive function impairment in early Alzheimer's disease

5.1.1 Level of decline on BADS total scores

For the early Alzheimer's group average performance scores fell more than two standard deviations below the normal population mean (Wilson et al., 1996). This indicates a notable decline and places group performance in the clinically impaired range. Performance scores significantly below those found for control subjects of similar age concurs with findings of previous studies (e.g. Lafleche et al., 1995; Collette et al., 1999). Magnitude of decline is difficult to compare directly across different studies (cp. Patterson et al., 1996), but some studies have also reported considerable decline (Crowell et al., 2002; Nagahama et al., 2003).

However, at this early stage of the disease process, executive dysfunction was not yet ubiquitous: 22.3% of people in the early AD group still performed at least in the low average range, although performance of 55.6% of participants with early dementia looked clinically impaired. Whereas overlap between AD patients and non-clinical groups has been commonly observed, and an estimate of 22% of participants performing in the average to low average range is compatible with data reviewed by Patterson et al. (1996), the majority of these latter participants in the current study could still be considered as showing decline in executive functioning. Compared to their expected level of functioning, based on estimated premorbid abilities, their executive function score fell around one standard deviation or more below their estimated IQ. It is not clear to what extent the research reported by Patterson has taken the participants' level of premorbid functioning into account, which may moderate clinical judgments in the assessment of individuals.

5.1.2 Level of decline on subtests

The early AD group also performed considerably below published mean scores on all subtests, although it needs to be considered that here the normative data reflects average performance across the whole adult age range rather than a restricted older adult age range. Age-related decline on executive function tests has been reported (cp. Bryan and Luszcz, 2000), but this remains mild. By contrast, many of the average subtest performances of the early AD group fell around two standard deviations below normative values, a decline that can be interpreted as clinically significant and extending decline expected for age alone. Decline across the different subtests concurs with previous research (Lafleche et al., 1995; Collette et al., 1999; Crowell et al., 2002; Nagahama et al., 2003), which reports decline across a range of executive function tests in people with early AD, but extends previous research by indicating difficulties with planning and organising. These aspects of executive functioning have been less well researched previously, although several authors suggest difficulties with strategy development and sequencing exist (e.g. Lafleche et al., 1995; Collette et al., 1999).

5.1.3 Stability of results after controlling for confounding variables

Once effects of 'age' as a confounding variable were controlled for, observed level of impairment on the different tasks and total scores remained unchanged, i.e. although 'age' had had a significant effect on performance scores on the BADS, this did not account for the observed decline in executive functioning in this group. The occurrence of an age effect on scores had already been age-corrected in line with effects found for the normative sample will be discussed in greater detail in section 5.6.

5.2 Executive function in Mild Cognitive Impairment

5.2.1 Level of decline on BADS total scores

For the MCI group average performance scores on a battery of executive function tasks fell just over one standard deviation below published general population norms (Wilson et al. 1996; i.e. below scores expected for age-matched peers without cognitive decline). Whereas this difference seems particularly noteworthy in the context of somewhat elevated levels of estimated premorbid intelligence in this group, it should also be borne in mind that the mean performance score still fell within the low average range rather than the clinically impaired range.

Average performance scores of the MCI group also fell between scores observed for people with AD and those expected for the normal older adult population, and this concurs with results from previous studies (Ready et al., 2003; review paper by Collie & Maruff, 2000). However, looking at the distribution of scores across individuals a different picture emerges.

Even mild decline was not ubiquitous, as the majority of people (47.4%) still achieved a score at least in the low average range. At the same time, a considerable minority of participants (36.8%) performed in the clinically impaired range on executive functioning tasks. Although this latter group of participants included a few people whose presentation indicated non-memory MCI and/or who had experienced a mild stroke, these variations in clinical presentation did not account for all MCI participants whose performance fell into the impaired range. This raises questions,

especially whether these individuals should be considered to have made the transition to dementia. This could not be completely excluded in the present study, but would have indicated a higher conversion rate in this group than would be expected (compare Petersen, 2003). The above result points to heterogeneity of decline in executive function in the MCI group. It would be a question of future research to determine whether differences in executive function could be useful to help differentiate between members of a group that is seen as heterogeneous, for example, if people with MCI showing mild executive difficulties progress differently over time than those without.

5.2.2 Differences in results on subtest scores compared to total scores

On a number of subtests the MCI group also performed below published mean scores (Wilson et al. 1996), although, the difference in age range of the normative sample again needs to be considered. However, average performance scores on the Key Search and Temporal Judgment subtests did not fall outside the expected performance range for adult controls. Hence, the MCI group did not seem to show decline on all tasks of executive function.

Research with cognitive estimate tests such as the temporal judgment test has led to mixed results in the past (Collie and Maruff, 2000; Nathan et al. 2001), and their usefulness as tests of executive function has been queried. The Key Search test has at least good face validity and ecological validity as a test requiring planning and executive control. Future inclusion of an appropriate control group could shed more light on whether the MCI group would still have been mildly impaired on this latter task. Alternatively, as this task closely mirrors everyday experience of losing objects, search strategies might be more practiced than other aspects of executive functioning. The question, if practice of executive skills has an impact on level of executive functioning is an interesting research question in itself.

The MCI group achieved their lowest mean score on the Zoo Map Test. Although this mean score fell only around 1 SD below that of the normative sample, this is partly related to a relative low mean score in the standardisation sample. Many

participants in the MCI group performed poorly on this test and multiple rule breaks were almost ubiquitous. In summary, reduced performance on four out of six individual subtests could also be observed for the MCI group. At around one to 1.5 SD below scores of the standardisation sample, decline was milder than in the early AD group, yet greater than authors such as Petersen (2003) would expect, and likewise somewhat greater than expected age-related decline alone.

5.2.3 Stability of results after controlling for confounding variables

As was the case for the early AD group, once effects of ‘age’ as a confounding variable were controlled for, differences in level of performance in the MCI group compared to the standardisation sample remained unchanged, i.e. ‘age’ effects did not fully explain the decline in executive functioning observed on total scores and several of the subtest scores.

5.3 Implications for test performance of individuals

As there is overlap between the two groups in the performances shown by individuals, mean group scores can only be used cautiously in clinical practice, when a patient is referred for assessment with a query of dementia. Although group mean scores in the MCI group would suggest that people function at ‘low average’ to ‘borderline’ levels, individual performance scores in this range were actually less frequently observed than either unimpaired or clinically significantly impaired performance. Whereas unimpaired performance on tasks of executive functioning concurs with expectations based on the clinical description of MCI, observation of clinically significant impairment in individuals from this group raises questions.

In as much as people with impaired executive functioning also had impaired memory, it could be argued that these participants would no longer meet criteria for MCI, but on clinical review might meet criteria for dementia. As participants had their last clinical review up to six months prior to the start of recruitment and assessments took place over a period of months, the possibility could not be excluded that a few people had deteriorated since they had last been seen at the

memory clinic, although numbers showing impaired performance exceeded numbers expected to make the transition to dementia over the time frame of the study.

Alternative explanations also have validity: Two people were impaired on executive functioning, but performed in the low average to average range on the memory test, thus seemed to fit criteria for single non-memory domain MCI better. As participants were selected on the basis of 'naturalistic' clinical diagnoses made by psychiatrists, this might have made the MCI group less homogenous than wanted, for example a couple of people also later reported mild strokes, which might have had an impact on their neuropsychological performance patterns. Thirdly, some participants from the MCI group with impaired performance on executive function tasks were aged 80 or older. Age played a role in executive functioning in this sample, and generally, decline in executive functioning can be observed particularly in very high age (Bryan & Luszcz, 2000). Additionally, people over 80 may have been overrepresented in the current sample compared to the standardisation sample, and hence the standard age-correction of the BADS may not have worked well enough here. Issues arising from differences in diagnostic practice, average performance scores on a memory task for some participants, and occurrence of an age effect are all discussed in greater detail below.

5.4 Performance patterns on tasks of executive function

Whilst the early AD group performed less well on all subtests, performance patterns across the different subtests of the BADS were similar in both the MCI and the early AD group. No significant interaction between BADS 'subtest' and 'group' status had been observed. Both groups achieved highest mean scores on the Action Program subtest whilst performing worst on the Zoo Map test, and performance on both these subtests also differed significantly from the Key Search test as a task of intermediate difficulty.

This result also fits well with existing literature. Crowell et al. (2002) looked more broadly at patterns of test performance across different cognitive abilities and found these to be similar for their MCI and mild AD groups. Mean subtest scores reported

by Ready et al. (2003) further suggested that performance patterns across different aspects of executive function could be expected to be similar for both groups. However, both the current study and the Crowell et al. (2002) results found differences in level of performance along with similar performance patterns, unlike the Ready et al. (2003) study. Nagahama et al. (2003) also found significant differences between their MCI and AD groups. Hence it does not seem justified to agree with the conclusion of Ready and colleagues that there are no differences between the groups. However, their study differed from other research by using informant ratings of executive function rather than psychometric test data.

Considering the above result together with results regarding performance categories (classifications), similar performance patterns seem to have arisen from a number of people showing significantly impaired performance whilst others remained unimpaired, rather than from a majority in each group showing milder impairment.

At subtest level, the MCI group performed significantly better than the early AD group on the Zoo Map and Modified Six Elements subtests. A trend in the same direction could also be observed for the Temporal Judgment subtest, whereas both groups did not differ significantly on the Rule Shift Cards, Action Program and Key Search subtests. Hence, overall group differences were not as pronounced on individual subtests as had been observed for total scores. Therefore total scores seemed to provide a more sensitive measure of executive function than the individual subtests.

5.5 Discriminative power of subtests

Because of the potentially different levels of difficulty of the BADS subtests it was assumed that different subtests may be better at detecting impairment in the two groups. Sections 5.1 and 5.2 reported how scores compared to published mean scores. This section tries to elaborate further what the implication of these comparisons might be for detecting impairment in the two clinical groups.

Although average scores in the Action Program subtest were slightly lower than scores of the standardisation sample, it seemed a relatively poor test to detect impairment in either the MCI or early AD group, as a number of people in both groups completed this task independently or with only limited help. Average scores on the Rule Shift Card test were considerably lowered in both groups, but performance on this test was only moderately correlated to overall test performance. Individuals from both groups either tended to make few, if any errors or failed to shift rules and hence maximised the error score. Although more people in the AD group fell into this latter category, a third of people with AD still achieved profile scores of '3' or higher on this task, hence some individuals still passed this task who overall showed noticeable impairment in executive function. This reflects a common problem in the assessment of executive functioning, i.e. that a number of people who have executive functioning difficulties still pass individual executive function tests (Burgess, 1997).

The Temporal Judgment and Key Search subtests were sensitive to detecting impairment in the early AD group, whereas the MCI group continued to show relatively unimpaired performance on these tasks. However, it is noteworthy that for the total sample the Key Search Test correlated most highly with the BADS total scores, hence people who performed poorly on this task were also likely to show impaired performance on the whole battery, irrespective of group status.

Both groups scored worst on the Zoo Map Test, with a floor effect occurring for the early AD group. Performance on this task might be affected even by mild impairment. Mean score differences compared to the Wilson et al. (1996) group were greatest on this subtest. However, a task that leads to a floor effect, for a group known to show global cognitive decline, does add little information for this group other than reflecting that participants might have felt overtaxed by this task.

The Modified Six Elements task also seemed sensitive to mild impairment, but, as for the Zoo Map Test, many participants seemed overtaxed with the task, especially with the amount of instructions that needed to be processed. A number of people

attempted this task despite stating they did not fully understand the instructions, which had been presented repeatedly. Whereas this might be clinical information in its own right about the person's capacity to process information, it reduces the value of this task as an assessment of executive function. The current study did not include a separate measure that allowed estimating a person's processing capacity (such as a working memory measure). However, performance on the immediate recall task did not seem to make a significant contribution to predicting performance on this executive function subtest. According to Morris (1997b) this task is of particular interest to executive function research due to its dual task demands. He argues that performance on tasks that require dual tasking is not linked to the frontal lobes, but that such tasks are particularly sensitive to impairment in dementia. Whereas the early AD group did perform poorly on this task, they also performed as poorly on a range of other subtests.

5.6 Interpretation of age effects

5.6.1 Impact of age as a covariate

Age explained a significant amount of the variance of the BADS total scores as well as variance on some of the subtest scores (regression models significant for Key Search, Temporal Judgement, and Modified Six Elements in the AD group, and for Zoo Map in the MCI group). It was therefore considered important to control further for the effect of 'age'. However, results after additional age-adjustment of scores indicated that differences between each group and the normative sample could not be accounted for by differences in the age of participants alone.

5.6.2 'Age' effects and other confounders in previous research on executive functioning in MCI and AD

'Age' effects were only considered separately in some studies investigating executive function in Alzheimer's disease, Mild Cognitive Impairment or groups selected on the basis of related concepts (Nagahama et al., 2003), but not others (e.g. Ready et al., 2003, Crowell et al., 2002). In contrast to the present research, Nagahama et al. (2003) only found a positive correlation between 'age' and perseverative errors on the modified Wisconsin Card Sorting Test (mWCST) in their

control group, but not in the MCI and AD groups. However, based on the pattern of performance of the MCI group and correlations with other measures, these authors also suggest that the poor performance of the MCI group on the mWCST was due to a combination of memory and executive function deficits, especially a reduced ability to encode and integrate new information into working memory. Hänninen et al. (1997) adjusted for both age and education and still found significant differences on most measures of executive function between their AAMI group and control participant.

Previous research has nevertheless considered other control variables, which were not assessed for the present sample (specifically processing speed). Both Nagahama and colleagues (2003) and Hänninen et al. (1997) found significant correlations between memory tests and tests of executive function. However, Hänninen and colleagues also reported higher depression scores for their AAMI group, but failed to report whether these had an impact on cognitive function. Neither Ready et al. (2003) nor Crowell et al. (2002) reported any associations between their measures of executive function and other cognitive variables or age, though Crowell and colleagues made an attempt to control for processing speed and Ready et al. attempted to separate apathy from depression.

Studies with early AD patients have lead to similar results: Lafleche et al. (1995) found that significant decline in executive function remained after they controlled for memory, and their AD group had not differed significantly from controls on an attentional task. However, Lafleche and colleagues also noted that performance on executive function tasks is not impaired uniformly: They concluded that the primary difficulty of AD patients could be observed on executive function tasks that required concurrent manipulation of information. Concurrent manipulation of information is a function that has been linked to the central executive component of Baddeley & Hitch's Working Memory Model (1974, 1986). As in Lafleche et al.'s study, performance on executive function tasks was not impaired uniformly across tasks, nor did all participants show impairment in the current study. Collette et al. (1999) included a working memory task as well as a dual task paradigm as part of their

executive function ‘battery’. After controlling for processing speed, they found AD patients presented with lower performance compared to controls in all executive function tasks. Based on results from factor analysis they suggested that observed deficits can be related to two domains of executive functions: firstly the inhibition abilities, and secondly the capacity to coordinate simultaneously the storage and processing of information, the latter again a process linked to the working memory model.

5.6.3 Interpretation of age effects

The occurrence of an age effect in a rather selected sample of older adults is puzzling. A restricted age range for the sample (70 to 92) and effects of known cognitive decline should have minimised the chance of any age effect occurring. A potential reason for finding age effects in the present sample in contrast to previous research might be that assessment instruments used by other researchers might have been better age-standardised than the BADS appeared to be. In the present study, measures which had more finely graded age-standardised norms, such as Verbal Paired Associates and the WTAR (Wechsler Test of Adult Reading), did not correlate with age, in contrast to BADS scores. Whilst the BADS might be criticised for providing norms for very broad age bands, i.e. providing only one comparison for all people over the age of 65, it would be prudent to assume that age adjustments made by the authors were reflecting a probably smaller degree of decline found for their group of normal controls rather than the age effect observed for the present sample. Reasons for this may of course lie in part in a different age distribution such that the current sample might have a higher proportion of people aged 80 and older, which might not have been as well represented in Wilson et al. (1996). Although the current study could be criticised for using the BADS with two people in the early AD group who were over the age limit for which the test battery had been validated, separate regression equations for age effects in executive functioning in both groups were very similar (see appendix E ii) and all people in the MCI group fell within the age range for which the test has been normed.

5.6.4 Questions raised by age effects

Effects of 'age' have been considered in numerous studies investigating cognitive changes in the normal control older adult population (Craik & Grady, 2002; Park, 2000; Morris, 1997), including research on changes in executive functioning. If Piguet et al.'s (2002) tenet is accepted that 'age' in itself is not an explanatory variable for cognitive decline, but instead mediates the impact of neurodegenerative processes associated with age this creates difficulties for the interpretation of results.

The current sample was drawn from a clinical population and had been classified into two groups according to the level of their impairment. Neuro-degenerative processes (occurring with age) are thought to underlie the cognitive difficulties in Alzheimer's disease. In as much as Mild Cognitive Impairment can be considered as a preclinical stage of dementia (as for example postulated by Petersen, 2000, 2003), the same degenerative processes would be expected to underlie the early stage of decline. As AD is thought to be the more advanced stage of the disease process, degenerative decline would be expected to be greater in this group. Yet despite this assumed homogeneity within groups and neuro-degenerative processes being seen as underlying cognitive difficulties in the groups, age continued to account for a significant amount of variance on tasks of executive function. There is considerable overlap between age-related neurodegenerative changes and neuropathology in Alzheimer Disease (Morris, 1996), and the question would be if age-related brain changes and dementia related brain changes might compound each other.

Aging processes affect particularly the frontal region of the brain (Piguet et al., 2002), whereas neuro-pathological changes in AD affect both frontal and parietal association areas of the brain, as well as the association areas of the brain concerned with the high-level multimodal integration of information (Morris, 1997; Perry & Hodges, 1999) and "the pathways linking the neural substrate of memory to the rest of cortical processing" (Morris, 1996). Hence, greater executive function deficits would be expected both with increasing age and with increasing neuropathological changes associated with AD affecting the (pre-) frontal cortex. If degenerative processes start to accelerate or compound age-related changes, i.e. weaken non-

optimal functioning further, greatest severity of dysexecutive problems should be expected, i.e. poorer functioning would be observed in very old people in whom degenerative changes have started. Another way of thinking about this would be that age-related brain changes lower the threshold for further neurodegenerative changes to cause functional impairment. However, this would also imply that the threshold for being diagnosed with dementia might be lowered with increasing age, as early memory problems in AD might be quickly followed by executive function difficulties resulting from aging alone or from accelerated neurodegenerative changes bringing the level of decline above 'threshold'. These would be questions for future research. It is noteworthy that 'age' remains the greatest risk factor for dementia in the normal older adult population (Petersen, 2000).

5.7 Issues relating to the diagnosis of MCI and AD

5.7.1 Age and diagnosis of dementia

'Age' has been cited as the greatest risk factor for dementia in the normal older adult population (Petersen, 2000). Research into cognitive aging has been criticised for failing to take into account variables that are implicated in the development of neurodegenerative disorder (Piguet et al., 2002; Ritchie et. al, 2001). Thus some researchers argue that a large portion of cognitive decline with age can in fact be explained by the presence of pathological processes rather than resulting from 'normal' aging (Piguet et al., 2002).

Decline in executive functioning can be expected with increasing age (Craik & Grady, 2002; Park, 2000; Piguet et al., 2002; Morris, 1997). The question arises, if a person who is very old and shows a considerable degree of 'normal' decline in executive functioning and then starts to develop memory problems would receive a diagnosis of dementia more quickly than a younger person, in whom 'normal' decline in executive functioning might be somewhat lesser, and who might therefore be diagnosed as MCI. Another interesting question would be, if a person over the age of 80 or 85 who is diagnosed with mild cognitive impairment will be more similar in presentation to a younger person with MCI or perhaps a younger person with dementia, if performance on tasks is not age-corrected.

Clinical diagnosis is not a process that is as exact as diagnostic textbooks (DSM IV, ICD-10) would have us believe, but relies to a degree on clinical judgment. There are always people who do not fit diagnostic categories exactly, do not progress as expected, or for whom other factors, such as physical health, have to be taken into account, hence 'grey areas' and areas of overlap remain in clinical diagnosis. Although only current diagnosis was recorded for participants, not the history of their diagnosis, it was coincidentally noted that three people (from two different centres) had their diagnosis reverted from probable/possible Alzheimer Disease to MCI. As MCI is not a universally accepted diagnosis, this might just reflect a change in individual clinical practice with regard to diagnosing patients. For example, a person might have been diagnosed as 'possible AD' in the past, but might be more likely diagnosed as 'MCI' once this diagnosis started to be used at a clinic. Hence, it might be possible for diagnosis to change in the light of new clinical information but also in response to finer differentiation within and between diagnoses.

5.7.2 Diagnostic issues in relation to the MCI diagnosis

Diagnostic uncertainties also arise with regard to mild cognitive impairment, both general issues and specific problems in the group studied. Some authors (Bischkopf et al., 2002; Collie and Maruff, 2002; Petersen, 2003) might be inclined to criticize that those people in the MCI group whose performance on executive function tasks was falling in the impaired range would no longer meet criteria for MCI.

On the other hand, it might reflect differences between the use of 'mild cognitive impairment' in clinical practice compared to possibly more stringent criteria used in major clinical trials. Although it was attempted to comply with Petersen criteria (1999) as far as possible, this was not entirely under the control of the main researcher, as selection had to be based on diagnoses made by clinicians at the different clinics. An example where clinical judgments might differ from operational and quantified criteria is the following: A diagnosis of dementia requires that activities of daily living are affected by cognitive decline, and clinicians might be disinclined to diagnose dementia whilst the person reportedly still manages their

everyday activities reasonably well, even if the person might show cognitive decline on psychometric tests in more than one domain. Failure on cognitive tests with retained function in familiar surroundings is not uncommon (Snowdon, 1997).

The finding of mild executive difficulties in a condition that is thought to be a harbinger of dementia might also reflect a general diagnostic difficulty: With a disease process that usually has an insidious onset and progresses often relatively slowly, it is difficult to set an exact cut-off point between the preclinical and clinical stage and people who fall into this 'grey area' of overlap might be particularly difficult to classify.

The use of clinically made diagnoses compared to consensus agreements between a group of researchers can be seen as both a weakness and strength of the current project. It might have weakened the internal validity of the study, although the risk would have been that the MCI group is more heterogeneous than intended, which would have the effect of decreasing differences between the MCI group and the normal adult population, hence should have decreased observed effects. By contrast, use of clinically made diagnoses should have enhanced the generalisability of results to clinical practice.

Some specific problems that related to 'naturalistic' clinical diagnoses in all or part of the current sample included the following. Both centres 2 and 3 had formal processes to diagnose mild cognitive impairment by team consensus, whereas psychiatrists at centre 1 seemed to vary more in their approach. For example 'mild cognitive impairment' and 'mild cognitive disorder' sometimes seemed to be used interchangeably, possibly because the latter diagnosis is included in ICD 10, whereas 'mild cognitive impairment' does not yet have similar official status. Without prompting, two participants in the MCI group also reported at assessment that they had had a mild stroke. This had not become sufficiently obvious to the main researcher at the recruitment stage, hence it is arguable, whether these participants should have remained in the sample or been excluded. Likewise, several people reported accidents that they had had in the past, but it remained unclear, whether

some of these accidents might have led to mild brain injury (concussion etc.) or not, and often these incidents had not become apparent from medical notes.

The presence of a few people in the MCI group who performed in the average range on the specific memory task that was used in this study also raised questions about diagnosis and impact on analysis of data. Two people in the early AD group also had average delayed memory recall scores, but average immediate memory recall scores were only observed in the MCI group. People who performed comparatively better on the Verbal Paired Associates memory task often spontaneously reported the use of visualisation as a mnemonic strategy, whereas many of those who struggled with the task complained about word pairs being unrelated to each other. Some people who performed well also reported that they had been given information by professionals about strategies to use to improve memory, which would suggest the usefulness of such intervention. Some participants with higher VPA scores had previously performed at a significantly lower level on a different memory task when they were seen clinically. Memory tasks also differ in their mode of presentation and might be affected by individual differences in preferred strategies used to memorize information (e.g. visual versus verbal). Finally, one of the participants with a history of mild stroke achieved memory scores above average, but was impaired on executive functioning, hence might be best described as ‘single non-memory domain’ MCI (Petersen, 2003).

Stability of MCI as a classification has also been criticised (Ritchie et al., 2001). Ritchie and colleagues report that a number of people who had been diagnosed with MCI could no longer be classified the same way at follow-up a year later. Rather than having deteriorated to fulfil AD criteria, these people either only fulfilled criteria for age-associated cognitive decline or performed in the normal range. It is possible that this also applies to some of the participants in the current study who had showed memory performance in the average range.

5.7.3 Diagnosis and premorbid level of functioning

A further issue that refers to both level of performance and diagnosis is the issue of premorbid level of functioning. Estimated levels of premorbid functioning fell at the high end of average for the MCI group, but were somewhat lower in the early AD group. A number of people in both groups showed performances that placed their premorbid level of functioning above average. Higher than average estimates of (premorbid) intelligence in groups of elderly research participants are not an uncommon phenomenon (Petersen, 2003). This might reflect differential survival or lower morbidity of people with higher general cognitive ability. Alternatively, it could represent a self-selection bias in people willing to volunteer for research projects, such that brighter or more educated people might be more willing to volunteer.

People with higher premorbid level of functioning might show decline compared to their previous level, but still continue to perform in the average range compared to age-matched peers. It may therefore be possible that people with higher premorbid intelligence are less likely to receive a diagnosis of possible Alzheimer's disease early on, as a drop from previously higher levels of functioning might be masked by seemingly preserved current abilities.

Although age referenced norms are commonly available, education referenced norms are less widespread. This means that despite best efforts to take a person's premorbid level of functioning into account when assessing for loss of function estimates may not be as accurate for people with previously high average or better functioning. Furthermore, diagnostic criteria may not be met, because the person might still be able to compensate for loss of function. A diagnosis of dementia specifically requires that functioning in activities of daily living is affected. However, a person whose function might drop from a superior level to an average level might not yet show significant impact on everyday functioning. They might therefore be more likely to be given a diagnosis of MCI rather than AD, compared to an individual who might drop from average to below average levels with a concomitant greater impact on everyday functioning.

5.8 Findings in the context of theories on cognition and aging

5.8.1 Findings and source theories

Source theories of cognitive aging have been discussed in the Introduction chapter. The present study identified an age effect on scores of executive functioning. Craik and Grady's model (2002) postulates decline in frontal lobe functioning as the primary factor in cognitive changes observed in old age. However, alternative suggestions to explain the data are also worth considering.

Bryan & Luszcz (2000) suggest that deterioration in executive function may be linked with age-related decline in speed of information processing, and evidence for slowing is substantial (Morris, 1997; Salthouse, 1986). No independent measure of processing speed was included in the present study, but some of the executive tasks of the BADS were influenced by processing speed. Processing speed can be an important component of executive function tests, as mild difficulties will sometimes only become apparent under time pressure. It might be possible to reanalyse some of the data from the current study with BADS subtest raw scores that have not been adjusted by time penalties. This analysis has not been done. If this adjustment was made, lesser degrees of decline might provide information on the impact of processing speed, but on the other hand might invalidate the tests.

A further resource theory suggests sensory functioning as the main protagonist to account for age-related changes (cp. Berlin Aging Study, Baltes et al., 1997). This variable had not been controlled for in the present study. Difficulties with hearing were reported by a noticeable proportion of people, although this has not been documented specifically as part of the data. A few people were still waiting to get hearing aids. Assessment particularly of memory was difficult, when people's hearing was not corrected. It is recommended that future studies include specific questions about sensory functioning or even take measures of acuity.

5.9 Implications of the study for research and clinical practice

The evidence has been steadily increasing that people in the earliest clinical and even preclinical stages of Alzheimer's disease show decline in a number of different

aspects of executive function. These include concurrent manipulation of information (Lafleche, 1995, Collette, 1999), and attentional set-shifting (Nagahama, 2003), the latter of which was also found on a much simpler task in the present study (Rule Shift Card Test). Collette et al. also report difficulties inhibiting unhelpful response tendencies, whereas Ready et al. (2003) described elevated levels of apathy and difficulties on everyday executive function tasks, but not of (social) disinhibition. The current research adds to this knowledge base by drawing attention to difficulties with planning and organising an efficient course of action and monitoring ones own performance during implementation of the plan (Key Search, Zoo Map and Modified Six Elements tests).

Clinically, this points to the need for rehabilitation efforts to consider compensatory strategies for planning deficits, for example through use of checklists (Wilson et al., 1996; Honda, 1999). It is not uncommon to find in clinical practice that patients who present with cognitive decline for the first time report difficulties with specific everyday tasks that require a higher amount of planning, such as DIY tasks (Bell-McGinty et al., 2002, Willis, 1998), and sometimes even have given up such interests.

The availability of total scores has been advantageous in detecting milder impairment and judging a person's level of functioning more accurately. Clinical decisions cannot be easily made on results of individual tasks alone, as people sometimes fail individual tasks, but pass others.

One of the aims had been to determine the clinical usefulness of the BADS for assessing executive dysfunction in MCI and early AD. Although Wilson et al.'s validation study (1996) included people with dementia in the patient group many participants with early AD in the current study seemed to feel overtaxed not just by the test demands but also by the lengthy instructions. Whereas it seemed likely that the written test instructions that remained in view of the participant for several of the tasks would reduce the demands made on memory, people were often not able to use this information effectively whilst at the same time trying to solve the tasks. People either

seemed to forget about these instructions or got so involved in reading them that it interfered with test performance. Although some subtasks seemed easier to manage than others for the AD group (e.g. rule shift cards, action program, temporal judgment, and to a lesser degree key search), on the whole the test seemed better suited to assessing impairment in the more high functioning MCI group and only the most high functioning individuals in the AD group (e.g. those with high premorbid level of functioning and only minimal current loss of functioning). It seemed unnecessary and to a degree unethical to complete the whole test battery with a person just to confirm a floor effect. Hence use of the BADS for people with dementia cannot be recommended unequivocally. Implications for clinical practice are discussed in greater detail in the critical review.

5.10 Limitations of the current study and recommendations for future research

Many of the limitations of the present research have already been discussed in previous sections of this chapter. Selection of participants on the basis of clinically made diagnoses rather than 'research diagnoses' was considered both strength and a weakness of the research. In this context issues of validity of diagnosis were discussed, such as inclusion of people who had suffered mild stroke and inclusion of people who showed average performance on the memory test. Another issue that may affect generalisability is that a smaller proportion of women were represented in the early AD group than can be found in clinical practice. The current research was conducted with a clinical sample. People who present to clinic with memory problems tend to be more impaired than MCI groups drawn from community samples (Collie and Maruff, 2002).

Although not formally part of the BADS, Wilson and colleagues (1996) have also developed a questionnaire for rating commonly experienced everyday executive functioning difficulties (the DEX). Separate versions exist for the client and for an informant, but norms for this scale have not been well developed. This questionnaire had not been included in the present research. Ready et al. (1999) have found informant ratings useful to assess for executive functioning difficulties in MCI

patients. It has perhaps been a missed opportunity not to combine both approaches and future research should consider this.

Other additional measures should also be included in future research. It was considered a shortcoming of the current research that no measure of working memory had been included. It might also have been useful to take an independent measure of processing speed. Both can be assessed with relatively short and simple tasks. As recommended by the researchers of the Berlin Aging Study (Baltes et. al., 1997), future research should also consider sensory abilities and sensory decline carefully in research on cognitive decline. As the study is cross-sectional rather than longitudinal it is not possible to determine, if the finding of executive function difficulties in some people with MCI has prognostic implications.

5.11 Conclusion

This study set out to investigate executive functioning in Mild Cognitive Impairment and early Alzheimer's disease. Both groups showed decline on executive functioning tasks, but this was mild in the MCI group compared to normative data, whereas significantly poorer performance was observed in the early AD group. Around half of the people in the MCI group still showed average to low average performance on tasks of executive functioning, some showed subtle difficulties, but a considerable number also showed impairment in executive functioning. By contrast, the majority of people in the early AD group showed impaired or borderline levels of performance on tasks of executive function. Only a few people retained at least low average performance, and for these participants their performance scores still showed mild decline compared to their estimated premorbid level of cognitive functioning. Despite these differences in executive function between the two groups, patterns of performance across subtests were similar for both groups. Different subtests had advantages and disadvantages for use with either group, in particular, the Key Search subtest, which had the highest correlation with total scores, and the Zoo Map test, which was sensitive even to mild impairment, but led to a floor effect in the early AD group.

References

- American Psychiatric Association (1994). Diagnostic and Statistical Manual of Mental Disorders (4th edn.) (DSM - IV). Washington, DC: American Psychiatric Press.
- Anthony, J. C., Le Resche, L. Naiz, U., Von Korff, M. R., and Folstein, M. F. (1982). Limits of the 'mini-mental state' as a screening test for dementia and delirium among hospital patients. Psychological Medicine, 12, 397-408.
- Arnaiz, E., and Almkvist, O. (2003). Neuropsychological features of mild cognitive impairment and preclinical Alzheimer's disease. Acta Neurologica Scandinavica, 107 (S. 179), 34-41.
- Baddeley, A. D. (1986). Working Memory. Oxford: Oxford University Press.
- Baddeley, A. D., & Wilson B. A. (1988). Frontal amnesia and the dysexecutive syndrome. Brain and Cognition, 7, 212-230.
- Baddeley, A.D., and Hitch, G. (1974). Working Memory. In G. H. Bower (Ed.), The psychology of learning and motivation, Vol.8, pp. 47-89. New York: Academic Press.
- Baltes, P. B., and Lindenberger, U. (1997). Emergence of a powerful connection between sensory and cognitive functions across the adult life span: A new window to the study of cognitive aging? Psychology and Aging, 12, 12-21.
- Barberger-Gateau, P. and Fabrigoule, C. (2003). Re: Bell-McGinty et al. Standard measures of executive function in predicting instrumental activities of daily living in older adults. International Journal of Geriatric Psychiatry, 18, 459-460.

Bell-McGinty, S., Podell, K., Franzen, M., Baird, A. D. and Williams, M. J. (2002). Standard measures of executive function in predicting instrumental activities of daily living in older adults. International Journal of Geriatric Psychiatry, 17, 828-834.

Bischkopf, J., Busse, A., and Angermeyer, M. C. (2002). Mild cognitive impairment – a review of prevalence, incidence and outcome according to current approaches. Acta Psychiatrica Scandinavica, 106, 403-414.

Bryan, J. & Luszcz, M. A. (2000). Measurement of executive function: considerations for detecting adult age differences. Journal of Clinical and Experimental Neuropsychology, 22(1), 40-55.

Burgess, P. W. (1997). Theory and Methodology in Executive Function Research. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Burgess, P. W., & Shallice, T. (1997). The Hayling and Brixton tests. Manual. Bury St. Edmunds: Thames Valley Test Company.

Burns, A., Denning T., Lawler, B. (Eds.) (2002). Clinical Guidelines in Old Age Psychiatry. London: Martin Dunitz.

Burns, A., Lawler, B., Craig, S. (Eds.) (1999). Assesment Scales in Old Age Psychiatry. London: Martin Dunitz.

Caine, E. D. (1986). The Neuropsychology of Depression : The Pseudodementia Syndrome. In I. Grant and K. M. Adams (Eds.), Assessment of Neuropsychiatric disorders. New York: Oxford University Press.

Cohen, J. (1992). A Power Primer. Psychological Bulletin, 112, 155-159.

Collette, F., Van der Linden M., and Salmon, E. (1999). Executive Dysfunction in Alzheimers's Disease. Cortex, 35, 57-72.

Collie, A. and Maruff, P. (2002). An analysis of systems of classifying mild cognitive impairment in older people. Australian and New Zealand Journal of Psychiatry, 36,133-140.

Collie, A. and Maruff, P. (2000). The Neuropsychology of preclinical Alzheimer's disease and mild cognitive impairment. Neuroscience and Biobehavioral Review, 24, 365-374.

Craik, F. I M & Grady, C. L. (2002). Aging, Memory, and Frontal Lobe Functioning. In: D. T. Stuss. & R. T. Knight (eds.), Principles of Frontal Lobe Function. Oxford: Oxford University Press.

Craik, F. I. M. (2000). Age-related changes in human memory. In: D. Park & N. Schwarz (eds.), Cognitive Aging. A Primer. Philadelphia: Taylor & Francis.

Craik, F. I. M., and Byrd, M. (1982). Aging and cognitive deficits: The role of attentional resources. In F. I. M. Craik and S. Trehub (Eds.). Aging and cognitive processes. New York: Plenum Press.

Crawford, J. R. (1998). Introduction to the assessment of attention and executive functioning. Neuropsychological Rehabilitation, 8 (3), 209-211.

Crowell, T. A., Luis, C. A., Vanderploeg, R. D., Schinka, J. A. & Mullan, M. (2002). Memory patterns and executive functioning in Mild Cognitive Impairment and Alzheimer's Disease. Aging, Neuropsychology and Cognition, 9 (4), 288-297.

Department of Health website. National Service Framework for Older Adults (2001).

Folstein, M. F., Folstein, S. E. McHugh, P. R. (1975). "Mini-Mental State": a practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research, 12, 189-198.

Groth-Marnat, G. (Ed.), (2000). Neuropsychological assessment in clinical practice. A guide to test interpretation and integration. New York: John Wiley.

Hänninen, T., Hallikainen, M., Koivisto, K., Partanen, K., Laakso, M.P., Riekkinen, P.J. and Soininen, H. (1997). Decline of frontal lobe functions in subjects with age-associated memory impairment. Neurology, 48, 148-153.

Hasher, L., and Zacks, R. T. (1988). Working memory, comprehension, and aging: A review and a new view. In G. H. Bower (Ed.), The Psychology of Learning and Motivation, (Vol. 22). San Diego, CA: Academic Press.

Honda, T. (1999): Rehabilitation of executive function difficulties after stroke. Topics in Stroke Rehabilitation, 6 (1), 15-22.

Kliegel, M., Ramuschkat, G. & Martin, M. (2003). Exekutive Funktionen und prospective Gedächtnisleistung im Alter – Eine differentielle Analyse von ereignis- und zeitbasierter prospektiver Gedächtnisleistung. Zeitschrift fuer Gerontologie und Geriatrie, 36, 35 – 41.

Kluger, A., Ferris, S. H., Golomb, J., Mittelman, M. S., and Reisberg, B. (1999). Neuropsychological prediction of decline to dementia in nondemented elderly. Journal of Geriatric Psychiatry and Neurology, 12, 168-179.

Kral, V. A. (1962). Senescent forgetfulness: Benign malignant. Canadian Medical Association Journal, 86, 257-260.

Lafleche, G., and Albert, M. S. (1995). Executive function deficits in mild Alzheimer's disease. Neuropsychology, 9 (3), 313-320.

Lezak, M. D. (1995). Neuropsychological assessment (3rd ed.). New York: Oxford University Press.

Morris, J. C. (1993). The Clinical Dementia Rating (CDR): current version and scoring rules. Neurology, 43, 2412-2414.

Morris, J. C., Storandt, M., Miller, J. P., McKeel, D. W., Price, J. L., Rubin, E. H. and Berg, L. (2001). Mild cognitive impairment represents early-stage Alzheimer's disease. Archives of Neurology, 58, 397-405.

Morris, R. G. (1997). Cognition and ageing. In: R. Jacoby & C. Oppenheimer (eds.), Psychiatry in the Elderly. Oxford: Oxford University Press.

Morris, R. G. (1996a). The Cognitive Neuropsychology of Alzheimer-type Dementia. Oxford: Oxford University Press.

Morris, R. G. (1996b). The Neuropsychology of Alzheimer's Disease and Related Dementias. In: R. T. Woods (ed.). Handbook of the clinical psychology of ageing. Chichester: Wiley.

Nagahama, Y., Okina, T., Suzuki, N. Matsuzaki, S., Yamauchi, H., Nabatame, H. and Matsuda, M. (2003). Factor Structure of a Modified Version of the Wisconsin Card Sorting Test: An Analysis of Executive Deficit in Alzheimer's Disease and Mild Cognitive Impairment. Dementia and Geriatric Cognitive Disorders, 15, 103-112.

Nathan, J., Wilkinson, D., Stammers, S., and Low, J. L. (2001). The role of tests of frontal executive function in the detection of mild dementia. International Journal of Geriatric Psychiatry, 16, 18-26.

Nelson, H. E., and O'Connell, A. (1978). Dementia: The estimation of premorbid intelligence levels using the National Adult Reading Test. Cortex, 14, 234-244.

O'Carroll, R. (1992). Predicting Premorbid Intellectual Ability in Dementia. The Clinical Neuropsychologist, 6 (1), 113-115.

Office of Population Censuses and Surveys (1990). Standard Occupational Classification. Volume 1. London: HMSO.

Office of Population Censuses and Surveys (1990). Standard Occupational Classification. Volume 2. London: HMSO.

Park, D. (2000). The basic mechanisms accounting for age-related decline in cognitive function. In: D. Park and N. Schwarz (Eds.), Cognitive Aging: A Primer. Hove: Taylor & Francis.

Parkin A. J. (1997). Normal age-related memory loss and its relation to frontal lobe dysfunction. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Patterson, M. B., Mack, J. L., Geldmacher, D. S., and Whitehouse, P. J. (1996). Executive functions and Alzheimers's disease: problems and prospects. European Journal of Neurology, 3, 5-15.

Perry, R. J., and Hodges, J. R. (1999). Attention and executive deficits in Alzheimer's disease. Brain, 122, 383-404.

Petersen, R. C.(Ed.) (2003). Mild Cognitive Impairment. Aging to Alzheimer's Disease. New York: Oxford University Press.

Petersen, R. C., Doody, R., Kurz, A., Mohs, R. C., Morris, J. C., Rabins, P. V., Ritchie, K., Rossor, M., Thal, L., and Winblad, B. (2001). Current concepts in Mild Cognitive Impairment. Archives of Neurology, 58, 1985-1992.

Petersen, R. C. (2000). Aging, Mild Cognitive Impairment, and Alzheimer's Disease. Neurologic clinics, 18 (4), 789-805.

Phillips, L. H. (1997). Do "frontal tests" measure executive function? Issues of assessment and evidence from fluency tests. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Phillips, L. H., Della Sala S., and Trivelli, C. (1996). Fluency deficits in patients with Alzheimer's disease and frontal lobe lesions. European Journal of Neurology, 3, 102-106.

Phillips, L. H. (1997). Do "frontal tests" measure executive function?: Issues of assessment and evidence from fluency tests. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Piguet, O., Grayson, D. A., Broe, G. A., Tate, R. L., Bennett, H. P., Lye, T. C., Creasey, H. & Ridley L. (2002). Normal aging and executive functions in "old-old" community dwellers: poor performance is not an inevitable outcome. International Psychogeriatrics, 14 (2), 139-159.

Rabbitt, P. (1997). Introduction: Methodologies and Models in the Study of Executive Function. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Ready, R. E., Ott, B. R., Grace, J. and Cahn-Weiner, D. A. (2003). Apathy and Executive Dysfunction in Mild Cognitive Impairment and Alzheimer Disease. American Journal of Geriatric Psychiatry, 11 (2), 222-228.

Reischies, F. M., & Neu, P. (2000): Comorbidity of mild cognitive disorder and depression – a neuropsychological analysis. European Archives of Psychiatry and Clinical Neuroscience, 250, 186 -193.

Ritchie, K., Artero, S., & Touchon, J. (2001). Classification criteria for mild cognitive impairment. A population-based validation study. Neurology, 56, 37-42.

Salthouse, T. A. (1996). The processing-speed theory of adult age differences in cognition. Psychological Review, 103, 403-428.

Salthouse, T. A. (1991). Theoretical perspectives on cognitive aging. Hillsdale, N. J.: LEA.

Salthouse, T. A. (1985). A theory of cognitive aging. Amsterdam: North Holland

Sbordone, (2000). The Executive Functions of the Brain. In: G. Groth-Marnat (Ed.), Neuropsychological assessment in clinical practice. A guide to test interpretation and integration. New York: John Wiley.

Schmidt, M. (2003). Hit or Miss? Insight into Executive Functions. Journal of the International Neuropsychological society, 9 (6), 962-964.

Shallice, T. (1982). Specific impairments of planning. Philosophical Transactions of the Royal Society London, B, 298, 199-209.

Snowdon, D. A. (2001). Aging with Grace: The Nun Study and the science of old age. London: Fourth Estate.

Snowdon, D. A. (1997). Aging and Alzheimer's Disease: Lessons from the Nun Study. The Gerontologist, 37 (2), 150-156.

Snowdon, D. A., and Perez Riley, K. (1998). "Aging and Alzheimer's Disease: Lessons from the Nun Study: Reply." The Gerontologist, 38 (1), 5.

Stuss, D. T. & Knight, R. T. (Eds.) (2002). Principles of Frontal Lobe Function. Oxford: Oxford University Press.

Wechsler D. (2001). Wechsler Test of Adult Reading. Harcourt Brace, The Psychological Corporation.

Wechsler D. (1997). Wechsler Memory Scale, 3rd edition. Harcourt Brace, The Psychological Corporation.

Weiner, M. F., Cullum, C. M., Rosenberg, R. N., and Honig, L. S. (1998). "Aging and Alzheimer's Disease: Lessons from the Nun Study: Comment." The Gerontologist, 38 (1), 5.

Willis, S. L., Allen-Burge, R., Dolan, M. M., Bertrand, R. M., Yesavage, J., and Taylor, J. L. (1998). Everyday problem solving among individuals with Alzheimer's Disease. The Gerontologist 38 (5), 569-577.

Wilson B. A., Evans, J., Emslie, H., Alderman, N., and Burgess, P. (1998). The Development of an Ecologically Valid Test for Assessing Patients with a Dysexecutive Syndrome. Neuropsychological Rehabilitation, 8 (3), 213-228.

Wilson B. A., Alderman, N., Burgess, P., Emslie, H., and Evans, J. (1996). Behavioural Assessment of the Dysexecutive Syndrome. Bury St. Edmunds: Thames Valley Test Company.

Woods, R. T. (1999). Psychological problems of ageing. Assessment, treatment and care. Chichester: Wiley.

World Health Organisation (1992). The Tenth Revision of the International Classification of Diseases and Related Health Problems (ICD-10). Geneva: WHO.

Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M. and Leirer, O. (1983). Development and validation of a geriatric depression screening scale: a preliminary report. Journal of Psychiatric Research, 17, 37-49.

Appendices

Appendix A: Letter confirming ethical approval

Appendix B: Introductory letter (consent to contact letter)

Appendix C: Patient Information Sheet

Appendix D: Consent Form

Appendix E: Supplementary Results

i) Boxplots for control variables

ii) Results of regression analysis and control for influences
of covariates

Appendix A: Letter confirming ethical approval

**R & D DEPARTMENT
ST. ANN'S HOSPITAL
ST. ANN'S ROAD
LONDON N15 3TH**

E-mail: research.department@beh-mht.nhs.uk
Direct Line: 020 8442 6503

12 December, 2003

Ms M Kreutz
9 Widford Road
Welwyn Garden City
Herts AL7 2LR

Dear Ms Kreutz,

03/107: Performance of MCI and early AD patients on the Behavioural Assessment of the Dysexecutive Syndrome test battery

I am pleased to note that you have received the favourable opinion of the Local Research Ethics Committee for your study.

All projects must be registered with the Research Department if they use patients, staff, records, facilities or other resources of the Barnet, Enfield and Haringey NHS Mental Health Trust.

The R&D Department on behalf of Barnet, Enfield and Haringey NHS Mental Health Trust is therefore able to grant approval for your research to begin, based on your research application and proposal reviewed by the ethics committee. Please note this is subject to any conditions set out in their letter dated 4 December 2003.

You are obliged to adhere to the research governance framework as set out by the Department of Health Research Governance Framework for Health and Social Care*.

It is required that all researchers submit a report and copies of all publications emanating from the study to the R&D Department. Furthermore, all publications must contain the following acknowledgement.

"This work was undertaken with the support of Barnet, Enfield and Haringey NHS Mental Health Trust, who received "funding" from the NHS Executive; the views expressed in this publication are those of the authors and not necessarily those of the NHS Executive".

“a proportion of funding” where the research is also supported by an external funding body; “funding” where no external funding has been obtained.

Best wishes, and look forward to hearing from you in the future.

Yours sincerely,



pp Gerard Leavey *CL*
Assistant Director R & D

*Further information on research governance can be obtained on the DH web pages at <http://www.doh.gov.uk/research/>

Appendix B: Introductory letter

Introductory letter

Dear

I am writing to you on behalf of a trainee clinical psychologist, Marianne Kreutz. She is inviting people with memory problems to take part in a study. She would like to find out whether people who have problems with their memories also experience difficulties in making plans and in carrying them out.

It is up to you whether you choose to participate in the study. Whether you choose to participate or not will not affect the treatment you get at the hospital in any way.

People who take part in the study will be given some tasks to do: for instance, you will complete a memory task, read some words and answer some questions about your mood. It is expected that the tasks will take about 1.5 hours to complete. Some people like to do all the tasks during one visit. Other people want two shorter visits. Ms Kreutz will visit you at home if you would like to take part in this research.

If you want to find out more about the study, please fill in the return slip below and post it back to us in the envelope provided. If you agree to participate, you will be given more information and you will be able to ask any questions you might have.

All the information collected about you for the study will be kept strictly confidential. To make sure the study is carried out properly, the researcher needs to look at your hospital file. Only information relevant to the study will be looked at.

The study may help us understand better the sort of difficulties experienced by people with memory complaints. If you wish, you can contact us at the [hospital name]: [+ phone number] or by telephoning Ms Kreutz: on (mobile phone)/ (work phone number) (Mon-Wed).

Thank you very much in advance for considering this request.

Yours sincerely,

Dr.
Consultant Old Age Psychiatrist

✂ -----

I want to find out more about the above study. Please provide me with further information.

Name: _____

Phone: _____

Address _____

Signed: _____ Date: _____

Appendix C: Patient Information Sheet

Study No: 03/107

Study Time: January – August 2004

Patient Information Sheet

You are being invited to take part in a research project. Here is some information to help you decide whether or not to take part. Please take time to read the following information carefully and discuss it with friends, relatives and your GP if you wish. Ask us if there is anything you do not understand or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

Study Title: Performance of people with memory problems on the BADS (Behavioural Assessment of the Dysexecutive Syndrome) test battery.

When people come to a clinic because they are worried about their memory, they often experience some difficulties in their everyday lives. The researchers are interested to find out, if a person with memory problems also finds it more difficult to make plans, organise themselves or solve a novel problem. To carry out a plan, we need to remember what to do next. To solve a novel problem means doing something new or different, for example finding your way to the hospital service for the first time. It can also mean adjusting your behaviour when an unexpected change happens in a routine action. For example, you might normally unlock your door automatically, but if the lock unexpectedly sticks, you will have to try to overcome this novel problem: you might have to fiddle with the key or check that you have used the right key. The researchers are interested how you go about situations that are similar to the everyday problems just described.

The researchers are also interested in comparing two groups of people: people who only complain of memory problems and people who experience memory problems as well as some difficulties in another aspect of their everyday living. All people taking part in the study will be given the same tasks to do.

A set of tasks has been developed to assess planning and problem solving related to everyday situations. These tasks have been called the 'Behavioural Assessment of the Dysexecutive Syndrome' or BADS for short. As the main part of the study, you will be asked to complete the tasks of the BADS. You will also be asked to do a short reading task and a memory task. Finally, you will be asked to fill in a questionnaire about your mood and asked for some information about yourself by the researcher. You can be visited in your home to take part in this research. The visit is expected to last 1.5 hours or sometimes two shorter visits will be arranged.

It will be helpful for the researcher to audiotape a short section of the assessment to be able to take more accurate notes later. This recording will only be made with your agreement. The tape will be destroyed once the researcher has completed her notes. As the researcher only wants to audiotape one task, you can still take part in the rest of the research, if you don't agree to the recording.

Before you decide to take part in the study, you have a chance to ask the researcher about any questions you may have about this project. The researcher will call you a few days after you have received this information sheet and will be happy to give you more information about her study. She will then ask you if you would like to take part.

If you decide to take part in the study, the main researcher will not meet with you again to discuss how you did on the tasks you completed. However, this can be arranged, if you would really like to know. If you or the researcher notices that you have more difficulty with the tasks than expected, the researcher will discuss with you, if somebody from the team at the clinic can be informed about this.

You may or may not receive any direct benefit from taking part in the study. However information obtained during the course of the study may also help us to understand better about the range of problems people with memory difficulties experience in their everyday life. This may also help us in the care of future patients.

It is up to you to decide whether to take part or not. If you do decide to take part you will be given an information sheet and a consent form. Even if you decide to take part, you are free to withdraw at any time and without giving a reason. This will not affect the standard of care you will receive. Your doctor will not be upset if you decide not to take part.

All the information collected about you during the course of the research will be kept strictly confidential. Any information taken away by the researchers will not have your name on it. Any published report of the research will not identify you.

If you have any further questions, please do not hesitate to contact me:

Marianne Kreutz on 01 (Mon – Wed)
(main researcher) or 07 (mobile; I will then ring back)

Appendix D: Consent Form

Centre Number: 1

Study Number: 03/107

Patient Information number for this trial:

CONSENT FORM

Title of Project: **Performance of people with memory problems on the BADS (Behavioural Assessment of the Dysexecutive Syndrome) test battery**

Name of Researcher: **Marianne Kreutz**

Please tick all boxes you agree to:

1.	I confirm that I have read and understand the information sheet. Date:.....	
2.	I understand that my participation is voluntary and that I am free to withdraw at any time without my medical care or legal rights being affected.	
3.	I am willing to allow access to my medical records but understand that strict confidentiality will be maintained. The purpose of this is to check that the study is being carried out correctly.	
4.	[I understand that audiotaping a short part of the assessment will help the researcher take better notes. The tape will be destroyed as soon as the notes are complete. I can still take part in the rest of the study, if I do not agree to the tape.] Do you consent to audiotaping? – YES / NO If not, do you want to take part in the rest of the study? - YES / NO	
5.	I agree to take part in the above study	

Name of Patient (block capitals)

Date

Signature

I have explained the nature, demands and foreseeable risks of the above research to the subject.

Name of Researcher
(Block capitals)

Date

Signature

1 for patient;

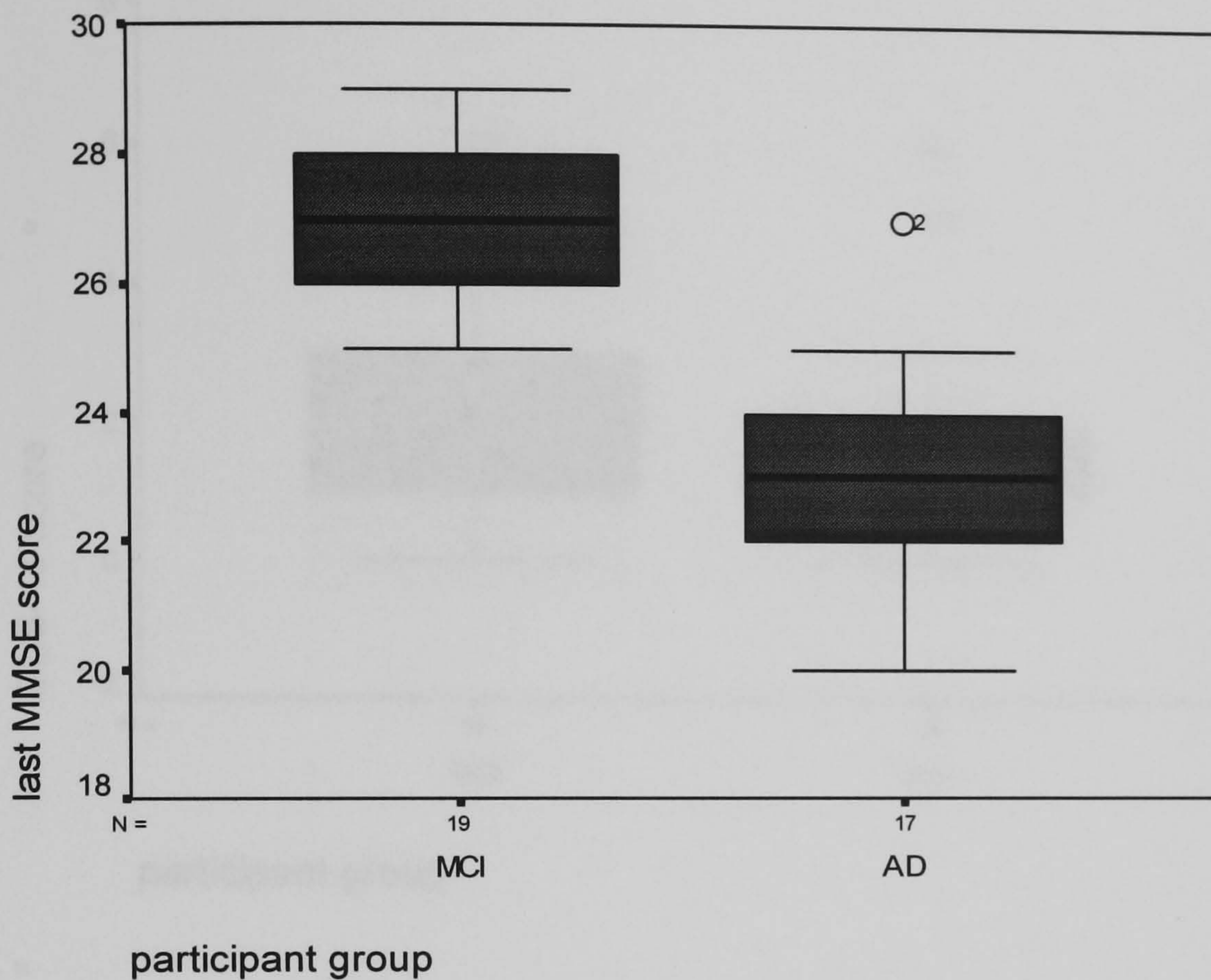
1 for researcher;

1 to be kept with hospital notes

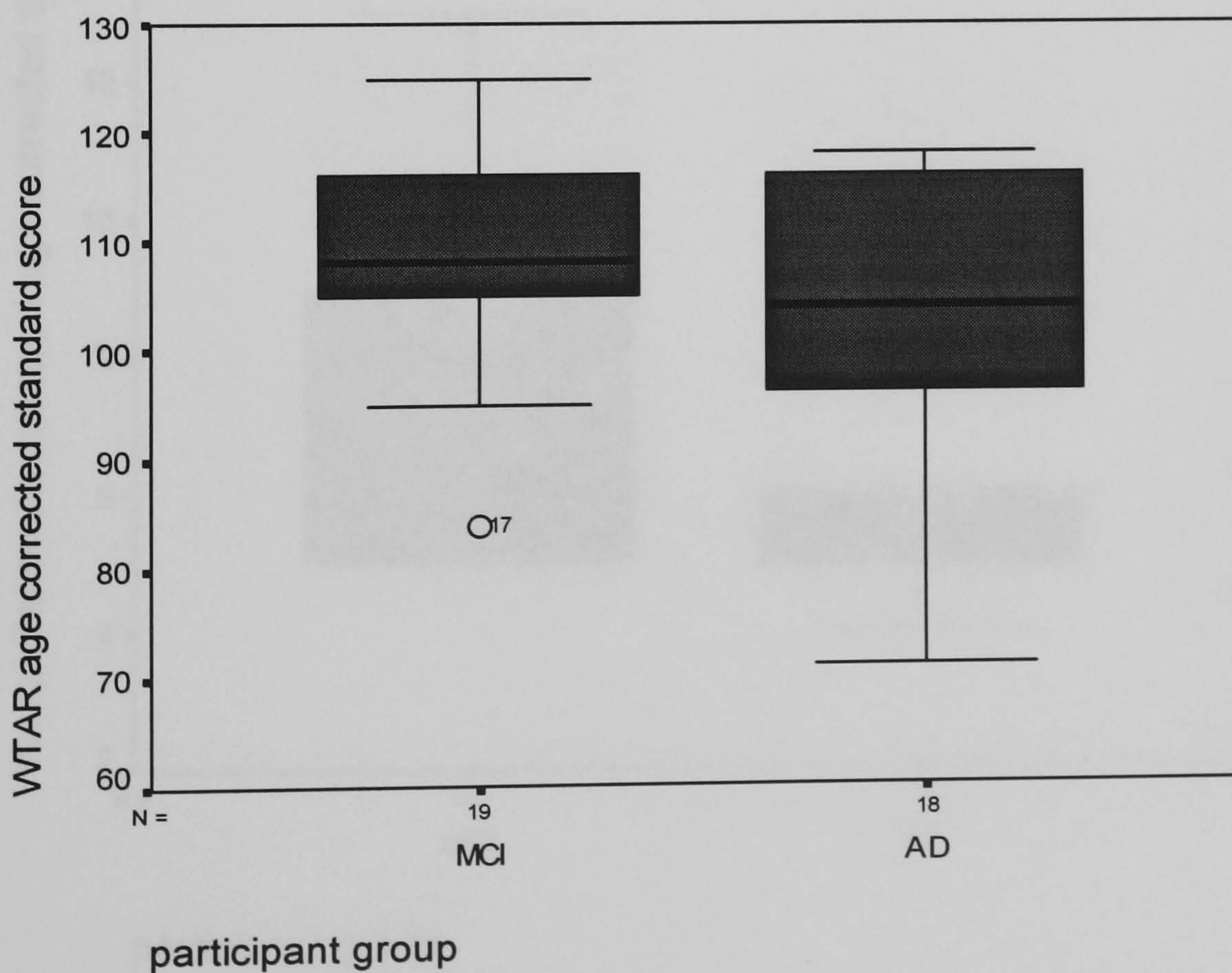
Appendix E: Supplementary Results

Appendix E i): Boxplots for control variables

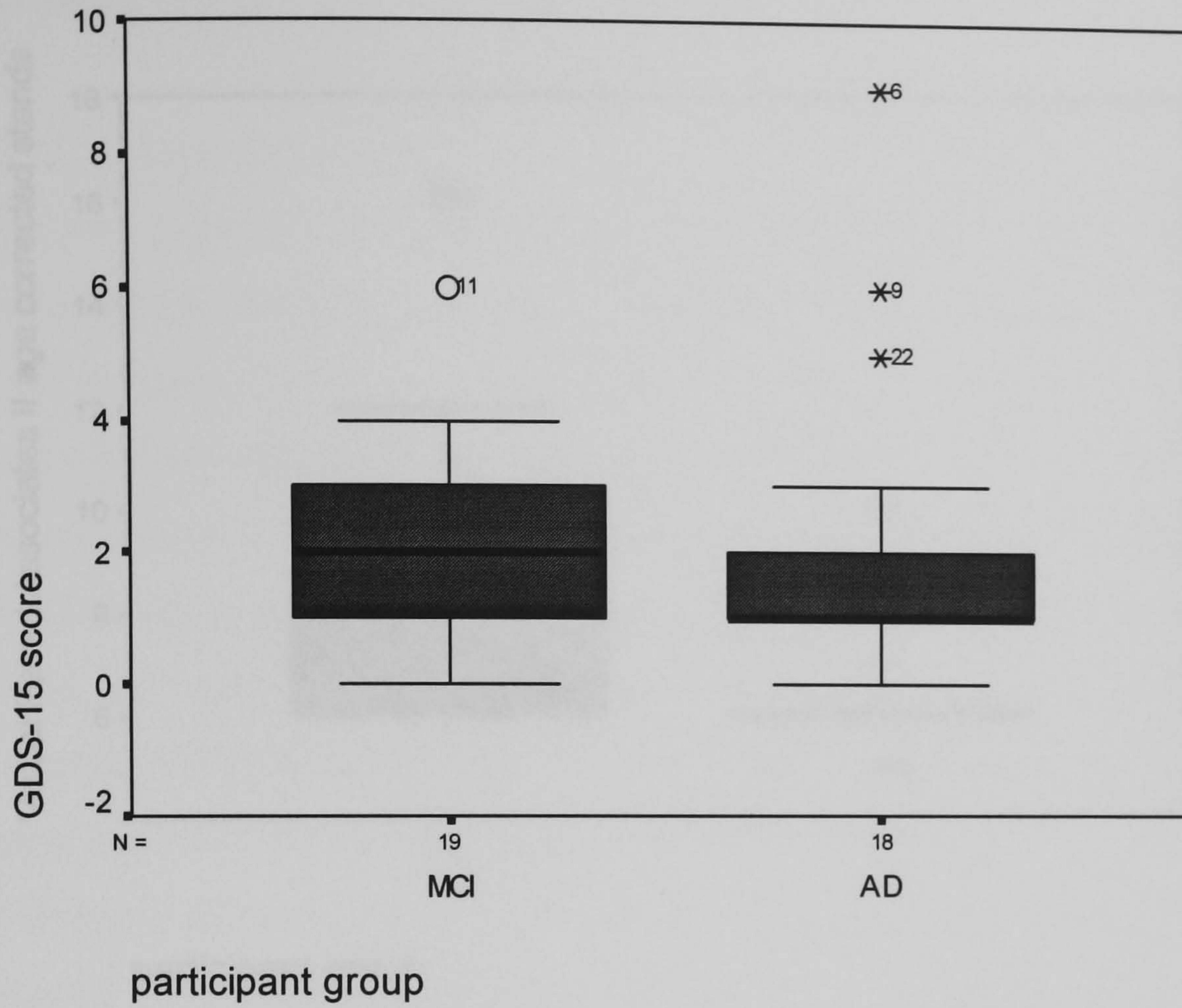
Supplementary Figure 1: Boxplots for MMSE scores by group



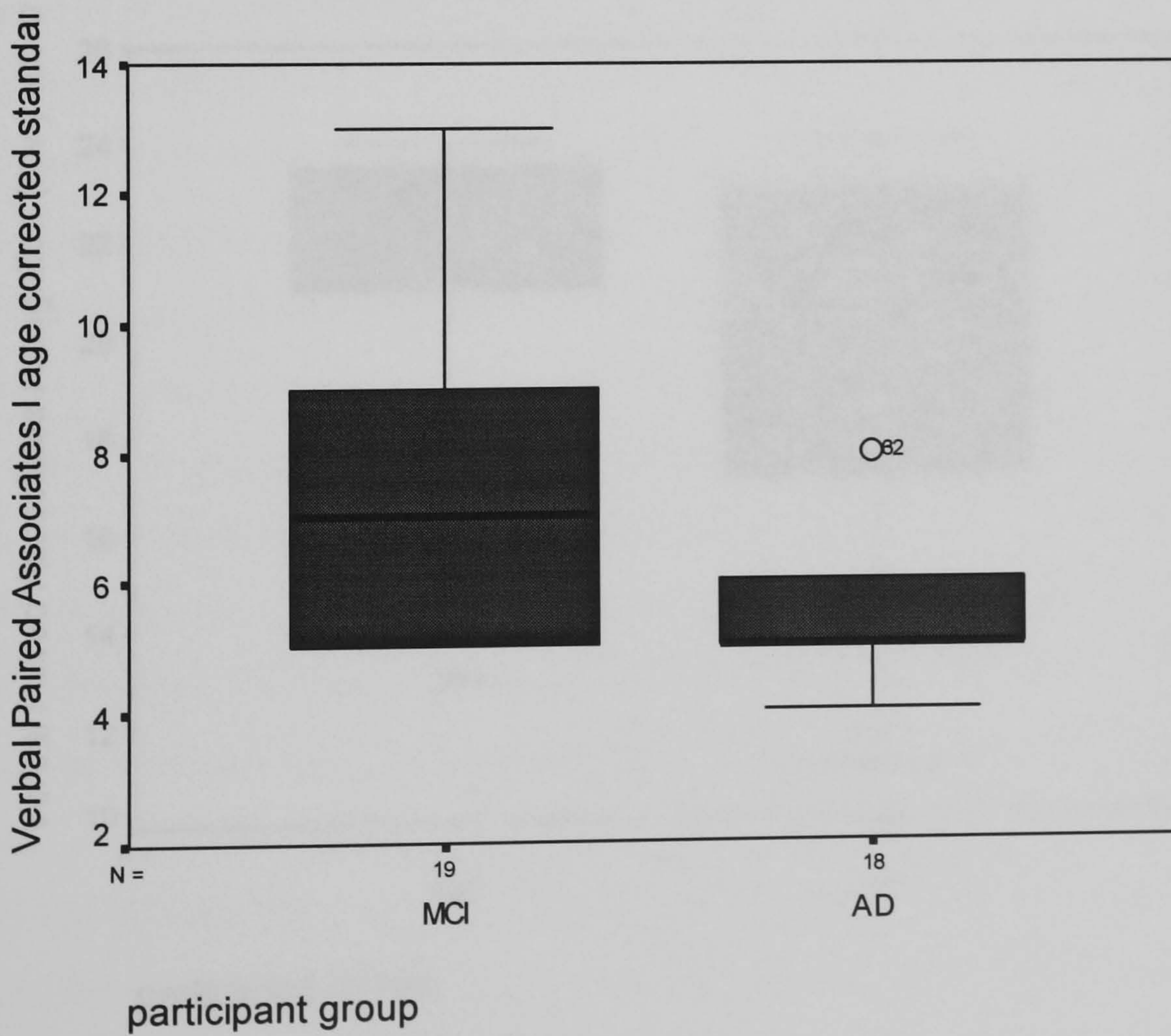
Supplementary Figure 2: Boxplots for WTAR scores by group



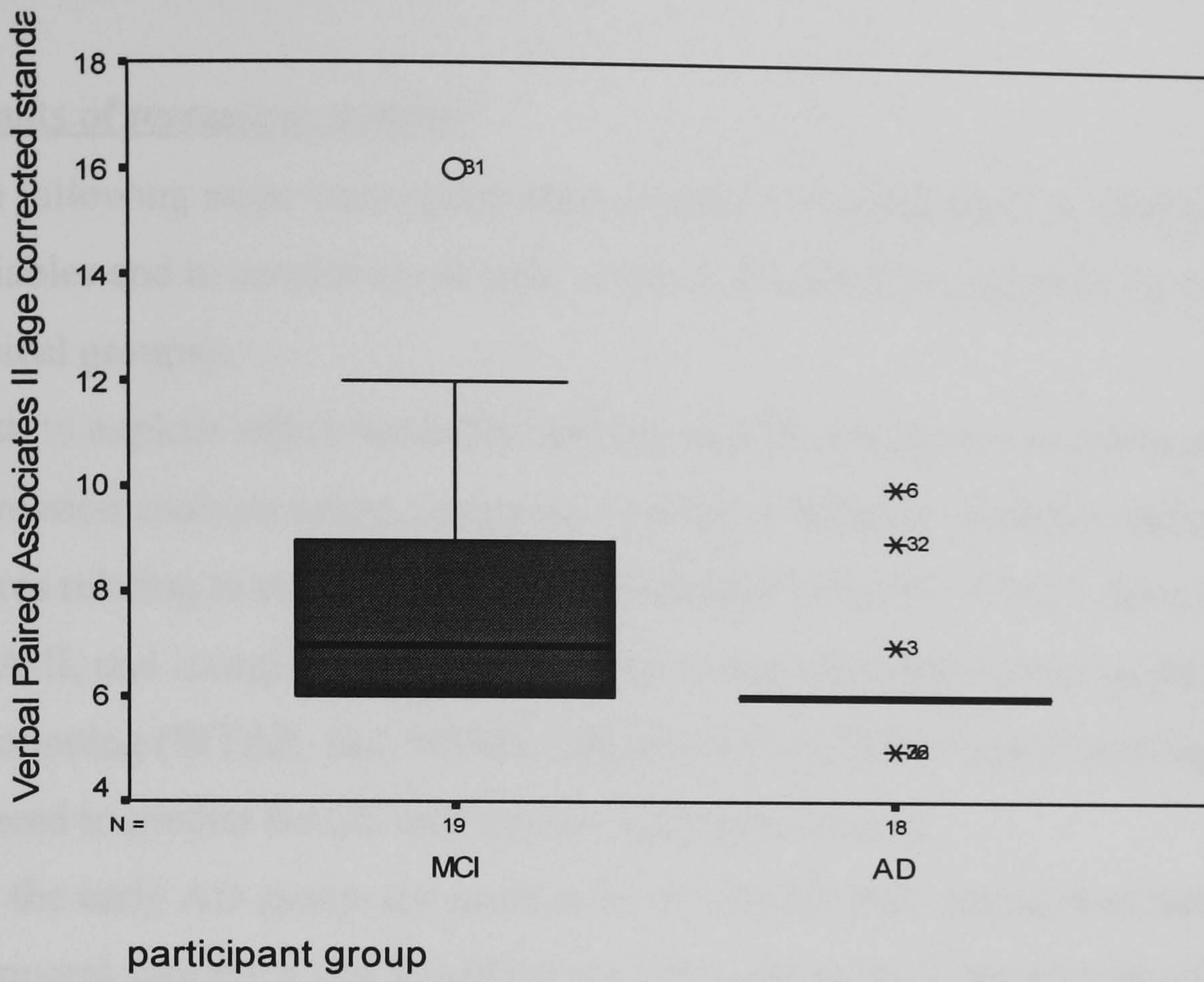
Supplementary Figure 3: Boxplots for GDS scores by group



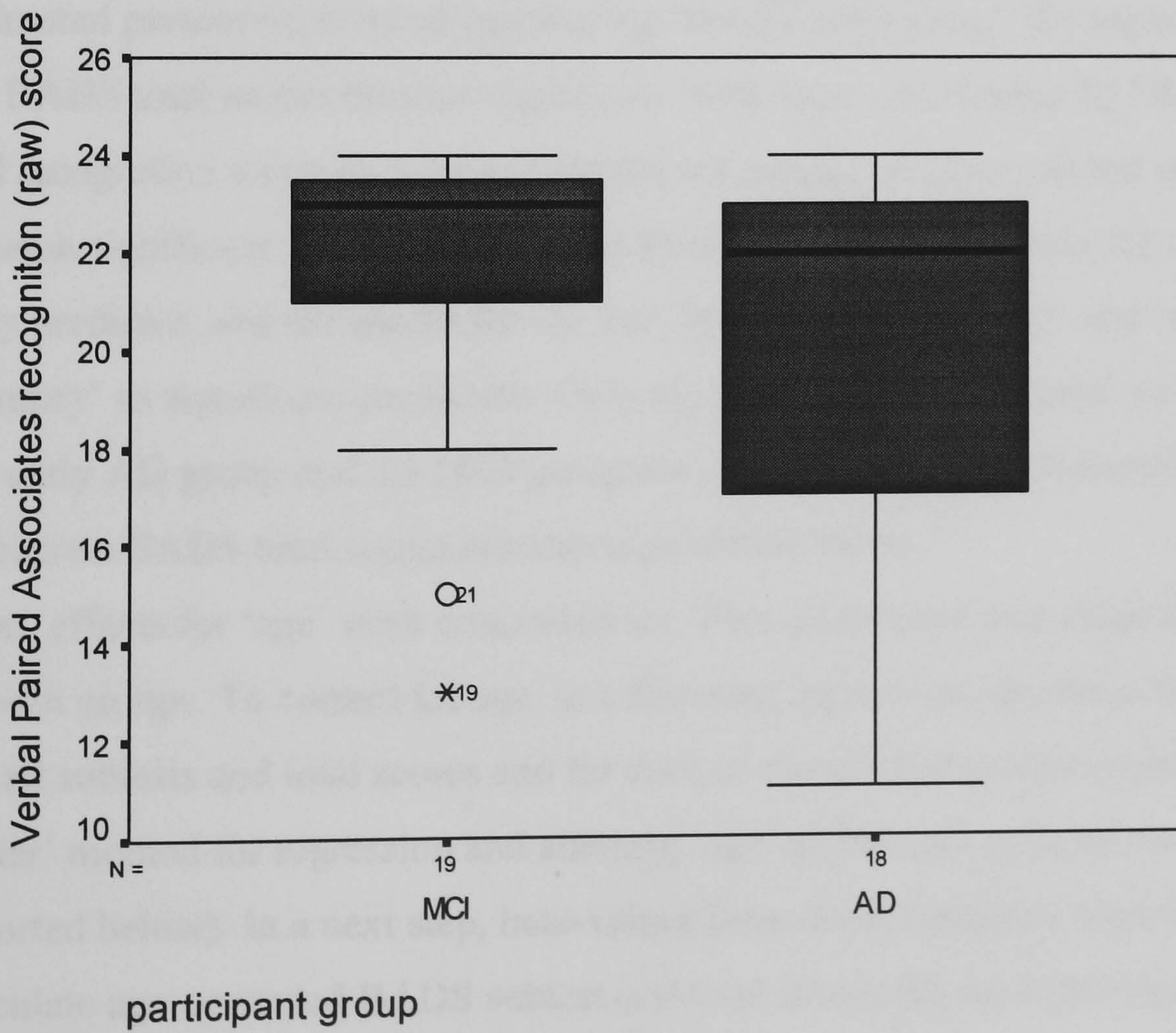
Supplementary Figure 4: Boxplots for VPA I scores by group



Supplementary Figure 5: Boxplots for VPA II scores by group



Supplementary Figure 6: Boxplots for VPA Recognition trial scores by group



Appendix E ii): Results of regression analysis and control for influences of covariates

Results of regression analysis

The following steps were undertaken to explore the influence of confounding variables and to control for at least some of the effects (separately for each of the two clinical groups):

First, to explore which variables had any significant impact on observed scores, regression analysis using a stepwise method of entering variables was used, and scores relating to memory function (immediate memory: VPA-I, delayed memory: VPA-II, and recognition memory scores), premorbid and current cognitive functioning (WTAR, and MMSE), depression, as well as age of participant were entered to predict BADS total scores and subtest scores.

For the early AD group, the models for the BADS total scores, Key Search, Temporal Judgment and Modified Six Elements subtests became significant, with 'age' being a significant predictor for all models. The model for the modified six elements test revealed further significant contributions from recognition memory and estimated premorbid level of functioning. For the MCI group, the regression model for BADS total scores became significant, with 'age', premorbid IQ (WTAR scores) and recognition memory scores as significant predictors. Two subtest models also became significant: the model for Rule Shift cards with premorbid IQ scores as the only predictor, and the model for the Zoo Map subtest with 'age' and 'recognition memory' as significant predictors. Only the models for BADS total scores for both the early AD group and the MCI group are reproduced below. Scatterplots for age effects on BADS total scores are also reproduced below.

Next, effects for 'age' were controlled for. This adjustment was made for all scores in both groups. To correct for age, in a first step regression equations were calculated for all subtests and total scores and for each of the clinical groups separately, using 'enter' method for regression and entering 'age' as the only variable (models reported below). In a next step, beta-values from these equations were used to calculate age-corrected BADS subtest and total scores for each participant according to the following general formula:

Age-corrected score = (age of participant – median age of group) * specific beta value + original score of participant

(e.g. the formula for adjusting total scores for the early AD group was:

age-adjusted total score = ((age - 79) * 2.14) + total score).

Descriptive statistics were calculated for the new scores and are reported in table 3 alongside statistics for the original scores. As correction for 'age' had only limited impact on results and beta-values for other confounding variables were even smaller, a decision was made not to correct for any further effects.

Regression analyses for the early AD group

Regression analysis BADS total scores

a) Model for stepwise regression:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.608	.370	.328	16.07061

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2276.033	1	2276.033	8.813	.010
	Residual	3873.967	15	258.264		
	Total	6150.000	16			

a Predictors: (Constant), Age (years)

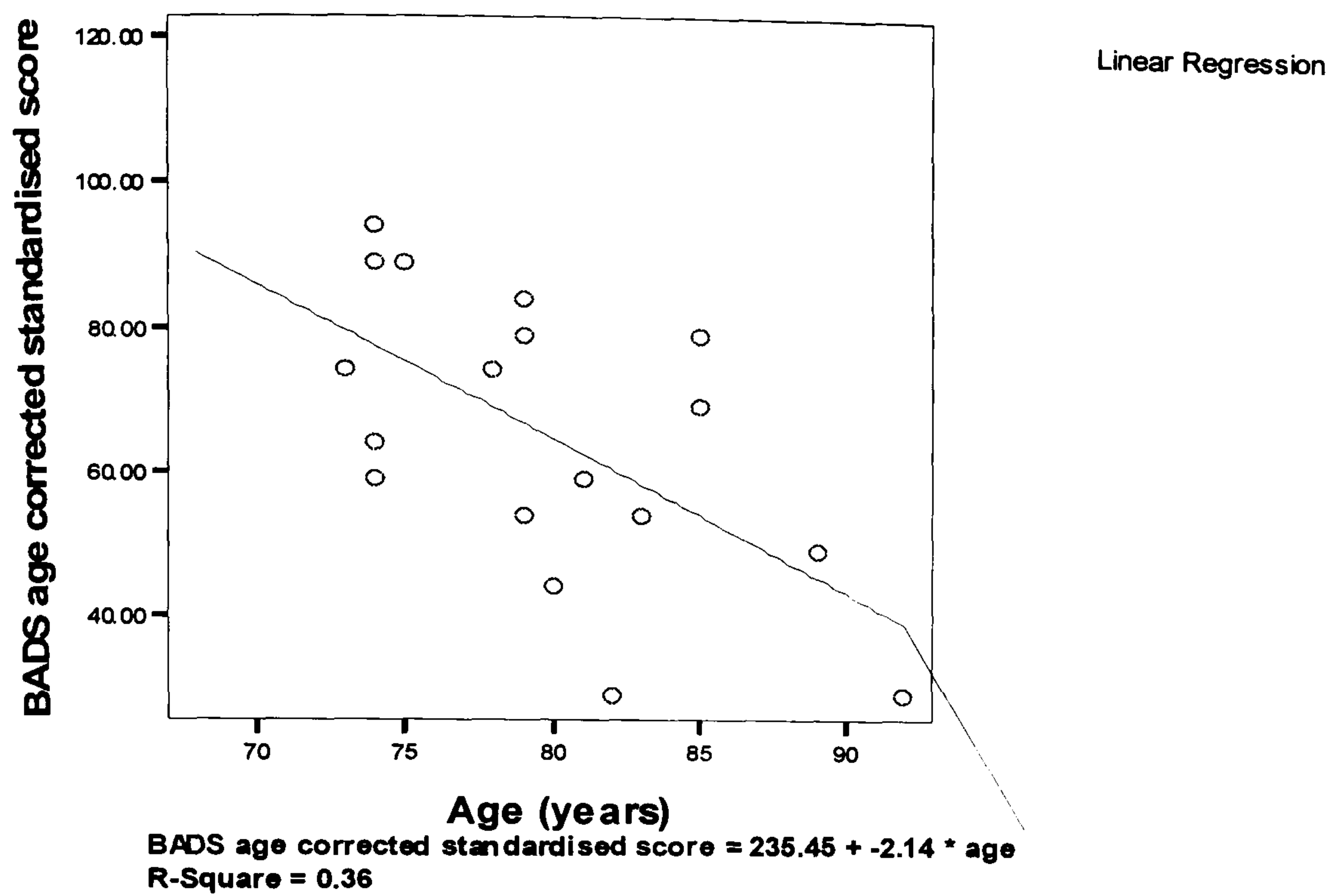
b Dependent Variable: BADS age corrected standardised score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	232.223	56.801		4.088	.001
	Age (years)	-2.107	.710	-.608	-2.969	.010

a Dependent Variable: BADS age corrected standardised score

Supplementary Figure 7: Scatterplot for BADS age-corrected standardised scores and age in early AD group



b) Model for regression using enter method:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.599	.358	.318	16.17991

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2339.146	1	2339.146	8.935	.009
	Residual	4188.631	16	261.789		
	Total	6527.778	17			

a Predictors: (Constant), Age (years)

b Dependent Variable: BADS age corrected standardised score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	235.447	57.111		4.123	.001
	Age (years)	-2.135	.714	-.599	-2.989	.009

a Dependent Variable: BADS age corrected standardised score

Regression analysis Rule Shift Cards test (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.133	.018	-.044	1.45542

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.608	1	.608	.287	.599
	Residual	33.892	16	2.118		
	Total	34.500	17			

a Predictors: (Constant), Age (years)

b Dependent Variable: Rule shift cards

profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	4.580	5.137		.892	.386
	Age (years)	-3.443E-02	.064	-.133	-.536	.599

a Dependent Variable: Rule shift cards

profile score

Regression analysis Action Program (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.274	.075	.018	1.15569

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.741	1	1.741	1.304	.270
	Residual	21.370	16	1.336		
	Total	23.111	17			

a Predictors: (Constant), Age (years)

b Dependent Variable: Action program

profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	7.425	4.079		1.820	.087
	Age (years)	-5.825E-02	.051	-.274	-1.142	.270

a Dependent Variable: Action program

profile score

Regression analysis Key Search test (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.510	.260	.214	1.14346

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.358	1	7.358	5.627	.031
	Residual	20.920	16	1.307		
	Total	28.278	17			

a Predictors: (Constant), Age (years)

b Dependent Variable: Key search

profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	10.942	4.036		2.711	.015
	Age (years)	-.120	.050	-.510	-2.372	.031

a Dependent Variable: Key search

profile score

Regression analysis Temporal Judgment test (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.574	.330	.288	.72354

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.124	1	4.124	7.877	.013
	Residual	8.376	16	.524		
	Total	12.500	17			

a Predictors: (Constant), Age (years)

b Dependent Variable: Temporal judgment profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	8.652	2.554		3.388	.004
	Age (years)	-8.965E-02	.032	-.574	-2.807	.013

a Dependent Variable: Temporal judgment

profile score

Regression analysis Zoo Map test (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.240	.058	-.001	.57486

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.324	1	.324	.980	.337
	Residual	5.287	16	.330		
	Total	5.611	17			

a Predictors: (Constant), Age (years)

b Dependent Variable: Zoo map profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	2.282	2.029		1.124	.277
	Age (years)	-2.512E-02	.025	-.240	-.990	.337

a Dependent Variable: Zoo map profile score

Regression analysis Modified Six Elements test (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.605	.366	.317	.52880

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.098	1	2.098	7.503	.017
	Residual	3.635	13	.280		
	Total	5.733	14			

a Predictors: (Constant), Age (years)

b Dependent Variable: Modified six elements profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	7.677	2.247		3.417	.005
	Age (years)	-7.790E-02	.028	-.605	-2.739	.017

a Dependent Variable: Modified six elements profile score

Regression analyses for the MCI group

Regression analysis BADS total scores

a) Model for stepwise regression:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.653	.426	.392	15.26871
2	.783	.613	.565	12.91452
3	.844	.712	.655	11.50526

a Predictors: (Constant), Age (years)

b Predictors: (Constant), Age (years), WTAR age corrected standard score

c Predictors: (Constant), Age (years), WTAR age corrected standard score, Verbal Paired Associates recognition (raw) score

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2939.363	1	2939.363	12.608	.002
	Residual	3963.269	17	233.133		
	Total	6902.632	18			
2	Regression	4234.074	2	2117.037	12.693	.000
	Residual	2668.557	16	166.785		
	Total	6902.632	18			
3	Regression	4917.067	3	1639.022	12.382	.000
	Residual	1985.564	15	132.371		
	Total	6902.632	18			

a Predictors: (Constant), Age (years)

b Predictors: (Constant), Age (years), WTAR age corrected standard score

c Predictors: (Constant), Age (years), WTAR age corrected standard score, Verbal Paired Associates recognition (raw) score

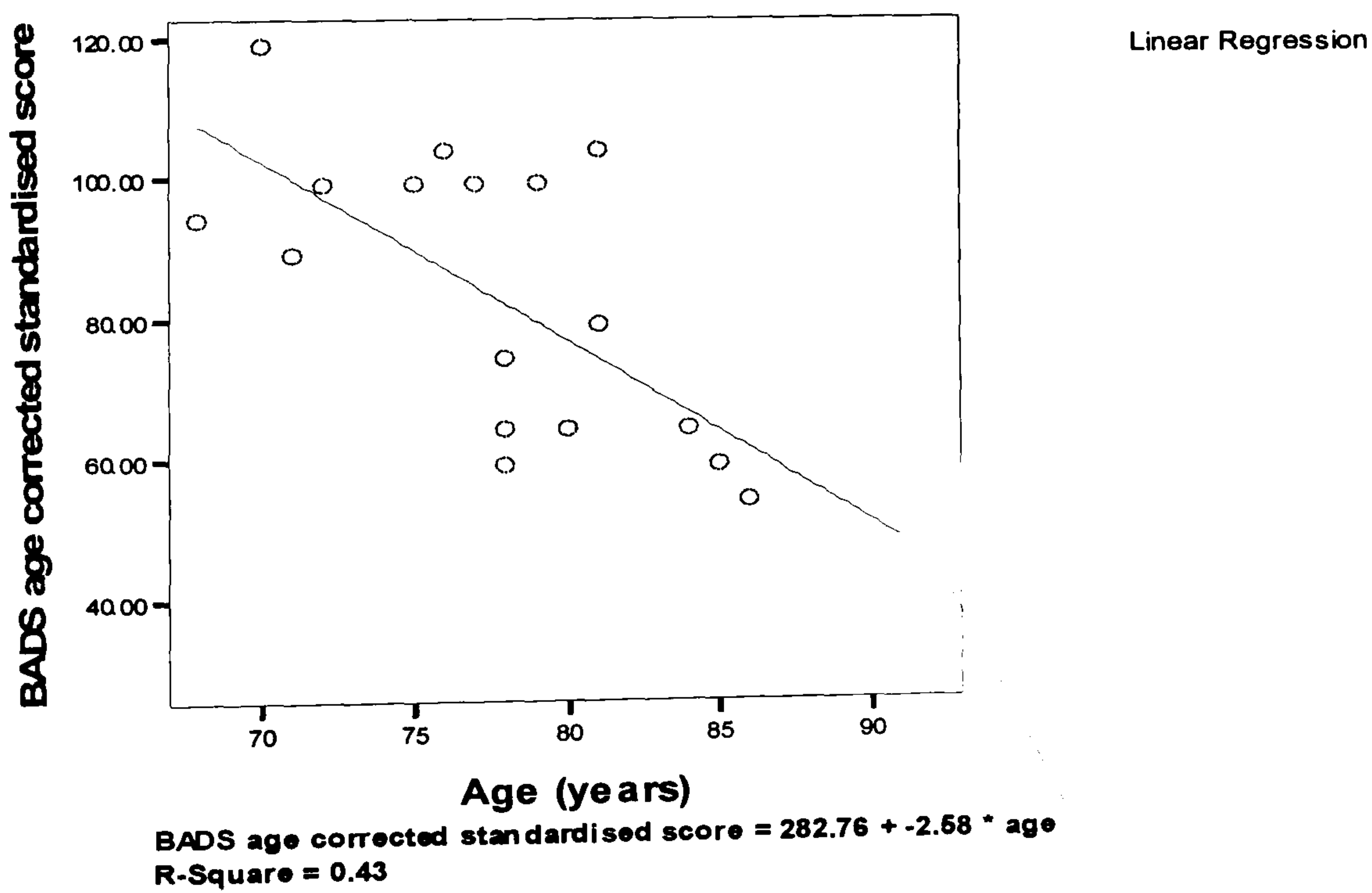
d Dependent Variable: BADS age corrected standardised score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	282.761	56.530		5.002	.000
	Age (years)	-2.575	.725	-.653	-3.551	.002
2	(Constant)	236.194	50.651		4.663	.000
	Age (years)	-3.236	.658	-.820	-4.920	.000
	WTAR age corrected standard score	.900	.323	.464	2.786	.013
3	(Constant)	168.688	54.031		3.122	.007
	Age (years)	-2.794	.618	-.708	-4.524	.000
	WTAR age corrected standard score	.791	.292	.408	2.712	.016
	Verbal Paired Associates recognition (raw) score	2.076	.914	.332	2.271	.038

a Dependent Variable: BADS age corrected standardised score

Supplementary Figure 7: Scatterplot for BADS age-corrected standardised scores and age in the MCI group



b) Model for regression using enter method:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.653	.426	.392	15.26871

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2939.363	1	2939.363	12.608	.002
	Residual	3963.269	17	233.133		
	Total	6902.632	18			

a Predictors: (Constant), Age (years)

b Dependent Variable: BADS age corrected standardised score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
		B		Beta		
1	(Constant)	282.761	56.530		5.002	.000
	Age (years)	-2.575	.725	-.653	-3.551	.002

a Dependent Variable: BADS age corrected standardised score

Regression analysis Rule Shift Cards test (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.124	.015	-.042	1.44602

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.559	1	.559	.267	.612
	Residual	35.546	17	2.091		
	Total	36.105	18			

a Predictors: (Constant), Age (years)

b Dependent Variable: Rule shift cards

profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	5.078	5.354		.949	.356
	Age (years)	-3.551E-02	.069	-.124	-.517	.612

a Dependent Variable: Rule shift cards profile score

Regression analysis Action Program (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.253	.064	.009	1.10053

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.410	1	1.410	1.164	.296
	Residual	20.590	17	1.211		
	Total	22.000	18			

a Predictors: (Constant), Age (years)

b Dependent Variable: Action program profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	7.388	4.075		1.813	.087
	Age (years)	-5.641E-02	.052	-.253	-1.079	.296

a Dependent Variable: Action program profile score

Regression analysis Key Search test (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.440	.193	.146	1.41164

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.124	1	8.124	4.077	.060
	Residual	33.876	17	1.993		
	Total	42.000	18			

a Predictors: (Constant), Age (years)

b Dependent Variable: Key search

profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
		B		Beta		
1	(Constant)	12.532	5.226		2.398	.028
	Age (years)	-.135	.067	-.440	-2.019	.060

a Dependent Variable: Key search

profile score

Regression analysis Temporal Judgment test (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.212	.045	-.011	.78417

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.494	1	.494	.803	.383
	Residual	10.454	17	.615		
	Total	10.947	18			

a Predictors: (Constant), Age (years)

b Dependent Variable: Temporal judgment

profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
		B		Beta		
1	(Constant)	4.649	2.903		1.601	.128
	Age (years)	-3.337E-02	.037	-.212	-.896	.383

a Dependent Variable: Temporal judgment

profile score

Regression analysis Zoo Map test (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.840	.706	.688	.55512

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.551	1	12.551	40.729	.000
	Residual	5.239	17	.308		
	Total	17.789	18			

a Predictors: (Constant), Age (years)

b Dependent Variable: Zoo map

profile score

Coefficients

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	14.196	2.055		6.907	.000
	Age (years)	-.168	.026	-.840	-6.382	.000

a Dependent Variable: Zoo map

profile score

Regression analysis Modified Six Elements test (enter method)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.311	.097	.037	1.09405

a Predictors: (Constant), Age (years)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.928	1	1.928	1.611	.224
	Residual	17.954	15	1.197		
	Total	19.882	16			

a Predictors: (Constant), Age (years)

b Dependent Variable: Modified six elements

profile score

Coefficients

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	7.921	4.395		1.802	.092
	Age (years)	-7.204E-02	.057	-.311	-1.269	.224

a Dependent Variable: Modified six elements

profile score

CRITICAL REVIEW PAPER

Critical Review

Is the Behavioural Assessment of the Dysexecutive Syndrome test battery a useful instrument to assess executive function difficulties in Mild Cognitive Impairment and early Alzheimer's Disease?

[Unpublished thesis: Kreutz, M. (2004). *Performance of People with Mild Cognitive Impairment or early Alzheimer's Disease on the Behavioural Assessment of the Dysexecutive Syndrome Test Battery.*]

Question: Do patients with Mild Cognitive Impairment (MCI) show decline on a battery of executive function tasks that is similar in pattern to decline in patients with early Alzheimer's Disease (AD) but milder in degree of impairment?

Design: A cross-sectional, quasi-experimental design with two clinical groups.

Setting: Memory clinics, dementia care services or older adult psychology at three centres in the North London and Essex areas serving urban, suburban and rural communities.

Participants: 37 community dwelling patients (45.9% male) aged 68 to 92 (mean age 78.76). 18 participants had a clinical diagnosis of early AD (ICD-10 / NINCDS-ARDRA), the other 19 participants showed mild cognitive impairment (Petersen criteria). Exclusion criteria were currently unremitted major psychiatric disorder, known history of significant brain injury, history of alcohol abuse and brain pathology incompatible with an AD diagnosis, the latter only, if this was known at the time of recruitment (not all participants had undergone scans). People were not removed from the sample if minor strokes were reported at a later stage.

Main outcome measures: Performance in executive functioning as assessed by BADS (Behavioural Assessment of the Dysexecutive Syndrome) total scores and subtest profile scores.

Main results: Average performance in the MCI group fell more than 1 SD below norms for the older adult population, and in the AD group more than 2 SD below norms, but impairment in executive functioning was not ubiquitous. The difference between the two groups was significant, but patterns of performance across BADS subtests were similar in both groups. Despite availability of age-corrected norms ‘age’ had a considerable impact on executive functioning. Other control variables (memory, premorbid functioning, and depression) were non-contributory.

Conclusion: A battery of executive function tasks was superior in detecting mild decline compared to individual subtests. However, different subtests seemed differentially suited to detecting decline in either group. Whereas the MCI group showed nearly no decline on some subtests, people with AD showed a floor effect on another subtest, which might reflect difficulty processing instructions as well as executive function difficulties. As increased age led to poorer performance on this test battery, it might be recommended to improve age-correction of this instrument, particularly at the higher end of the age spectrum. Use of the full battery does not seem advisable for people with established dementia, but would seem useful in cases of diagnostic uncertainty.

Issues in executive function research

Research into executive function is notoriously difficult. Although attempts have been made to define the construct (Lezak, 1995; Phillips, 1997; Schmidt, 2003; Sbordone, 2000) executive function is a very broad concept, and its operationalisation in research is not straight forward. Some authors have attempted to separate aspects of executive functioning and consider the clinical consequences, if functioning of any particular aspect breaks down (Sbordone, 2000). More theoretically oriented authors have started to discuss fractionation of executive function (Burgess, 1997; Collette et al, 1999; Rabbitt, 1997; Stuss and Knight, 2002), considering it as a system of functions analogue to the way we think about different components of the memory system. However, little clarity exists what

might be the constituent components of such an executive function system. Hence from a pragmatic point of view, use of multiple tasks to assess executive function can be considered a strength of the above project.

Theoretically, the central executive component of Baddeley and Hitch's working memory model (Baddeley, 1986; Baddeley and Hitch, 1974) and Shallice's 'Supervisory Attentional System' (Shallice, 1982) have been at the centre of the cognitive debate on models of executive control. However, alternative models include Goldman-Rakic's (in Phillips 1997) proposal that the frontal cortex acts as a working memory system that provides cohesion between elements of complex tasks, and their model does not need to postulate a central executive component. What is notable about all three models is the postulated close association between executive function and other cognitive abilities, specifically attention and working memory. Other memory functions have also been postulated to fall under executive control, (Craig & Grady, 2002, Shallice, 1982), and within the debate on cognitive aging this has sparked an 'executive function hypothesis' of aging (Craig & Grady, 2002). It may therefore have been interesting to include a wider range of additional cognitive tasks in the above study, specifically a working memory task (this will be discussed in more detail below). The above models may also explain cognitive congruence between executive function and memory tasks to some degree.

As no prototypical executive function task exists (Rabbitt, 1997) nor clarity over which components would make up a fractionated executive function system, executive function research generally faces a challenge when specific tasks have to be chosen for inclusion in a study. It is common for patients to fail some, but not other executive function tasks (Burgess, 1997), hence where research is interested in clinically significant change in executive functioning, a single task approach would not seem sufficient, whereas a single task approach might be better suited to help theoretical development. Specific criticisms of individual tests have been discussed elsewhere (literature review and introductory chapter of thesis), and will not be repeated here. However, even when multiple tasks are selected, the theoretical importance of some tasks might remain unclear, specifically as many commercially

available tests were originally developed solely for the clinical purpose of detecting frontal lobe injuries in patients with head trauma (Wilson et al., 1996) rather than from a theoretical perspective.

Yet, the relationship between neuropathology of the frontal lobes and performance on executive function tasks is far from perfect, and other brain structures have also been implicated in impaired executive functioning (Wilson et al., 1996), particularly on dual task paradigms (Morris, 1996, 1997). On the other hand, some tests that have been developed on a theoretical basis present clinicians with problems, for example, instruments might not be readily available, might be impractical, if they rely on laboratory equipment (Baddeley et al., 1997), and test results might not translate easily into predictions how cognitive difficulties will affect a person in their everyday life (Wilson et al., 1996). Whilst Wilson et al. (1996, 1998) have specifically selected tasks for the BADS on the basis of high ecological validity, they only provide a generic theoretical context for the construction of their battery, whereas the rationale for the choice of specific subtests tends to be presented descriptively rather than explicitly theoretic. Advantages of and difficulties with using the BADS with the specific clinical samples studied for the above research project are discussed in the following.

Implications for Clinical Practice

Advantage of total scores

Use of a battery of executive functioning tests, i.e. completion of the entire BADS with all participants (or at least five of six subtests to calculate a pro-rated total score), has had distinct advantages over the use of individual subtests. Differences between the two clinical groups (MCI and early AD) were most obvious on total scores, whereas differences on some of the subtests were less pronounced, hence failed to achieve statistical significance. Similarly, relative decline of the groups compared to mean scores of the standardisation sample were most obvious on total scores compared to differences in subtest scores. This is particularly true for the MCI group, who performed near average on some of the subtests, despite the caveat that subtest mean scores were only available for the whole standardisation sample, not

the subset of age matched peers. Similar patterns of performance in both clinical groups studied suggest that executive function difficulties can be detected early and inclusion of suitably sensitive measures of executive functioning in longitudinal research is recommended.

Total scores were also useful to assess for mild decline in individuals. Clinical practice is concerned with the assessment of individuals rather than groups. Whereas other tests of executive functioning (e.g. Trail Making Test, Reitan, 1958; Wisconsin Card Sorting Test (WCST), Heaton, 1981) also provide norms that allow indicating mild decline, integration of test results become less straightforward, if an individual performs at somewhat different levels across different tests of executive functioning. Compared to the Wisconsin Card Sorting Test, which is sometimes described as the best available test of executive functioning (Kolb and Whishaw, 1985), the BADS takes no longer to complete, but does not only provide information on a broader range of executive functioning difficulties, but can inform on areas in need of assistance and suitable rehabilitation methods more directly. For example, a person's performance on the Zoo Map Test might highlight that the individual can no longer develop and organise an effective plan him/herself, but is still able to carry out a plan accurately, if provided with step-by-step instructions.

All subtests are equal, but some subtests are more equal than others

In some respects the Key Search test seemed the most appropriate individual subtest from this battery for use with the populations under study, although group differences on this subtest had not become significant nor did the MCI group seem to perform significantly worse than the standardisation sample on this task. Of all subtests, the Key Search task was most highly correlated with overall test performance. Many participants appreciated the everyday relevance of this task and generally seemed to understand the instructions, once questions had been clarified. Like many of the BADS subtests it required developing and implementing an appropriate plan of action, but unlike the Zoo Map and Modified Six Elements subtests it seemed to make less demands on memory, as no constraining rules had to

be considered for its completion. Hence the Key Search test seemed equally suited for use with MCI and early AD participants.

To calculate total scores all subtests of the BADS are treated as equal and raw scores are first converted to profile scores that have the same scale for all subtests ('0'/low to '4'/high). Whereas this should principally be seen as an advantage, it is not without drawbacks. Different subtest seemed to have different levels of 'difficulty', not just in the present sample, but also for Wilson et al.'s (1996) standardisation sample. However, difficulty of task demands and difficulty achieving a high score do not in all cases go hand in hand for the different subtests of the BADS. The standardisation sample showed near perfect average performance on some subtests (Action Program, Rule Shift Cards and Modified Six Elements), yet performed at what could be seen as a 'borderline' level on the Temporal Judgment test. The Temporal Judgment subtest seems problematic, as each profile score corresponds to correctly answering one item on the subtest. As average number of correct answers is around '2' in the standardisation sample, level of performance on this test by an individual becomes difficult to interpret. As a score of '4' could not be described as 'superior' it would seem equally unjustified to denote a score of '0' as failure. The median for performance in both clinical groups studied was in fact '2', and it does seem surprising that at group level the participants with MCI did actually perform better than the early AD group. Whereas instructions for this test are simple, performance might be affected, if the person shows decline in semantic memory, hence a dementia group might perform worse on this subtest for reasons other than loss in executive functioning.

Conversion to profile scores also seemed problematic for the Rule Shift Card subtest. By and large people either managed to shift rules, leading to few, if any errors, or perseverated on the original rule, maximising errors. Time penalties were only awarded in a minority of cases, and slowed processing may be observed in older adults without presence of executive function difficulties. Hence the distribution of scores appeared bimodal rather than truly corresponding to a five-point scale. Nonetheless, this test seems sensitive to perseveration and is shorter to administer

than some other tests that require rule shifting (Brixton test, Burgess and Shallice, 1997; WCST, Heaton, 1981).

Whereas the theoretical value of the Action Program subtest as a novel problem solving task seemed sound, its practical value did not emerge as clearly. Both groups performed best on this subtest and only few people needed more than just initial help. However, participants showed some qualitative differences in the way they approached the subtest that might have been related to a sense of self-efficacy regarding this task. People often spontaneously described themselves as 'good at practical things' and embraced the task, whereas others needed a lot of encouragement because they perceived it as a science task, at which they felt they had never been much good. Participants sometimes also arrived at a correct solution through what seemed pure experimentation with the material, rather than cognitive problem solving.

Some subtests did not seem well suited for use with the early AD group. Both the Zoo Map and Modified Six Elements tests have lengthy and fairly complex test instructions and many of the participants struggled with these. Whereas these tasks justifiably make high demands on planning and organisational abilities, hence executive functioning, they also rely on the ability to process and remember the instructions in the first place. Difficulty with this often led participants to focus on some aspects of the instructions at the cost of others, for example, some people focused on not breaking rules but forgot to some degree what the task at hand was, e.g. visiting the right places at the Zoo or attempting all six subtests. Whilst this might reflect a breakdown in executive function, it was felt that people were struggling to remember the instructions. Incomplete understanding of the task demands would necessarily lead to non-optimal performance. It is a shortcoming of the present research that no independent measure of processing ability (working memory) was taken, to see which impact this variable might have had on performance.

Although it had been anticipated that demands on memory would be minimised by providing additional written instructions that remained in view of the participant throughout completion of the subtest, many participants did not seem able to use these effectively, for example either forgot that they could refer to instructions or were too focused on completing what they perceived to be the task to pay attention to written material. It might be argued that a lack of monitoring one's understanding of the task and of initiating search for further information in itself reflects a breakdown in executive function. However, the role of memory cannot be disregarded completely as a few participants could be observed to start with fairly appropriate performances which then seemed to break down after a few minutes, as if the person had suddenly forgotten what it was they were doing. Zoo Map and Modified Six Elements were the only subtasks that showed some moderate correlations with performance on the memory task.

Overall suitability of the BADS

As a number of people with dementia had difficulty coping with several tasks of the BADS, some struggling even with understanding the requirements of the easiest tasks, habitual use of the whole battery with this client group cannot be recommended. If a person struggles to understand some of the simpler instructions, for example those of the Key Search test, it might not be professionally/ethically appropriate to ask them to attempt the most difficult tasks, such as the Modified Six Elements test, if the main aim is assessment for deficit rather than to inform rehabilitation. There may of course be situations when using the more difficult tasks is still appropriate, for example using the Zoo Map tests to gain understanding how much a person might profit from written instructions to help maintain a higher level of functioning. Thus for this clinical group use of individual subtests might be more indicated in contrast to advantages of total scores with other clients. Validity of test results with regard to reflecting executive functioning deficits might also be called into question, if instructions are not understood, and hence tests might have been failed for a variety of reasons. To assess executive functioning validly in early Alzheimer disease tests need to be chosen that rely as little as possible on subordinate skills that are affected early on in the disease process. Whereas a number

of primary skills, such as perceptual skills, remain intact, memory is almost always affected (Morris, 1997, 1998). To the extent that executive function tasks draw on memory ability, interpretation of decline on test performance becomes ambiguous.

By contrast, at least a majority of people from the MCI group seemed to understand test instructions reasonably well, although a number of people from this group also struggled with the Modified Six Elements test. Overall, the BADS seemed much better suited to assessing people with milder degrees of cognitive decline / executive functioning difficulties. As discussed above, total scores seemed to provide the best measure of mild impairment, hence use of the complete battery would be recommended. Therefore, the BADS would be an appropriate tool to use clinically when there is uncertainty about the diagnosis, and possibly the prognosis of a client. Similar patterns of performance in both the early AD and MCI group reinforce the potential of this tool to detect decline early, but longitudinal research would have to be completed to decide, if mild impairment in executive functioning in a person with Mild Cognitive Impairment has prognostic value in detecting people who are likely to make the conversion to dementia.

The problem of the age effect

The occurrence of an age-effect on performance on the executive functioning tasks in the two clinical samples presents a problem for the clinical use of the BADS. More theoretical difficulties with interpreting this effect have already been discussed in the thesis itself, and will not be repeated here. It might be possible that age-correction of BADS standardized scores has not been achieved to an optimal degree based on the Wilson et al. sample (1996), and/or that the current sample differs in important respects from the older adults participating in the validation study of the BADS. As there was no comparable association between age and performance on Verbal Paired Associates or the Wechsler Test of Adult Reading in the current sample, and both of these tests provide separate norms for each five year age range, it may be indicated to establish more finely graded norms for the BADS as well, as currently only one reference score is provided for the 65+ age group. No separate demographic information is provided for the older adult subgroup of Wilson et al.'s

sample, hence it has not been able to ascertain, if the current sample might have had a significantly higher mean age or differed on other variables. An obvious difference lies in the populations from which both samples were drawn, i.e. normal controls versus clinical sample. If Wilson et al.'s sample had been biased toward people who showed 'optimal' aging, age effects might have been less pronounced in their sample. On the other hand, age effects should be diminished in a clinical sample for which cognitive decline is presumed to be based on pathological changes in the brain.

Cognitive assessment of older adults

Neuropsychology takes a very positivistic attitude to assessment. Although measurement errors are taken into account by calculating confidence intervals, test scores are largely considered as reflecting the 'true' ability of an individual. Environmental influences and practice effects on level of cognitive abilities are not generally taken into consideration. It is well known that practice improves performance on psychometric scales to some degree, and for example practice effects are considered when a person is retested.

However, practice effects do not only play a role in the narrow context of test-retest performance, but in the practice of cognitive skills as they are applied in daily life, such as remembering to do tasks, managing finances and many other examples from everyday life. Some degree of loss of function might occur due to lack of practicing a particular skill. Arguably, skills such as planning effectively and making decisions need to be used more frequently when a person is still actively integrated in an occupational role and has to balance this with his or her private life. Societal expectations of retirement are that life will take a slower pace, and although this may not be true for each individual case, many older adults have more time at their hands to do fewer things that need to be done. Sometimes, more complex tasks, such as handling bills, are taken over by adult children in the good intention to help the older person.

Kitwood (1996) has written extensively about the adverse effects of lowered expectations and environmental responses to such expectations that lead to more

rapid decline in dementia, as the person does not only become deskilled due to neuropathological changes, but also due to environmental responses which Kitwood calls 'malignant'. In turn their environment becomes impoverished, as the person receives less stimulation by not doing tasks for themselves. Kitwood is not the only person to challenge the idea of an exact correspondence between the degree of brain pathology and degree of observed cognitive decline. In his findings from the Nun study Snowden (1997, 2001) reports on people with retained cognitive function and no functional decline in their familiar surroundings despite abundant evidence of Alzheimer Disease pathology in their brains. Whereas Kitwood (1996) highlights the possibility of rapid functional decline in the absence of equally rapid worsening neuropathology, Snowden (2001) highlights the possibility of maintained functioning despite presence of extensive neuropathology. Hence the implicit assumption in cognitive science that decline is expected to be linear, does not seem tenable. Environmental influences on functioning should not be neglected.

This has several clinical implications. Cognitive tests of skills that older adults do not need to practice as much, might have less validity for them. Tasks might have less face validity, for example a number of participants did not only feel overwhelmed by the Modified Six Elements task but also queried why they were asked to do it. Or the ecological validity might also be reduced: despite apparent difficulties on a cognitive test, the person might continue to be able to use the same skill in everyday tasks, because of greater familiarity with their routine tasks. An advantage of the BADS over other executive function tests is that it was constructed to resemble everyday tasks as much as possible. Kitwood's (1996) findings suggest the importance of educating relatives and carers of the person with cognitive difficulties about the importance of encouraging the person to retain roles and practice skills as much as possible, for example practice executive skills by helping make plans and decisions.

Research Implications

Reflection on the research process

The research project was originally started in one centre, but recruitment from at least two sites was anticipated from the beginning, as it was expected that no single centre would provide access to sufficient numbers of people with MCI. The main researcher was not clinically attached to any of the centres; hence recruitment happened through clinical teams which did not know the researcher initially. Arrangements to get introduced early on in one of the centres could not be made for reasons beyond the researcher's control. This led to later difficulties with recruitment, for example case holders requested changes to participant letters after these had already passed through the ethics committee. Numbers approached for the study is based on numbers suggested for recruitment, although there were indications that some letters did not get sent, but this could not be quantified. It also led to delays in the recruitment process, which might have led to a greater risk of participants deteriorating and potentially no longer meeting criteria by the time they were seen. It is of course valid for collaborating teams to be able to comment on the research protocol, even if their input can only be minimal. Although the main researcher had been aware of the importance of establishing positive links, practical barriers to this were probably not overcome as effectively as they should have been.

Closer liaison with clinical teams in future research is recommended. There were also drawbacks to completing this research project as a sole researcher, such as not being blind to diagnosis. Difficulties with homogeneity and validity of diagnoses have already been raised in the discussion of the thesis. Collaboration with a medically/ psychiatrically trained researcher would help overcome this shortcoming. Lack of training with regard to interpretation of neuropathological findings meant that the main researcher could not ensure fidelity to selection criteria as well as was hoped. Uneven recruitment of participants from different centres into the two clinical groups can also be seen as a shortcoming, although it is not unusual for MCI patients and early AD patients to be seen in different clinical contexts anyway, for example by a psychologist versus at a memory clinic.

Reflection on methods

The suitability of the BADS as a whole and of individual subtests for both groups studied has already been discussed above. It might prove useful to reanalyse the available data to find out, if the qualitative observation that people with MCI seemed to profit more from the structured instructions in the second part of the Zoo Map test, can be quantified and born out by the data. Such a finding would have significant implications for clinical rehabilitation, as patients are often advised to make lists to compensate for cognitive difficulties, but this strategy can only be considered useful as long as the person is still able to benefit from such structured instructions, else approaches might have to be simplified considerably. The Key Search test also has implications for rehabilitation, for example, the impact of memory problems might be perceived as greater, if the person can no longer develop effective search strategies for items that have been lost. Shortcomings of the measure for estimating premorbid intelligence and of the specific memory task used have already been considered in the discussion of the thesis.

Learning from the research

The conception of this research developed from an interest in mild cognitive impairment as a condition that has gained increasing interest in the last decade. As the research project developed it became increasingly clear that for the study of mild cognitive impairment an understanding of both normal aging and dementia is also necessary. Working with the participants I have learned about the differences of clinical expression both within and between the two clinical conditions, experience that no textbook can adequately provide. Executive functioning and pursuit of interests can be linked and affect a person's quality of life. It would seem advisable to redress the balance of clinical assessments, which still tend to focus more on memory loss, to take account of mild executive functioning difficulties as well. Both relative decline compared to estimates of premorbid functioning and actual current level of ability need to be considered for clinical planning. If future longitudinal research would identify decline in executive functioning as having prognostic value for predicting conversion to dementia, a subtle decline in high-functioning individuals should still give them early access to developing pharmacological

treatments that might slow further decline, whilst they might otherwise continue to function in the average range.

Limitations of Research

The advantages and disadvantages of researching an MCI group as found in actual clinical practice have been discussed in detail in the discussion chapter of the thesis. Despite these limitations, selection criteria seem to have excluded people with depression fairly effectively, as indicated by low mean Geriatric Depression Scale scores. Previous MCI research has been criticised for including people with depression, although interestingly, first episode depression in late life has recently been considered as a harbinger of dementia in its own right (Petersen, 2003). Heterogeneity of people in the early AD group might have been increased by response to medication in this group, such that medication helped some people maintain function in the mild dementia range who might have otherwise fallen into the moderate range of severity.

A further shortcoming of the current research is that working memory was not assessed separately. It was felt that the ability to process information efficiently that is provided in the instructions of the BADS could have played a considerable role in performance on subtests. Although great efforts were made to ensure participants understood the test instructions there were limits to achieving this. The Wilson et al. (1996) validation sample might also not have been the best comparison group for the current research, despite including a greater number of participants than could have been seen for the current project.

Recommendations for future research

Future research should consider including a comparison group of normal controls. Multi-method assessment of executive functioning, including cognitive tests, self-report and informant report measures, such as the DEX (Wilson et al., 1996) would expand our understanding with regard to objective decline, awareness of the person and perception of decline by significant others. As the DEX enquires about the experience of executive function difficulties in everyday situations this might help

close the gap between cognitive assessment and everyday functioning even further than the BADS achieves due to high ecological validity. Inclusion of a scale on Instrumental Activities of Daily Living (activities such as managing finances) would also add to this line of research. However, selection of measures should be considered with theoretical as well as pragmatic rationales in mind, as the value of results from executive function research with respect to theory development cannot always be readily perceived. Control variables that were not included in the present study should be considered for future research, including a working memory and processing speed measure, and assessment of sensory function. As differences in level of functioning between people with mild cognitive impairment and normal controls as well as between people with MCI and people with early dementia are considerable, i.e. effect sizes are large, research with relatively small groups still yields sufficient power to produce interesting results.

References

- Baddeley, A. D., Della Sala, S., Grey, C. Papagno, C. and Spinnler, H. (1997). Testing Central Executive Functioning with a Pencil-and-paper test. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.
- Baddeley, A. D. (1986). Working Memory. Oxford: Oxford University Press.
- Baddeley, A.D., and Hitch, G. (1974). Working Memory. In G. H. Bower (Ed.), The psychology of learning and motivation, Vol.8, pp. 47-89. New York: Academic Press.
- Burgess, P. W. (1997). Theory and Methodology in Executive Function Research. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.
- Burgess, P. W., & Shallice, T. (1997). The Hayling and Brixton tests. Manual. Bury St. Edmunds: Thames Valley Test Company.
- Collette, F., Van der Linden M., and Salmon, E. (1999). Executive Dysfunction in Alzheimer's Disease. Cortex, 35, 57-72.
- Craik, F. I M & Grady, C. L. (2002). Aging, Memory, and Frontal Lobe Functioning. In: D. T. Stuss. & R. T. Knight (eds.), Principles of Frontal Lobe Function. Oxford: Oxford University Press.
- Heaton, R. K. (1981). Wisconsin Card Sorting Test (WCST). Odessa, Fl.: Psychological Assessment Resources.
- Kolb, B., and Wishaw, I. Q. (1985). Fundamentals of Human Neuropsychology. New York: W. H. Freeman.

Kitwood, T. (1996). A dialectical framework for dementia. In: R. T. Woods (Ed.). Handbook of the clinical psychology of ageing. Chichester: Wiley.

Lezak, M. D. (1995). Neuropsychological assessment (3rd ed.). New York: Oxford University Press.

Morris, R. G. (1997). Cognition and ageing. In: R. Jacoby & C. Oppenheimer (eds.), Psychiatry in the Elderly. Oxford: Oxford University Press.

Morris, R. G. (1996). The Neuropsychology of Alzheimer's Disease and Related Dementias. In: R. T. Woods (Ed.). Handbook of the clinical psychology of ageing. Chichester: Wiley.

Phillips, L. H. (1997). Do "frontal tests" measure executive function? Issues of assessment and evidence from fluency tests. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Rabbitt, P. (1997). Introduction: Methodologies and Models in the Study of Executive Function. In: P. Rabbitt (Ed.), Methodology of Frontal and Executive Function. Hove: Taylor & Francis.

Reitan, R. M. (1958). Validity of the Trail Making Test as an indicator of organic brain damage. Perceptual and Motor Skills, 8 271-276.

Sbordone, (2000). The Executive Functions of the Brain. In: G. Groth-Marnat (Ed.), Neuropsychological assessment in clinical practice. A guide to test interpretation and integration. New York: John Wiley.

Schmidt, M. (2003). Hit or Miss? Insight into Executive Functions. Journal of the International Neuropsychological society, 9 (6), 962-964.

Shallice, T. (1982). Specific impairments of planning. Philosophical Transactions of the Royal Society London, B, 298, 199-209.

Snowdon, D. A. (2001). Aging with Grace: The Nun Study and the science of old age. London: Fourth Estate.

Snowdon, D. A. (1997). Aging and Alzheimer's Disease: Lessons from the Nun Study. The Gerontologist, 37 (2), 150-156.

Stuss, D. T. & Knight, R. T. (Eds.) (2002). Principles of Frontal Lobe Function. Oxford: Oxford University Press.

Wilson B. A., Evans, J., Emslie, H., Alderman, N., and Burgess, P. (1998). The Development of an Ecologically Valid Test for Assessing Patients with a Dysexecutive Syndrome. Neuropsychological Rehabilitation, 8 (3), 213-228.

Wilson B. A., Alderman, N., Burgess, P., Emslie, H., and Evans, J. (1996). Behavioural Assessment of the Dysexecutive Syndrome. Bury St. Edmunds: Thames Valley Test Company.