CHAPTER ONE

Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is the current diagnostic label for the clinical syndrome that is now recognised as one of the most common neurobiological/developmental disorders of childhood. Children with ADHD present with a persistent pattern of hyperactivity-impulsivity and/or inattention "that is more frequent and severe than is typically observed in individuals at a comparable level of development" (American Psychiatric Association [APA], 1994, p. 78). Although estimates of its prevalence vary considerably, ADHD is thought to affect between 3% and 9% of the school-age population, and approximately three times as many boys as girls (American Psychiatric Association, APA, 1994, 2000; Mental Health Division of Western Australia, 2000; National Institute of Health, 2000).

Children with ADHD are at an increased risk of a range of adverse outcomes, including low academic achievement, poor school performance, grade retention, suspension, and expulsion (Barkley, 1997a, 2001a). In addition, as many as 50% to 80% of children with ADHD will carry the symptoms into adolescence, and between 30% and 50% into adulthood. Where ADHD persists into adolescence and adulthood, it is associated with greater risk for poor peer and family relations, anxiety, depression, aggression, conduct problems, delinquency, early substance experimentation and substance abuse, driving accidents and speeding violations, as well as difficulties in adult social relationships, marriage, and employment (Barkley, 1997a, 2001a).

Furthermore, ADHD rarely occurs in isolation, with evidence from research indicating that as many as 50% to 80% of children with ADHD also meet the

diagnostic criteria for other disorders (Tannock, 1998). The presence of comorbidity (i.e., two or more disorders which occur at one point in time; Clarkin & Kendall, 1992) can complicate the assessment, diagnosis, and treatment of ADHD, and may result in increasingly adverse outcomes. A recent study by Langsford (1999) found that ADHD was the most comorbid of the 20 school-age disorders most commonly referred to school psychologists. While the most frequent comorbidity is with other disruptive behaviour disorders (i.e., Oppositional Defiant Disorder and Conduct Disorder), there is also evidence to suggest that ADHD children are at an increased risk of mood disorders, anxiety disorders, and specific learning disabilities, compared to non-ADHD controls (Langsford, 1999; Tannock, 1998).

Despite the considerable amount of research has been conducted on ADHD since it was first described as a clinical syndrome by Still in 1902, researchers and clinicians continue to challenge the conceptualisation of ADHD (Tannock, 1998). Thus while ADHD is one of the most extensively researched syndromes of child psychopathology, it remains one of the most controversial. While the key characteristics of ADHD have remained relatively constant, the conceptualisation of the disorder has continued to evolve as new research findings have challenged the prevailing construct (Tannock, 1998). Thus, over the years children with ADHD have been given any number of labels, suggesting that their disorder is the result of: a deficit in moral control, biological causes (such as minimal brain damage/dysfunction), hyperactivity and poor impulse control, a deficit in attention, and more recently, impaired response inhibition.

The evolving conceptualisation of ADHD

Until recently, most of the research conducted on ADHD since 1994 has relied on the conceptualisation that was established with the publication of the DSM-IV (i.e., the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders; APA, 1994; Text Revision, APA, 2000). While there continues to be some disagreement among researchers as to the exact nature of ADHD, the DSM-IV arguably represents the most widely used international diagnostic standard. Thus the DSM-IV diagnostic criteria (presented in Table 1 of the following chapter) were adopted as definitive for the purposes of the present research.

The DSM-IV conceptualises ADHD as a multiaxial disorder which comprises an inattentive and a hyperactive-impulsive symptom dimension (Lahey et al., 1994). Although most individuals with ADHD display symptoms of both inattention and hyperactivity-impulsivity, there are some individuals in whom one or the other pattern is predominant. Thus the DSM-IV delineates three behavioural subtypes of ADHD: ADHD, Predominantly Inattentive Type (ADHD-PI); ADHD, Predominantly Hyperactive-Impulsive Type (ADHD-HI); and ADHD, Combined Type (ADHD-CT).

In recent years, however, the limitations of the DSM-IV criteria have become increasingly apparent. In 1997, Barkley suggested that a new theory of ADHD was needed because the existing model (i.e., based on the DSM-IV) was purely descriptive and largely atheoretical, and provided little direction for research or treatment (Barkley, 1997a). Instead, Barkley (1997a) argued that a theory of ADHD should serve as a scientific tool that could explain the findings of previous research and make explicit predictions about new phenomena that

might be observed and tested, thus advancing the understanding of ADHD. Furthermore, Barkley (1997a) posited that a theory of ADHD should link the disorder to an abnormality in normal human development, and advance a range of specific and testable hypotheses that will give rise to further research and provide a means of falsification.

Barkley (1997a) subsequently drew together the earlier work of Quay, Bronowski's theory of human language, and Fuster's theory of prefrontal functions, to construct a Unifying Theory of ADHD. In this Barkley argued that the primary impairment in ADHD was one of response inhibition, and that this in turn resulted in secondary impairments in four executive functions (i.e., those self-directed behaviours that are responsible for self-control). These executive functions were non-verbal working memory, verbal working memory, the self-regulation of emotion, and reconstitution (i.e., behavioural analysis and synthesis). According to Barkley, the successive chain of impairments in response inhibition and the executive functions give the appearance of poor sustained attention in children with ADHD, when in fact the disorder actually represents a reduction of the control of behaviour by internally represented information (i.e., self-control).

A range of other theories have, over the years, been proposed in an attempt to best account for the observed manifestations of ADHD. Zentall's (1985) optimal stimulation theory, Sergeant's (2000) use of the cognitive-energetic model developed by Sanders (1983), and Sonuga-Barke et al.'s (1996) notion of delay aversion in children with ADHD, are among the most prominent. However few, if any, of these theories are as comprehensive or testable as the model proposed by Barkley (1997a). Whilst most of these models have sought a single unitary cause - whether biological, neurological, or genetic - which now

appears increasingly unlikely (Tannock, 1998), they have also served to provide a focus for research.

The limitations of previous research

The recent development of theories that focus on the component problems which underlie ADHD represents a significant advance in the field (Tannock, 1998). Previously, most of the research conducted on the nature of ADHD was exploratory and descriptive, rather than theoretically motivated (Taylor, 1996). In addition, the existing research in this area has been weakened by the incessant changes in the conceptualisation of ADHD, and hampered by a number of confounding factors. That few studies have attempted to control for these factors might help to explain the inconsistent findings across studies (Tannock, 1998). These factors include:

Limited sample sizes

Many previous studies of children with ADHD have been conducted using small sample sizes, which limits their statistical power and hence the generalisability of their findings. The reliance on small samples also demands that the findings of such studies be interpreted with caution until the results can be replicated with larger samples. Due to the over-representation of boys among the ADHD population, few studies have been conducted involving girls (e.g., Houghton et al., 1999; Seidman, Biederman, Faraone, Weber, & Oullette, 1997).

In addition, few studies have included sufficient numbers of ADHD-PI children to permit comparisons to be drawn between the different ADHD subtypes, despite evidence to suggest that the developmental course of the hyperactive-

impulsive and inattentive symptom clusters might differ (e.g., Lahey et al., 1994). Yet recent genetic research (Willcutt, Pennington, & DeFries, 1999) has suggested that the two ADHD symptom clusters might be etiologically distinct. In a study of 373 twins, selected because one twin showed evidence of learning difficulties, Willcutt et al. (1999) found that whilst extreme inattention was highly heritable regardless of the presence of hyperactivity-impulsivity, the same was not true for hyperactivity-impulsivity in the absence of inattention. This result appears to be in line with Barkley's (1997a) suggestion that the ADHD-PI might represent a different disorder entirely, with a qualitatively different impairment in attention. However, since the risks associated with ADHD are generally thought to reside with the hyperactive-impulsive symptom cluster (Tannock, 1998), a number of current theories (e.g., Barkley, 1997a) have focused on this to the exclusion of the ADHD-PI subtype.

Inadequate controls

The failure to adequately control for a number of factors that relate to the samples of ADHD and control children being studied may also have served to confound the results of earlier research. These include the use of now superseded diagnostic criteria (such as DSM-III or DSM-III-R), an insufficient number of control children, or the use of poorly matched control groups. Although Barkley (1997b) argued that matching the ADHD and control groups on IQ is may be inappropriate since slightly depressed IQ might be characteristic of the ADHD population, there is no similar argument against matching on age. Indeed, given that the DSM-IV (APA, 1994; Text Revision, APA, 2000) requires ADHD symptoms to be of "a degree that is maladaptive and inconsistent with developmental level" (p. 83 and p. 92 respectively), the use of appropriate age controls would appear essential in this and subsequent research.

In addition, while stimulant medication has been found to improve aspects of executive and attentional functioning (Barkley, 1990), thereby giving rise to a potential medication effect (Houghton et al., 1999), many previous studies have failed to adequately control for the use of stimulant medication (Barkley, 1997b). For example, in a naturalistic study of neuropsychological functioning in 118 boys with ADHD, Seidman, Biederman, Faraone, Weber, and Ouellette (1997) reported that 68% of the ADHD participants were medicated at the time of testing.

Comorbidity

Comorbidity, whether diagnosed or undiagnosed, has also been identified as a frequent confounding factor in the existing research. While this may, at least in part, be due to the extensive comorbidity between ADHD and other disorders (see Tannock, 1998; Langsford, 1999), the present study sought to examine only those ADHD boys who had no diagnosed comorbidity. In order to achieve this, the ADHD participants used in the present study were drawn from a larger sample of approximately 3500 children with ADHD, of whom only 122 were identified as having no diagnosed comorbidity. This appears to be in line with recent evidence from Barkley (2001a) which has suggested that approximately 3% of ADHD children have no diagnosed comorbidity. Alternatively, the high rates of comorbidity in general, and evidence suggesting that comorbidity occurs more frequently than the component disorders alone occur by chance (e.g., Langsford, 1999), might suggest a need to develop new diagnostic constructs (Tannock, 1998).

Poor construct validity

In addition to the changing conceptualisation of ADHD, research has also been hampered by the inability of researchers and clinicians to reach a consensus on the definition and operationalisation of constructs such as attention and the executive functions. For example, while there is strong agreement that the concept of "executive function" does not refer to basic cognitive processes such as sensation, perception, motor activation, attention, and memory, a precise definition has yet to emerge (Tannock, 1998). Without this, the logic of many studies that have examined executive functioning in ADHD children appears almost circular, with the construct under examination effectively being defined by the measures used to assess it. However, in the present study, the information obtained from a series of semi-structured interviews with leading professionals in the field of ADHD research served to define the constructs being examined, and to inform the selection of instrumentation used to assess them.

Aims of the research

The overall aims of the present research, therefore, were to: (i) examine the current conceptualisation(s) of ADHD and its associated cognitive impairments; (ii) systematically examine these predicted impairments empirically; (iii) address the acknowledged limitations of previous research; and (iv) to further contribute to the development of theory about ADHD. The present study also sought to extend current understanding by verifying or challenging aspects of the existing theoretical models of ADHD (e.g., Barkley, 1997a), and suggesting modifications where appropriate. A particular aim of this research was to examine cognitive impairments among ADHD boys who had no diagnosed comorbid conditions and who were unmedicated at the time of testing, since

these were identified as frequent confounding factors in previous research with this population.

The present study also sought to address the issue of construct validity and the inconsistent results obtained in earlier research, by employing recently developed instrumentation specifically designed to be sensitive to the predicted impairments of children with ADHD. Thus it is anticipated that this research will also prove to be a valuable source of additional psychometric data for these measures. A final aim of this study is the dissemination of the research findings to the widest possible audience, with the aim of increasing the understanding of ADHD, and in doing so to facilitate improved outcomes for children with the disorder. Therefore, the publication of the findings of this research in a leading international journal was a desirable outcome of the present study.

Original contribution of this research

It is anticipated that this research will provide a significant contribution by developing a clearer understanding of the current conceptualisation(s) of ADHD, which is considered essential given the continuing evolution of the disorder. Study One is exploratory and will involve a comprehensive review of the theoretical and research literature, the prevailing theoretical models of the disorder (e.g., Barkley, 1997a), and a series of semi-structured interviews with leading professionals in the field of ADHD research. Study One will also serve to identify any predicted executive impairments of ADHD children and their observable manifestations, thereby ensuring that the subsequent empirical investigation of these impairments (i.e., Study Two) will be adequately operationalised. In particular, the results of Study One will guide the selection of instrumentation (to be used in Study Two) sensitive to the predicted impairments of ADHD children. In contrast, many studies of ADHD to date

have relied upon poorly defined constructs (such as the executive functions), or the instrumentation used to assess them, with the result that the findings of such studies have appeared inconsistent, thereby raising concerns as to the construct validity of the applied instrumentation.

Study Two will also attempt to address the range of methodological limitations that were identified in the review of previous research on ADHD. These included: limited sample sizes, inconsistent diagnostic procedures, poor age-matching between groups, and failure to control for comorbid disorders or medication status at the time of testing. In addition, while many current theories of ADHD are restricted to those children who present with symptoms of both inattention and hyperactivity-impulsivity (e.g., Barkley, 1997a), the present investigation also included those ADHD children who display symptoms of inattention only (i.e., ADHD-PI). While it is acknowledged that the size of the ADHD-PI sample employed was only limited (n = 14), their inclusion in the present study may provide an indication of whether the existing theories of ADHD can be extended to accommodate them, or the development of a new theory is warranted.

Chapter summary

Although a considerable amount of research has been conducted on ADHD since the syndrome was first identified, much of this research has been confounded by the evolving conceptualisation of ADHD and a number of methodological flaws. The present study seeks to address these limitations by way of an empirical investigation of the current conceptualisation(s) of ADHD. The results of this research will also serve to verify or challenge certain aspects of the existing theories of ADHD (and suggest modifications where

appropriate), and in doing so contribute to the further development of understanding about ADHD.

The following chapter describes the review of literature which served to provide the theoretical basis for the subsequent research. Those issues that arose from the review of literature which required further clarification were explored in more detail in semi-structured interviews with leading professionals in the area of ADHD research. The data obtained from these semi-structured interviews are presented in Chapter Three and discussed in Chapter Four, where they serve to inform the selection of instrumentation to be applied in Study Two. Chapter Five provides details pertaining to the design of the empirical investigation of the predicted executive impairments of ADHD children, and extends hypotheses to be tested. The results of the subsequent empirical investigation of the executive functioning of boys with ADHD are presented in Chapter Six. Finally, Chapter Seven attempts to reconcile the results of Study One and Two with the review of literature, and the aims of the research. This chapter also discusses the reconceptualisation of ADHD that is suggested by these data and provides directions for further research.