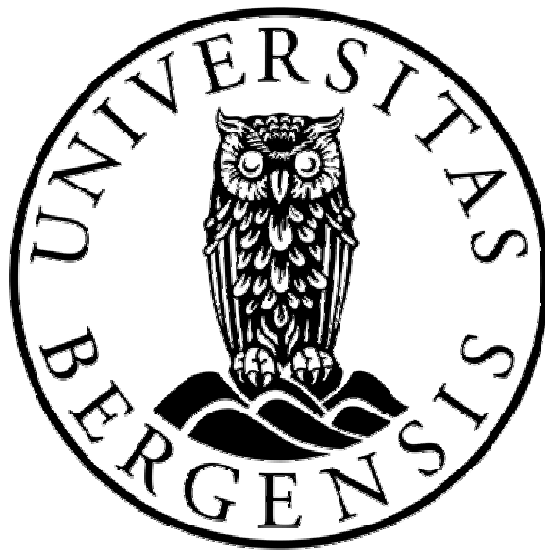


**Mental Health of African School Children**  
**Epidemiological, Clinical and Neuropsychological Studies**  
**from Kinshasa, the Democratic Republic of Congo**

**Espérance Kashala**



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**Contributors**

This PhD project is the result of cooperation between and contributions from the following units at the University of Bergen and the Centre Neuropsychopathologique, University of Kinshasa, DR Congo.

**Center for International Health (CIH)**

The CIH has provided main supervision of the candidate through Professor Thorkild Tylleskär.

**Institute of Clinical Medicine, Section of Paediatrics**

The Section of Paediatrics has provided co-supervision of the candidate through associate Professor Kristian Sommerfelt and Dr. med. Irene Elgen.

**Centre Neuropsychopathologique, Department of Neurology (CNPP), University of Kinshasa, DR Congo**

The CNPP has employed the candidate and provided co-supervision during the fieldwork through Professor Kayembe Kalula.



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**Terminology and abbreviations**

ADD	Attention deficit disorder
ADHD	Attention deficit hyperactivity disorder
CD	Conduct disorder
DAMP	Deficits in attention, motor control and perception
DAT1	Dopamine transporter
DBD	Disruptive behaviour disorder
DR Congo	Democratic Republic of Congo
DRD4	Dopamine D4 receptor
DSM-III	Diagnostic and statistical manual for mental disorders, 3 <sup>rd</sup> edition
DSM-III-R	Diagnostic and statistical manual for mental disorders, 3 <sup>rd</sup> edition-revised
DSM-IV	Diagnostic and statistical manual for mental disorders, 4 <sup>th</sup> edition
DSM-IV-TR	Diagnostic and statistical manual for mental disorders, 4 <sup>th</sup> edition-Text revised
ERS	Examiner rating scale
GDP	Gross domestic product
ICD-10	Tenth revision of the international classification of diseases: classification of mental and behavioural disorders
MD	Mood disorders
MR	Mental retardation
ODD	Oppositional defiant disorder
SDQ	Strengths and difficulties questionnaire
SDQ-HI	Strengths and difficulties questionnaire, hyperactivity-inattention scale
TDAH	Trouble déficitaire de l'attention avec hyperactivité (French abbreviation for ADHD)
WISC-R	Wechsler intelligence scale for children-revised
WHO	World Health Organisation

## List of publications

This thesis is based on the following papers, which will be referred to in the text by their Romans numerals:

- I. Kashala E, Elgen I, Sommerfelt K, Tylleskär T. Teachers' ratings on Mental Health among school children in Kinshasa, Democratic Republic of Congo. *European child & Adolescent Psychiatry* (2005) 14: 208-215.
- II. Kashala E, Lundervold A, Sommerfelt K, Tylleskär T, Elgen I. Co-existing symptoms and risk factors among African school children with hyperactivity-inattention symptoms in Kinshasa, DR Congo. *Submitted*.
- III. Kashala E, Tylleskär T, Elgen I, Kayembe KT, Sommerfelt K. Attention Deficit and Hyperactivity Disorder among African school children in Kinshasa, DR Congo. *African Health Sciences* (2005) 5: 172-181.
- IV. Kashala E, Elgen I, Sommerfelt K, Tylleskär T, Lundervold A. Cognition in African school children with Attention Deficit Hyperactivity Disorder. *Pediatric Neurology* (2005) 33: 357-364.

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## **Executive summary**

Mental health disorders frequently occur in school children but only little attention has been paid to this topic in Africa in general, and in the Democratic Republic of Congo (DR Congo) in particular. A research project on mental health among school children aged seven to nine years old was carried out in Kinshasa, DR Congo. The aims of the project were to explore mental health problems among school children in Kinshasa, an African urban setting. To perform further clinical and neuropsychological investigations on those likely to have mental problems, with a specific focus on children with attention deficit and hyperactivity disorder symptoms (ADHD).

A sequence of epidemiological, clinical and neuropsychological studies was conducted on 1187 school children in the age group 7- 9 years recruited from ten randomly selected primary schools. The Strength and Difficulties Questionnaire (SDQ) addressed to the teachers was first used as a screening tool to pilot its use in an African urban setting and to explore mental health problems. In addition, teachers were asked to give information about children's school performance. Using the 90<sup>th</sup> percentile cut-offs, 8% of children scored 8 or more on the hyperactivity-inattention scale of the SDQ (SDQ-HI) and 7% scored 7. These 15% of the studied children with the highest scores were considered likely to have hyperactivity-inattention symptoms. They were thus further studied together with a randomly selected control group, and were assessed with the Disruptive Behaviour Disorder rating scale (DBD). This evaluation with the DBD was done to assess whether or not the hyperactivity-inattention symptoms corresponded to the symptoms of attention deficit and hyperactivity disorder (ADHD) as defined according to the Diagnostic and Statistical Manual for Mental Disorder Fourth Edition (DSM-IV). The DBD scale is based on the 18-item of the DSM-IV for ADHD. In addition to the DBD evaluation, all children underwent a clinical, including a neurological examination, and a neuropsychological testing. Their parents were also interviewed regarding the socio-demographic background and the child medical history in order to identify possible associated risk factors.

The results indicate that mental health problems do exist among African school children in Kinshasa. ADHD symptoms were as common as elsewhere, with an estimated prevalence of 6%. Conduct problems were the most common co-existing symptoms. Poor school performance and family health problems were found to be the most common risks factors associated with mental health problems, especially ADHD symptoms. The neuropsychological evaluation revealed that children with ADHD symptoms had overall good cognitive functioning but exhibited motor skills impairments.

## Résumé (French summary)

Un projet de recherche sur la santé mentale des enfants en milieu scolaire a été menée à Kinshasa, en République Démocratique du Congo. Les principaux objectifs de l'étude étaient l'identification des problèmes comportementaux en milieu scolaire à Kinshasa ainsi que les facteurs de risque associés. Un total de 1187 élèves âgés de 7 à 9 ans, recrutés dans 10 écoles primaires choisies au hasard, ont été inclus à l'étude. Ces élèves ont été évalués par leur enseignants à l'aide d'un bref questionnaire comportemental, le « SDQ », pouvant être rempli par les enseignants et les parents d'élèves âgés de 4 à 16 ans ou les adolescents eux-mêmes âgés de 11 à 16 ans. En plus de l'évaluation comportementale, les enseignants ont aussi évalué les performances scolaires des élèves.

Environ 15% d'élèves ont été considérés à risque pour les symptômes d'hyperactivité-inattention sur base de leurs scores au niveau de l'échelle d'hyperactivité du « SDQ ». Les profils clinique et neuropsychologique de ces élèves ont été comparés à ceux d'un groupe témoin composé d'enfants choisis au hasard et ayant des scores normaux. Ce groupe d'élèves a en plus été évalué à l'aide de l'échelle « Disruptive Behaviour Disorder », (DBD) dans le but de déterminer si oui ou non les symptômes d'hyperactivité-inattention tels qu'identifiés par le « SDQ » correspondent aux symptômes du trouble déficitaire de l'attention avec hyperactivité (TDAH). Le DBD est une échelle basée sur les 18 questions du TDAH tel que définit selon le Manuel Diagnostique et Statistique des Troubles Mentaux, 4<sup>ème</sup> édition (DSM-IV). Les parents de ces élèves ont été interviewés sur les facteurs socio-démographiques et les antécédents médicaux de leurs enfants, à la recherche d'éventuels facteurs de risque associés.

Sur base des résultats obtenus, il a été conclu que les troubles de comportements de l'enfance existent en milieu scolaire à Kinshasa. La prévalence des symptômes du TDAH a été estimée à 6%. Les troubles de conduites sont les plus fréquemment associés aux symptômes d'hyperactivité-inattention. Les difficultés scolaires et les problèmes familiaux de santé ont été identifiés comme étant les principaux facteurs de risque associés aux troubles comportementaux, en particulier au TDAH. L'évaluation neuropsychologique des enfants présentant des symptômes du TDAH a révélé un bon fonctionnement cognitif et des troubles d'habileté motrice.

## **1. Introduction**

### **1.1 Mental health**

Mental health and normality are central issues in psychiatric theory and practice but are difficult to define (Sadock et al., 2003). From a cross-cultural perspective, it is nearly impossible to define mental health comprehensively. It is however, generally agreed that mental health is broader than a lack of mental disorder. According to the Text Revision of the Fourth Edition of the Diagnostic and Statistical Manual of Mental Disorder (DSM-IV-TR), mental disorder is conceptualised as a behavioural or psychological syndrome or pattern that is associated with distress (e.g., a painful symptom) or disability (e.g., impairment in one or more important areas of functioning) (American Psychiatric Association, 2000).

Mental disorders represent approximately 11% of the worldwide burden of disease (WHO, 2001). Unfortunately, in most part of the world and mainly in developing countries, mental health and mental disorders have been largely ignored or neglected. Few attempts have been made to improve mental well-being, as a result, there is an increasing burden of mental disorders (WHO, 2001). Of those suffering from mental or behavioural disorders, only small minorities have access to proper recognition and treatment.

Mental and behavioural disorders are also common during childhood and adolescence, but inadequate attention is paid to this area of mental health. It has been reported that 10-20% of all children have one or more mental or behavioural problems, though this prevalence figure varies considerably between studies (WHO, 2001). According to the WHO, child mental or behavioural disorders will rise to become one of the five most common causes of morbidity, mortality and disability among children by the year 2020 (WHO, 2001). However, it is important to stress the fact that in childhood and adolescence, which are developmental phases, it is difficult to draw clear boundaries between abnormal and normal phenomena that are part of development (Sadock et al., 2003). In addition, though several studies have used behavioural checklists completed by different informants such as parents and teachers, the information may not always correspond to definite diagnoses.

On the African continent, research on mental health, especially among children, has been limited. The few available studies suggested that the prevalence of psychiatric conditions in Africa is at least comparable to that of the international community (Aina, 2001; Chabwine et al., 2001; Demyttenaere et al., 2004). Besides the scarcity of research, people's attitudes towards mental health problems are strongly influenced by traditional beliefs, stigmatization and misinformation regarding mental illness (Gureje et al., 2005; Hugo et al., 2003).

Mental and behavioural problems of childhood and adolescence are distinct from those in adults because they are specific and influenced by the developmental stage of the child (Stevens et al., 2001). Also they are complex, multifactorial and may lead to behavioural impairment and learning disabilities. They interfere with normal development and have a large impact on individuals, families and communities. Besides that, they are costly to the society both in terms of human and financial resources (WHO, 2001). There is therefore a need to pay more attention to mental and behavioural disorders of childhood and adolescence.

## **1.2 Mental health assessment**

In the domain of developmental and psychiatric disorders with onset during childhood, there is no definitive diagnostic test (Scahill et al., 2000). It is a complicated task to acknowledge the presence of behavioural symptoms in childhood, as they might be age-related. However, there are different methods of assessing children behaviours of which many include rating scales and clinical observation. The rating scales are widely used both for clinical and scientific purposes. They yield scores that may be used either as continuous measures or as defined cut-off values to identify cases.

The use of rating scales or behavioural questionnaires enables to gather information on the child's behaviours. Single or multiple informants such as parents, teachers or youth themselves can provide this information. However, multiple informants are not always used as widely recommended in order to address the challenge of biased reporting (Crystal et al., 2001). Also, it is worthy to mention that some informants have turned out to be better or more valuable than others in reporting particular behaviours. This is for example the case of youth themselves, who seem to be better informants in reporting internalising behaviours (Becker et al., 2004; Hay et



al., 1999), whereas parents and teachers give better information about externalising behaviours (Tarren-Sweeney et al., 2004). In the case of attention deficit and hyperactivity disorder (ADHD), some authors mentioned that teacher's information is more useful than parent's in discriminating among the subtypes of ADHD (Crystal et al., 2001).

### 1.3 Attention deficit and hyperactivity disorder

#### 1.3.1 Definition

ADHD is a developmental disorder, which refers to children having significant deficiencies in behavioural inhibition, sustained attention, resistance to distraction, and the regulation of activity level (Eric J. Mash et al., 1998).

According to the DSM-IV (American Psychiatric Association, 1994), the following criteria are stipulated for diagnosing ADHD:

A. Either (1) or (2)

(1) Six (or more) of the following symptoms of *inattention* have persisted for at least six months to a degree that is maladaptive and inconsistent with developmental level:

- a. Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
- b. Often has difficulty sustaining attention in tasks or play activities
- c. Often does not seem to listen when spoken to directly
- d. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
- e. Often has difficulty organizing tasks and activities
- f. Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as school work or homework)
- g. Often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)
- h. Is often easily distracted by extraneous stimuli
- i. Is often forgetful in daily activities

- (2) Six (or more) of the following symptoms of *hyperactivity/impulsivity* have persisted for at least six months to a degree that is maladaptive and inconsistent with developmental level.

*Hyperactivity*

- a. Often fidgets with hands or feet or squirms in seat
- b. Often leaves seat in classroom or in other situations in which remaining seated is expected
- c. Often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
- d. Often has difficulty playing or engaging in leisure activities quietly
- e. Is often "on the go" or often acts as if "driven by a motor"
- f. Often talks excessively

*Impulsivity*

- g. Often blurts out answers before questions have been completed
- h. Often has difficulty awaiting turn
- i. Often interrupts or intrudes on others (e.g. butts into conversations or games)

- B. Some hyperactive, impulsive or inattention symptoms that caused impairment were present before seven years of age.
- C. Some impairment from the symptoms is present in two or more settings (e.g., at school or work and at home).
- D. There must be clear evidence of clinically significant impairment in social, academic or occupational functioning.
- E. The symptoms do not occur exclusively during the course of a pervasive developmental disorder, schizophrenia, or other psychotic disorder, and are not better accounted for by another mental disorder (e.g., mood disorder, anxiety disorder, dissociative disorder, personality disorder).

According to the World Health Organisation (WHO) in its Tenth Revision of the International Classification of Diseases: Mental and Behavioural Disorders (ICD-10), ADHD is referred to as Hyperkinetic Disorders (WHO, 1992). Hyperkinetic disorders are characterised by early onset, a

combination of overactivity, poorly modulated behaviour with marked inattention and lack of persistent task involvement, and their pervasiveness over situations and persistence over time.

The diagnostic definitions and criteria of DSM-IV and ICD-10 are somewhat similar, though the DSM-IV ADHD remains a more broadly defined category than hyperkinetic disorders (Thapar, A. K. et al., 2003). Indeed, the ICD-10 diagnostic guidelines, requires both impaired attention and overactivity for the diagnosis of hyperkinetic disorders.

### 1.3.2 Brief history

The term ADHD or hyperkinetic disorder is the most recent diagnostic label for children presenting with significant problems with attention, impulsiveness, and overactivity. The disorder has been labelled differently through the ages. In 1902, Georges Still, a British doctor, first described ADHD symptoms. He documented cases involving impulsiveness and called it *Defect of Moral Control*. He believed it was a medical condition rather than a spiritual one. In 1922, it got a new name, *Post Encephalitic Behaviour Disorders*. In 1930, the term of *minimal brain damage* was used. In 1937, Charles Bradley introduced the use of stimulants to treat hyperactive children, and Ritalin was first introduced as a treatment for hyperactive children in 1956. In 1960, the term *minimal brain damage* was changed to *minimal brain dysfunction*, and later on in 1968 to *hyperkinetic syndrome*. Most recently in the early 1980's, the American Psychiatric Association in its Third version of the Diagnostic and Statistical Manual of Mental Disorder (DSM-III) introduced the term *attention deficit disorder* (ADD). The ADD could be diagnosed with or without hyperactivity. In 1987, the American Psychiatric Association in the Third Revised version of the DSM-III (DSM-III-R) introduced the word hyperactivity in the diagnosis of ADD, which was then labelled ADHD. In 1994, with the publication of the Fourth Edition of the DSM (DSM-IV), and more recently the Text Revised Version of the DSM-IV (DSM-IV-TR), ADHD is classified in three subtypes according to the predominance of inattention or hyperactivity/impulsivity symptoms. In 1992, with the WHO publication of the ICD-10, hyperkinetic disorder has been defined more broadly than it was in the previous ICD-9 and its definition became almost similar to that of the ADHD definition in the DSM-IV.

### **1.3.3 Aetiology**

The exact aetiology of ADHD remains unclear. Different biological hypotheses such as genetic factors or brain abnormalities, and environmental hypotheses have been suggested:

- Genetic contributions:

Family, twin and adoption studies have showed that it is a familial and highly heritable disorder (Faraone et al., 2001; Swanson, J M et al., 1998; Thapar et al., 1999). Several studies have suggested two candidates dopamine genes, the dopamine D4 receptor (DRD4) (Barr et al., 2000; Swanson, J. M. et al., 1998) and the dopamine transporter (DAT1)(Cook et al., 1995; Gill et al., 1997). Similarly, in a meta-analysis of 21 studies, although both family-based and case-control studies have found a small association between ADHD and DRD4 7-repeat allele, Faraone et al. (Faraone et al., 2001) concluded that the association was significant enough. However, the debate continues over the role of heredity in the occurrence of ADHD, as other investigators have failed to replicate these findings (Castellanos et al., 1998; Qian et al., 2004).

- Brain dysfunctions:

Structural neuroimaging studies have shown volumetric brain abnormalities, particularly of the frontal lobe, basal ganglia, parietal lobe and cerebellum in children with ADHD (Castellanos et al., 2002; Hill et al., 2003; Sowell et al., 2003). Additionally, decreased cerebral blood flow in the prefrontal cortex and striatum has been suggested in ADHD subjects (Kim et al., 2002; Spalletta et al., 2001). Despite their tremendous contribution to our understanding of the key brain components involved in ADHD, imaging studies do not yield specific results enough to be used as a diagnostic tool (Giedd et al., 2001; Paule et al., 2000).

- Perinatal factors:

Neurobiological factors, especially those acting during the period of brain growth and leading to brain injuries, hypoxia or ischemia have also been suggested in the pathophysiology of ADHD. They include foetal exposure to alcohol, environmental toxins, drugs or cigarettes, the adverse effects of perinatal obstetrical complications or prematurity (Bradley et al., 2001; Rutter et al., 2004).

- Environmental factors:

Besides the important influence of biological factors such as genetic or brain injury in the pathophysiology of ADHD, psychosocial or environmental factors may also play a contributing role (Cantwell, 1996). It has been reported that in the presence of a genetic predisposition to ADHD, environmental factors may enhance its expression (Taylor et al., 1998). Indeed, a number of studies have reported an association between ADHD and environmental factors such as prenatal smoking, low birth weight, low parental education level or family psychosocial characteristics (Satake et al., 2004; St Sauver et al., 2004; Thapar, A. et al., 2003). According to Biederman et al. (Biederman et al., 1995) behavioural disturbances are rather associated with the aggregate of adversity factors.

#### **1.3.4 Neurochemistry of ADHD**

Several genetic studies have focused on the neurochemistry underlying the heritability of ADHD (Faraone et al., 2001). They have agreed upon the dysfunction of the dopaminergic and noradrenergic system. The evidence of the dopamine system dysfunction in the pathophysiology of ADHD is also supported by the therapeutic action of stimulant drugs that influence this system and improve ADHD symptoms (Solanto, 2002).

Dopamine is a neurotransmitter that is made from the amino acid tyrosine, and which has been implicated in numerous functions within the body, including movement, attention, learning and the reward and reinforcement aspects of addictive drugs. It is the primary neurotransmitter affected by cocaine, amphetamines and opiates. In the brain the most important three systems involving dopamine are the nigrostriatal, the mesolimbic and the mesocortical. The axons of the nigrostriatal system project to the caudate nucleus and putamen of the basal ganglia, which is involved in the control of movement. The mesolimbic and the mesocortical systems play a role in reward and reinforcement. According to Johansen et al. (Johansen et al., 2002), a dysfunction of the meso-limbo-cortical dopamine branch produces altered reinforcement and extinction processes, which in turn result in deficient sustained attention, hyperactivity, behavioural variability and impulsiveness. In addition, a dysfunctioning nigrostriatal dopamine branch will cause poor motor control.

### **1.3.5 ADHD and co-morbidities**

ADHD frequently occurs with a wide variety of co-morbid psychiatric disorders such as conduct, anxiety, depression, and learning disabilities, which may complicate the diagnosis, treatment and prognosis of ADHD (Souza et al., 2004; Waxmonsky, 2003). These co-morbidities interfere with the normal development of childhood and adolescence, and increase the risk for antisocial outcomes and personality disorders in adulthood (Fischer et al., 2002). Although, some symptoms are shared by both ADHD and co-morbid psychiatric conditions, these overlapping symptoms are independent and do not lead to spurious diagnosis of ADHD (Milberger et al., 1995). Evidence accumulated from clinical and community-based studies suggests that the prevalence of the reported co-morbidities in ADHD might be more than 50% (Barkley, 1998; Kadesjo et al., 2001). In a community-based study of Swedish school children with deficits in attention, motor control, and perception (DAMP), it was reported that 64% of them had at least one co-morbid psychiatric diagnosis (Gillberg, 1983). These findings highlight the importance of considering these co-morbidities in the management of ADHD.

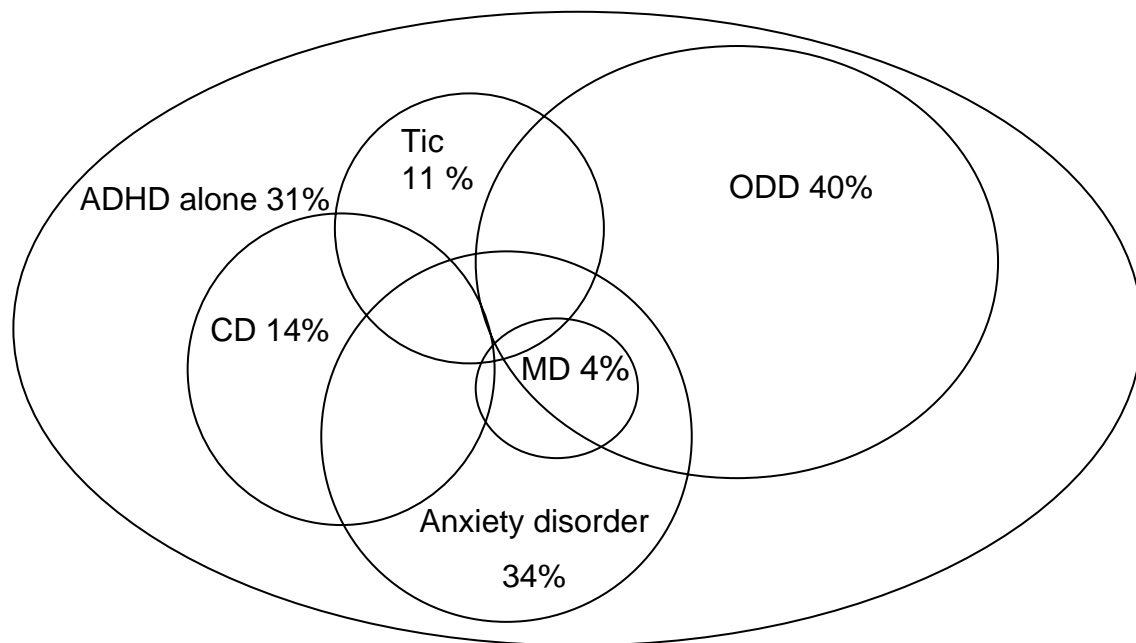
The most encountered co-morbidities are Oppositional Defiant Disorder (ODD), Conduct Disorder (CD), anxiety or emotional disorder and learning disability (Stein, 2002).

- **Oppositional and Conduct Disorder:**

It is widely accepted that children with ADHD display a greater degree of oppositional and defiant behaviour, aggressiveness, conduct problem and even antisocial behaviour. Over 65% of children with ADHD may show stubbornness, refusal to obey, temper tantrum and verbal hostility. Studies suggest that about 60% of children with ADHD meet criteria for ODD (Kadesjo et al., 2003) and 20-50% meet criteria for CD (Schubiner et al., 2000).

- **Anxiety and mood disorders:**

There is a high occurrence of emotional symptoms in children with ADHD. Studies suggest that 20-40% of children with ADHD meet criteria for anxiety and mood disorder (MD) (Jensen et al., 1997; Souza et al., 2004). This co-morbidity of anxiety or MD is often associated with a history of family or parental psychosocial distress, and reduced responsiveness to stimulant medication (Barkley, 1998).



*Figure 1 ADHD and co-morbidities in children*

Figure 1 illustrates ADHD and the co-morbidities as described in the MTA, Multimodal Treatment Study of Children with ADHD (The MTA cooperative Group, 1999).

### **1.3.6 Social and economic impact of ADHD**

The core symptoms of ADHD include levels of inattentiveness, overactivity and impulsiveness, which cause clinically significant impairments in social, academic or occupational functioning (American Psychiatric Association, 2000). The symptoms interfere with normal development and have a large impact on individuals, families and communities. Families having children with ADHD, as with other behavioural disorders, experience increased level of parental frustration, marital discord. Young people with ADHD are at increased risk of dropping out of school, teenage pregnancy and criminal behaviour (Harpin, 2005). Untreated ADHD increases the risk for future complications such as poor academic performance and learning delay, low self-esteem, poor social skills and physical injury in childhood. In Adolescence, it increases the risk for school suspension and drop-outs, academic difficulties, substance abuse, social exclusion, mood

disorders, teen pregnancy, driving accidents and delinquency. Besides that, ADHD may constitute a financial burden regarding the cost of medical care and work loss for patients and family members (Swensen et al., 2003).

### **1.3.7 Assessment of ADHD**

Behaviour and personality characteristics of children are difficult to define and assess. In the domain of ADHD, there is no definitive diagnostic test (Scahill et al., 2000). The accuracy in the diagnosis of ADHD remains difficult mainly because many of the symptoms occur frequently in childhood and the decision although guided by criteria remain subjective (Weiler et al., 1999). However, there are several ways of assessing ADHD. They include behavioural rating scales and clinical observation or interview:

#### **- Behavioural rating scales**

The uses of behavioural rating scales or screening questionnaires are one of the methods to obtain information about the child behaviour efficiently. This method is widely used and may be useful as an initial screen for the recognition of ADHD. However, it is recommended that the assessment procedure should include information from different informants, usually both parents and teachers (Gimpel et al., 2000). The information can be obtained using a structured questionnaire to be filled out by the informants, or using a semi-structured interview. In the latter case, it is the interviewer who completes the structured questionnaire. The rating scales generate scores, which above a certain cut-off point suggest that ADHD may be present. Although, these tools are useful in the recognition of ADHD and are highly correlated to the direct clinical interview, which suggest that they may be used as accurate measures of a child's behaviour to recognize symptoms of ADHD, they are not substitutes for the clinical observation (Wolraich et al., 2003).

#### **- Clinical observation or interviews:**

Typically, the clinician will obtain information from the parents and/or teachers. However, the information obtained from parents and/or teachers through the clinical interview should not be the sole method used for the clinical assessment (Thapar, A. K. et al., 2003). The clinician will need to observe the child in order to ascertain the presence or absence of ADHD and to make differential diagnosis. In addition, she/he will need to assess the level of impairment, whether or not the symptoms are developmentally inappropriate, and to identify co-morbid disorders or



other medical conditions. The clinical observation will also delineate the types of interventions/treatments needed to address the disorder, the academic and social impairment.

### **1.3.8 Treatment of ADHD**

A multimodal approach has been followed for many years in the treatment of children with ADHD. It includes pharmacological and behavioural interventions (Swanson, J M et al., 1998; The MTA cooperative Group, 1999). Research on pharmacological therapy suggests that stimulants, antidepressants and antihypertensives have proven to be useful in the management of ADHD symptoms (Mash et al., 1998).

The stimulants medications such as methylphenidate and amphetamines are considered first-line agents for ADHD symptoms treatment. They increase the availability of dopamine to the postsynaptic receptors by blocking the dopamine transporter that is involved in re-uptake of dopamine at presynaptic neurones thereby preventing re-entry of dopamine into the neurone. This results in more dopamine in the synaptic cleft, and therefore increases attentiveness, improves school performance and social relationship and decreases impulsivity (Kalat, 2004; Stein, 2002).

The use of tricyclic antidepressants such as desipramine and imipramine, or newer antidepressant such as bupropion has shown to be helpful and may have resulted from cases where stimulants have been contraindicated or non-effective (Mash et al., 1998; Swanson, J M et al., 1998). They are generally considered second-line drugs of choice for ADHD. Although, less is known about their pharmacokinetics and behavioural effects in children with ADHD, it is assumed that their activity in ADHD stems from their action on catecholamines (norepinephrine and dopamine) reuptake (Biederman et al., 2000).

The antihypertensives drugs, such as clonidine and guanfacine are alpha-2-adrenergic agonists and believed to inhibit the release of norepinephrine, increase dopamine turnover, and reduces blood serotonin levels. They are used to treat the hyperactive-impulsive symptoms of ADHD (Wilens et al., 2002). However, limited is the literature supporting their efficacy (Banaschewski et al., 2004; Biederman et al., 2000).

A new drug, atomoxetine, which has not yet been extensively used, has shown to be efficacious in treating children and adolescent with ADHD (Kelsey et al., 2004; Michelson et al., 2003;

Michelson et al., 2002). It is a non-stimulant drug, which acts as a selective norepinephrine re-uptake inhibitor and has little affinity for other neurotransmitter receptor sites. The drug does not appear to have abuse potential and is not associated with adverse effects on cardiac conduction.

Although there is an extensive literature supporting the effectiveness of pharmacotherapy, behavioural interventions should also be considered in the management of ADHD (Wilens et al., 2002). Indeed, the treatment of ADHD requires expertise in many different domains, which increases the efficacy in management of children with ADHD (Mash et al., 1998).

Behavioural interventions comprise behavioural and educational training approaches, which include teachers, parents and youth themselves. The use of behavioural methods in treating ADHD is justified by the fact that the disorder leads to social distress and academic failure (Mash et al., 1998). However, though these behavioural approaches have been reportedly effective in children, adolescent and adults with ADHD, their benefit independent of pharmacotherapy has yet to be determined (Pelham et al., 2000).

### **1.3.9 Prevalence of ADHD**

ADHD is one of the most prevalent childhood psychiatric disorders (Barkley, 1998), affecting 3-7% of school-age children (American Psychiatric Association, 1994). More boys than girls are diagnosed. In the United States, the disorder represents one of the most common reasons for children referral to mental health practitioners and affects 2-8% of children (Nolan et al., 2001). This prevalence range varies with the use of DSM-III, DSM-III-R or DSM-IV (Wolraich et al., 1998; Wolraich et al., 1996). In Europe, prevalence in the range of 10-20% have been reported (Baumgaertel et al., 1995; Gadow et al., 2000). However, lower estimates of 1.4% have been reported in Europe with the use of ICD-10 criteria for hyperkinetic disorders (Meltzer et al., 2000). In Latin-America, prevalences in the range of 6-12% were reported (Pineda et al., 2003; Rohde et al., 1999), whereas lower prevalences of 2% and 9% have been reported in Africa and Asia respectively (Ashenafi et al., 2001; Leung et al., 1996). The differences in the prevalence ranges vary by sex with a male to female ratio of 3:1, by age, the disorder being more common among children than adults, and according to the approaches used at identifying the disorder.

## **2. Aims of the study**

The aim of the thesis was to study mental health of African school children in Kinshasa, DR Congo, with the following objectives:

1. To pilot the use of the Strengths and Difficulties Questionnaire (SDQ) in an African urban setting. To explore the association between mental health problems and various demographic factors, illness, nutrition and school performance (Paper I).
2. To explore and describe the health status, socio-demographic factors, school performance and co-existing symptoms among African school children with abnormal scores on the hyperactivity-inattention scale of SDQ (Paper II).
3. To estimate the prevalence of and determinants for Attention Deficit and Hyperactivity Disorder (ADHD) symptoms among school children in an African urban setting (Paper III).
4. To explore the neuropsychological performance of African school children with ADHD symptoms, and the functions covered by the selected neuropsychological tests (Paper IV).

### **3. Population and methods**

#### **3.1 Brief history of the study area**

##### **Demography**

The Democratic Republic of Congo (DR Congo), formerly called Zaïre, is a large country located in central Africa. The country size is approximately seven times the surface of Norway (Figure 2). During the colonial time, the country was known as the Belgian Congo and was controlled by the King Leopold II of Belgium. The country independence was granted in June 1960. According to the State of the world's children (UNICEF, 2004), the country-approximated population is 53 million, with about half of the population being under 15 years of age. The life expectancy at birth is estimated at 42 years.

There are five main different ethnic groups and more than 300 spoken languages including four national languages (Kikongo, Lingala, Swahili and Tshiluba), making the country a complex socio-cultural for research. French is the official language, which is used for education and administrative purposes.

##### **Economy**

The country has natural and human resources, including fertile soils and varied mineral resources. Historically, mining of copper, cobalt, diamonds, gold, zinc, uranium and petroleum extraction accounted for about 75% of total export revenues, and about 25% of the country's Gross Domestic Product (GDP). The country's formal economy has collapsed over the past decade due to mismanagement and instability. In recent times, the country is marked by years of dictatorship, socioeconomic and political instability. The country has also gone through intense turmoil and revolts in the Eastern part of the country. This conflict has completely destabilised the economy. Enormous potential mineral wealth and the mining sector collapsed after the looting and systematic pillaging of the country's wealth. The DR Congo is currently one of the countries with the poorest economic and social basic indicators. The GN per capita is 100 US dollars.

## Health and education

The consequences of this instability are also reflected in other aspect of life such as health and education. The country expenditure on health as percentage of GDP is 1.5%. The infant mortality rate is 205 deaths per 1,000 live births. The total adult literacy rate is 68%, with an illiteracy rate of 14% in urban areas and 40% in rural (DR Congo et al., 2002). There is a dramatically drop in the rate of adult literacy level and primary school attendance. The country's schooling rate of the children aged 6 to 11 years old has dropped to 52% in the recent years (DR Congo et al., 2002). In the DR Congo, primary school attendance is compulsory, the schooling system and program are the same in all part of the country and under supervision of the Ministry of Education. Although, the primary school attendance is compulsory, it is not free of charge. Thus, the affordability and accessibility for all children remain a problem.



Figure 2 Map of the Democratic Republic of Congo showing Kinshasa, the study area

## The capital city

Kinshasa is the capital, which is located in the South Western part of the country, which is about 2-3 hours by airplane from the Eastern part. The city has an estimated population of 5 million and was established in 1881 by the British Sir Henry Morton Stanley who was working for King Leopold II of Belgium as his main Central Africa explorer. The city was known as Leopoldville during the colonial times and up to 1966. After the completion of the railway project, the city

grew and became the largest city in the country. It is the financial, commercial and industrial center of the country. Kinshasa has also the largest college campus of the country along with other schools and colleges. The city has the highest rates of adult literacy (89.5%) and schooling attendance of the children aged 6 to 11 years old (76%) (DR Congo et al., 2002). However, although Kinshasa is located far in the Western part and do not experienced the direct impact of the civil war, the city is also suffering from the economic decline due to the socio-political instability and mismanagement.

### 3.2 Study population and design

#### Population

The study was conducted among school children in Kinshasa (Figure 3).



*Figure 3 Picture of school children playing in the playground*

#### Design

The study was conducted in two stages. Firstly a cross-sectional study was performed to pilot the use of the Strengths and Difficulties Questionnaire (SDQ), and secondly a case-control design to characterise children with abnormal scores on the hyperactivity-inattention scale of the SDQ (SDQ-HI) through further investigations (Figure 4).

1. Screening to pilot the use of the SDQ (Paper I)

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A cross-sectional study was conducted from July to September 2002. A total of 1187 children aged seven to nine years old recruited from 10 randomly selected schools were included in the study. Teachers were asked to fill out the print out of the French version of the SDQ, available on-line ([www.sdqinfo.com](http://www.sdqinfo.com)) and free of charge, which was used as a behavioural questionnaire to assess children's mental health.

## 2. Characterisation of children with abnormal scores on the SDQ-HI (Paper II, III & IV)

Scores higher than the 90<sup>th</sup> percentile cut-offs on the SDQ-HI scale were considered as abnormal. Children with such scores further compared to a group of children with normal scores underwent a case-control study from December 2002 to March 2003. Two hundred and eighty six children aged seven to nine years old were evaluated by means of the Disruptive Behaviour Disorder rating scale (DBD). This scale is based on the DSM-IV ADHD items and was chosen in order to identify the presence of ADHD symptoms according to the DSM-IV. All children were also subject to a clinical including a neurological examination, and to a neuropsychological testing (Papers III & IV). Additionally, the health status, socio-demographic factors, psychosocial background and school performance of the children, as well as the co-existing symptoms associated with abnormal SDQ-HI scores (hyperactivity-inattention symptoms) were explored through a case-control approach (Papers II & III).

The research protocol was approved by the National Medical Council in DR Congo and the Regional Ethics Committee on Medical Research in Norway. The collaboration and informed consent were obtained from all head masters, teachers and parents. All children kindly accepted to participate and were given gifts after their evaluation.

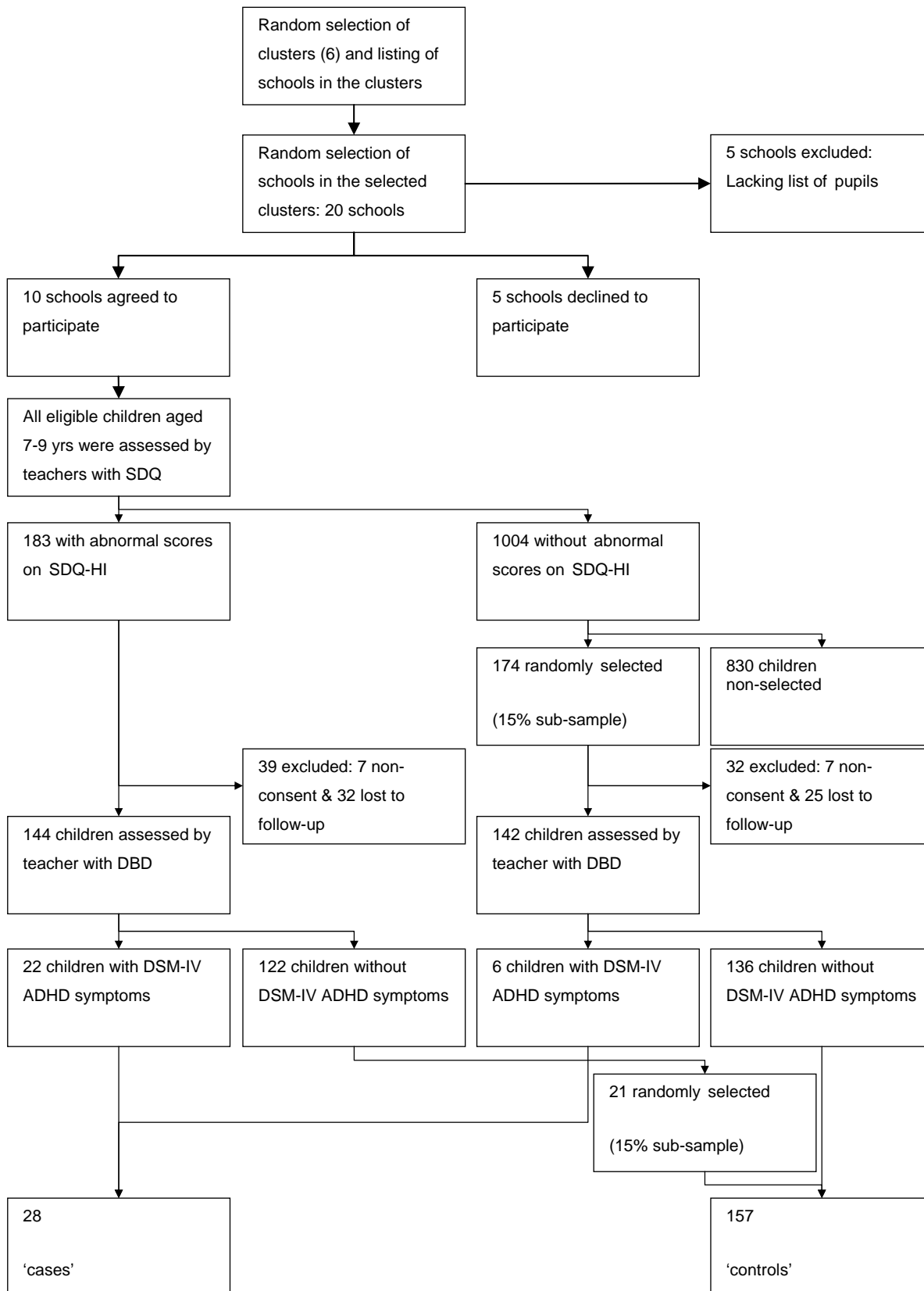


Figure 4 Flowchart summarizing the study design.



### 3.3 Methods of child assessment

Teachers were used as the only informant about the child's behaviour in the first stage of the study. This was done to avoid some parents' illiteracy in French and the multi-lingual limitation. In the second stage, parents were involved and interviewed to give information about the different background factors. The selection of the different methods that have been used also emphasized on the ability to provide a wide range of information about the child's behaviour, school performance and socio-demographic background, and on the easiness to be administered. To evaluate the different tools to be used, a pilot study was performed. It included assessment by teachers, interview with parents and testing of 30 children.

The pilot testing revealed that children were more confident and less distracted when performing certain neuropsychological tasks in-group. None of the children tested in the piloting procedure were included in the main study. Table 1 gives an overview of the different methods used for the child assessment.

Table 1 Overview of the different investigations methods used in the different papers

Methods	Paper I	Paper II	Paper III	Paper IV
Cross-sectional study	+	-	-	-
Case-control study	-	+	+	+
Use of SDQ	+	+	-	-
Use of DBD	-	-	+	+
Parents' interview	-	+	+	-
Clinical examination	-	+	+	-
Neuropsychology	-	-	-	+

#### 3.3.1 Behaviour

Mental and behavioural disorders of childhood and adolescence are difficult to define and assess in addition to being dependent on child developmental stage, genetics, socio-cultural influences and psychological factors. In addition, they interfere with normal development, school

performance and have a large impact on individuals, families and communities. Although it is preferable to use two different approaches, an extensive observation of the child behaviour and reports from multiple informants in the assessment of child behaviour, this is not always feasible.

In the present study, teachers were the main informants on the child behaviour. In addition, all children were subject to a non-extensive observation during the clinical examination and the neuropsychological evaluation. Teachers' information was collected using two internationally available questionnaires, the SDQ (Goodman, 1997) and the DBD (Pelham et al., 1992). The non-extensive observation used the short version of the Examiner Rating Scale (ERS) (Sommerfelt et al., 1996).

### 1. The SDQ

The SDQ was used as a screening tool. It has been extensively used worldwide in several studies but not yet in Africa. This brief behavioural screening questionnaire can be administered to the parents and the teachers of 4-16 years old and to 11-16 years old themselves. The tool has an extended and a non-extended version to meet the needs of researchers, clinicians and educationalists. The extended version includes 25 core items, and an impact supplement questionnaire that enquires about chronicity, distress, social impairment, and burden for others (Goodman, 1999). All versions of the SDQ ask about 25 items, some positive and others negative that yield scores in five scales of five items each (Emotional symptoms, Conduct problems, Hyperactivity/inattention, Peer problems and Prosocial behaviour). For each of the 25 items, there is the possibility of answering: 'Not true', 'Somewhat true' and 'Certainly true'. The score for each answer ranges between 0 and 2 and differs according to the 5 scales. Summing the scores from all the scales except the "Prosocial scale" generates the Total Difficulties Score. The resultant score may range from 0 to 40.

For the present study, only the non-extended version was used. The 90<sup>th</sup> percentile (10<sup>th</sup> for Prosocial scale) cut-off scores were used to identify children with abnormal scores on the different scales of the SDQ. The principal component factor analysis was used to explore the factor structures of the scales (Paper I).

## 2. The DBD

The DBD was used to investigate the presence of ADHD symptoms according to the DSM-IV. This tool comprises 45 items representing symptoms of ADHD, ODD and CD. The items asked about the occurrence and the severity of symptoms in different situations and are scored from 0 to 3. For the present study, only the 18 items (9 inattention, 6 hyperactivity and 3 impulsivity) based on DSM-IV items assessing ADHD were used. The symptoms count method given by the constructor of the tool was used to determine whether the child meets the DSM-IV ADHD symptoms criteria (Paper III).

## 3. The ERS

The ERS (Table 2) was used during the clinical examination and the neuropsychological testing. This rating scale was not used to ascertain the diagnosis of ADHD but rather as a mean to observe the child's behaviour and to identify obvious psychosocial conditions that could explain the presence of symptoms.

Table 2 ERS Short version

1. Extremely absorbed by task	1	2	3	4	5	6	7	Very inattentive
2. Very low activity level	1	2	3	4	5	6	7	Very high activity level
3. Socially very confident	1	2	3	4	5	6	7	Socially very insecure
4. Over-confident in own abilities	1	2	3	4	5	6	7	Distrusts own abilities
5. Rapport very easily established	1	2	3	4	5	6	7	Rapport very difficult to establish
6. Seems very happy	1	2	3	4	5	6	7	Seems very unhappy
7. Seems very anxious	1	2	3	4	5	6	7	Seems very calm
8. Generally optimum performance	1	2	3	4	5	6	7	The child did not use much of its potential

### **3.3.2 Socio-demographic background and school performance**

A close-ended questionnaire was specially designed to evaluate the socioeconomic and nutritional status, and the school performance. For the evaluation of the socioeconomic and nutritional status, teachers and parents were asked to classify the child according to the following categories: poor/poor, middle/good and rich/very good. They were also asked to classify the average school performance and also specified performance in reading, spelling, writing, mathematics, geometry, and manual work. Each question had three possibilities of answering ranging from zero (non-optimal) to three (optimal) (Papers I, II & III). In addition, they were asked if the child has repeated the grade or needed extra-educational resources.

Parents were also interviewed using a semi-structured questionnaire comprising both open- and close-ended questions to assess the child socio-demographic background, perinatal and health characteristics (Papers II & III).

### **3.3.3 Hyperactivity-inattention and ADHD symptoms**

The presence of hyperactivity-inattention and ADHD symptoms was assessed using the 5 items of the hyperactivity-inattention scale of the SDQ (SDQ-HI) and the 18-items of the DBD. In addition, somatic and neurologic conditions, or obvious psychiatric disorders, which may lead to inattentive, hyperactive and impulsive behaviour had to be excluded.

#### **1. The 5-items of SDQ-HI**

A child was considered to be likely to have hyperactivity-inattention symptoms if reported with a score above the 90<sup>th</sup> percentile cut-off score on the SDQ-HI. This scale comprises 5 items asking about the child activity and attention with three possible answers ranging from 0-2. The score can range from 0-10 if all the five items are completed (Paper I & II).

#### **2. The 18-items of the DBD**

A child was considered to have ADHD symptoms if she/he was reported by teachers to display inattentive, hyperactive and impulsive behaviour on the 18-items of the DBD rating scale. Each item has four response possibilities, which are scored from 0-3, with 3 representing the highest level of the occurrence and severity of symptoms. The symptom count method was used to determine the presence of symptoms according to the DSM-IV (Papers III & IV).

### 3.3.4 Cognition and neuropsychology

Child cognition and neuropsychological performance were assessed using a set of non-verbal neuropsychological tests. This choice was guided by the multi-lingual setting of our study to ensure that all children would evenly understand the tests.

They were selected to measure aspects of attention and memory functions, but also motor speed and coordination, intellectual function, visual cognition, problem solving and planning ability. Figures 5 & 6 illustrate some of the neuropsychological tests used.

#### 3.3.4.1 Intellectual function

Intelligence is defined as the ability to understand, recall, mobilize, and constructively integrate previous learning in meeting new situations (Sadock et al., 2003). In the present study, the *Raven's Coloured Progressive Matrices* (Raven JC, 1965) was included as a measure of non-verbal intellectual function (Figure 5). It consists of pattern problems with one part removed, and the task is to select the right one from a set of possible patterns. In the present study, mental retardation (MR) was defined as a performance poorer than two standard deviations below the mean score of the study population.

#### 3.3.4.2 Measurement of attention

Attention is crucial for a good functioning in a wide range of social activities, and can be conceived as a system necessary for conscious processing of information, as well as maintenance of the alert state required for this processing (Beaumont et al., 1999).

Two tests were selected to measure attention:

- 1) The *Cats and Faces Test* from the NEPSY battery (Korkman et al., 1998) was included to assess the ability to sustain attention. This test measures the speed and accuracy with which a child is able to focus selectively on and maintain attention to visual targets within an array. The subject is asked to find and mark all the cats or faces as quick as he can within a limit time of 180 seconds per item. Cats and faces items are visual targets specified for 5-12 years old children. A Visual Attention Scoring Template is then used to identify the number of targets marked correctly and the commission errors. On each item the child accuracy score is determined by subtracting the number of commission errors from the number of targets marked correctly. The total accuracy score for visual attention is the sum of the two item

scores. The total time score is the sum of the time on both items. The total score for this subtest is determined using both the time-to-completion (speed) and the accuracy scores.

- 2) The *Statue* from the NEPSY battery (Korkman et al., 1998) is a test designed to assess motor persistence and response inhibition. In the present study it was selected to assess the control part of the attentional process. The child is asked to maintain a body position with eyes closed during 75 seconds period and to inhibit the impulse to respond to sound distracters. The child stands with feet slightly apart, the left arm at the side and the right arm bent at the elbow so that it is perpendicular to the body, and the right hand is in a fist as if holding a flag. Errors such as laughing, body movement, eye opening and vocalisation are registered. This test is specified for 3-12 years-old children. The materials needed are the record form, a pencil and a stopwatch. The scoring is done according to the errors by time interval. The total raw score is the number of the points earned across all intervals. The maximum score is 30.

#### **3.3.4.3 Measurement of memory**

Learning is the acquisition of new information. Memory is defined as the ability to retain learned information and can be divided in two parts (Lasserson et al., 2000): 1) declarative memory for facts and events. This memory is easy both to acquire and to lose, 2) procedural memory for skills/behaviour, which is hard to acquire and to lose.

The declarative memory comprises the sensory memory, which is a store of all sensory information that has just been processed; the working memory, which contains the information that are being processed; and the long-term memory that is a collection of different types of memory that are differentiated by the nature of the information stored.

Four tests were selected for measuring memory:

- 1) The *Design Copying Test* from the NEPSY battery (Korkman et al., 1998) is designed to assess the ability to copy two-dimensional geometric figures for 3-12 years old children. It was used as a general measure of visual cognition. The subject is encouraged to copy as many designs as possible for an approximately during time of 5-10 minutes. The child's pencil grip is also characterized. The scoring is done according to the Universal Scoring Template.

- 2) The *Coding B Test* from the Wechsler Intelligence Scale for Children-Revised (WISC-R) (Wechsler, 1987) was included as a more complex test of visual attention, where psychomotor tempo, visuo-motor coordination and immediate memory function are involved. The test is specified for eight years and older children, regardless of their estimated mental ability. It consists of row with small blank squares associated with a given number from one to nine. Each number corresponds to a code (a nonsense symbol) given above the row, and the subject is asked to fill in as many blank squares with the symbols as fast as possible within 90 seconds. The materials needed are the items sheet, a pencil without an eraser, a stopwatch and the record form. One point is given for each item filled in correctly and the maximum score is 93.
- 3) The *Digit Span Test* from the WISC-R (Wechsler, 1987) is an auditory test of focused attention and short-term memory span. It consists of two parts: the Digit Span Forward and the Digit Span Backward. The subject has to repeat sequences of numbers given by the experimenter in the same or backward sequence. Both parts involve auditory attention and depend on a short-term memory capacity. The Digit Span Backward is more complex and is known to be more heavily dependent on a working memory component than the forward version (Lezak, 1995). The materials needed are the items sheet and the record form. Each part is scored according to the number of trials succeeded and the total score is the sum of scores on both Forward and Backward Digits. The maximum total score is 28 and the approximately during time is five minutes.
- 4) The *Knox Cube Test* from the Arthur Point Scale of Performance Battery (Arthur, 1947) was included as a visual measure of focused attention and immediate memory span. The subject is supposed to tap four cubes as shown by the examiner, in sequences of increasing length and complexity. The series are continued until the subject fail three successive series. It is thus a measure of an immediate attention span as well as a sequencing and memory component (Bornstein, 1983). The material needed is four Knox cubes of one inch wooden cubes spaced two inches apart attached to a piece of wood approximately nine inches long. Credits are given for series one and series two if they are repeated correctly without help. The score for each trial is the number of series repeated correctly. The score for the test is the average of the two trials. The approximately during time is five minutes.

#### **3.3.4.4 Measurement of executive functions**

Executive functions assess the ability to plan, organise, inhibit impulse, and maintain awareness and to monitor (Rutter et al., 2004). All these functions are known to be impaired in children with ADHD.

The *Tower Test* from the NEPSY battery (Korkman et al., 1998) was designed to assess nonverbal planning and problem-solving abilities (Figure 6). The child is presented a Tower model item with a target position and he/she is asked to achieve the same target position in a specified number of moves within the time limit for that item. The test is specified for 5-12 years-old children. The materials needed are the Stimulus booklet, the Tower model and balls and the stopwatch. Scoring is performed according to the achieved target position in the specified number of moves within the time limit. The time limit is 30 seconds per item for items 1 - 4 and 90 seconds per item for items 5-20. Time estimated for the test is 10-30 minutes.

#### **3.3.4.5 Measurement of motor skills**

Children with ADHD often exhibit poor motor control as a result of dysfunction of the nigrostriatal dopamine branch (Lezak, 1995). In this study, the *Fingertip Tapping Test* from the NEPSY battery (Korkman et al., 1998) was included to assess motor speed and finger dexterity. The test consists of two parts: the Repetitive Fingertip Tapping and the Sequential Fingertip Tapping, which assess finger dexterity and motor speed. Both preferred and non-preferred hands are tested. The materials needed are the items listed in the Record Form and a stopwatch. The subject is required to make a circle with the tips of his thumb and index finger, then opening the circle about an inch and closing it again as quick as he can in the repetitive items 1-2. The same procedure is done with index, middle, ring and little finger in the sequential items 3-4. The time limit is 60 seconds for items 1-2 and 90 seconds for items 3-4. The total raw score is the sum of the times from all items. The maximum time sum is 300 seconds. In addition, the *Grooved Pegboard Test* (Matthews et al., 1964) was used to evaluate motor speed and coordination. A board with a set of slotted holes angled in different directions is put in front of the subject, who is asked to fill in the holes with pegs that have to be rotated into the correct position for each hole. This test measures this fine manipulative skill with both the preferred and non-preferred hand. Only one hand is used for each trial. The material needed is the Grooved Pegboard with twenty-five identical pegs and the record form. The scores for both trials are summed to include



the total time, the total number of drops and the total number of pegs correctly placed in the board. The approximately estimated time is 10 minutes.



*Figure 5 Examples of the neuropsychological tests.*

*Top: Raven's Coloured Progressive Matrices Test, for explanation see page 36.*

*Bottom: In-group session Tests (Design Copying Test, Coding B Test, Cats and Faces Test), for explanation see pages 35, 36 & 37.*



*Figure 6 Picture of a child performing the Tower Test.*

*For explanation, see page 38.*

### **3.3.5 Physical examination**

A standard clinical examination including anthropometric measures, evaluation of audition and vision, as well as a neurological examination was performed on every child. The rationale for the physical examination was to discover any medical conditions that could explain the presence of behavioural symptoms, or affect the other assessments, and to obtain a measure of the general health status.

Audition was not evaluated with an audiometer but the child was asked whether or not he/she has difficulties to hear, also each ear was examined using an otoscope.

The visual acuity was tested both monocularly and binocularly using the Snellen chart.

The neurological examination included the standard items used by most neurologists. Each item was scored 2 when considered normal, 1 when slightly abnormal, and 0 when clearly abnormal (Table 3).

If a child had a condition affecting his/her well-being such as malaria, he/she was rescheduled at a later date and parents were contacted for therapeutic advice.

### **3.3.6 Evaluation procedure**

The evaluation protocol was designed to ease both the filling process of the behavioural questionnaires by teachers and the interview with parents. The teachers were met at school and were given a questionnaire per child. Each item of the questionnaire was carefully explained to them. The questionnaires were collected on a basis of timetable convenience.

The same interviewer visited the parents at home after the headmaster of the school had officially contacted them and obtained their consent. During the parents' interview, the informed consent to examine their child was obtained from each of them.

All children were evaluated and examined at school in a quiet room specially prepared for that purpose. The children started with the neuropsychological tests before undergoing the clinical examination including neurological, audiovisual evaluation and anthropometrics measurements.

The psychometrists administered the neuropsychological tests and the neuropsychiatrist performed the clinical examination. The child's behaviour was observed during the whole procedure. Each child was promised a gift. All children were given a gift at the end of the evaluation. Both the psychometrists and the neuropsychiatrist were unaware of the child's background and scores on the behavioural questionnaires.

## **3.4 Statistical analyses**

To verify the proposed factor structure and assess the construct validity of the behavioural questionnaire, a principal component factor analysis with Varimax rotation including all the 25 items of the SDQ questionnaire was performed (Paper I). The neuropsychological outcome variables (Paper IV) were analysed in a similar manner to explore the factor structure of the tests. The cut-off levels of the different scales of the SDQ were calculated for males and females using the 90<sup>th</sup> percentile (10<sup>th</sup> for Prosocial) for each gender (Paper I). Low-test results on the neuropsychological tests were defined as the performance allocating the 10% weakest children on each test (Paper IV).

The reliability of the SDQ and DBD was assessed using the internal consistency (Cronbach's  $\alpha$  coefficient).

The Statistical Package for the Social Sciences (SPSS) for Windows, versions 11.5 and 12.0 were used for the statistical analyses. Details of the analyses are given in the papers. Briefly, multiple linear regression was used as the multivariate method when continuous outcome variables were involved, and multiple logistic regression when the outcome variables were dichotomous. Mean group differences were compared using T-tests. Differences in proportions for outcome variables between groups were compared using Pearson Chi-Square test and odds ratios were used as risk estimates. Fisher' Exact Test was used when appropriate. All tests were 2-tailed and the results were considered statistically significant at  $p < 0.05$ .

Table 3 Neurological examination protocol

Name of item	Description of item	Scoring of item		
		2	1	0
1. Handedness	Scored from drawing, cutting and other items	R	LR	L
2. Finger opposition	Seconds used in opposing of thumb to other fingers	< 4	4-6	> 6
3. Diadochokinesis	6 pro--/supinations of dominant forearm	fluent	not fluent	unable
4. Mirror movements	Pro--/supinations of opposite hand observed while performing previous item.	none	present	severe
5. Choreiform movements	Examined on extension of arms and fingers for 10s	none	present	severe
6. Dyskinesia	Athetotic movements and chorea	none	present	severe
7. Ataxia severe	Clinically observed truncal ataxia and dysmetria		none	present
8. Hypotonia	Evaluation of truncal and extremity hypotonia	none	present	severe
9. Heel walk	Walk four consecutive steps on heels	able	2 steps	unable
10. Balance	Standing on one foot, eyes closed, hands on hips	> 5 "	3-5 "	< 3 "
11. Arm hypertonia R	Examined on passive flexion and extension, elbow	none	present	severe
12. Arm hypertonia L	Examined on passive flexion and extension, elbow	none	present	severe
13. Biceps reflex R	Child seated	++	+++	++++
14. Biceps reflex L	Child seated	++	+++	++++
15. Leg hypertonia R	Examined on passive flexion and extension, ankle <sup>1</sup>	none	present	severe
16. Leg hypertonia L	Examined on passive flexion and extension, ankle <sup>1</sup>	none	present	severe
17. Patellar reflex R	Child seated	++	+++	++++
18. Patellar reflex L	Child seated	++	+++	++++
19. Achilles reflex R	Child seated	++	+++	++++
20. Achilles reflex L	Child seated	++	+++	++++

++ Normal, +++ exaggerated, ++++ clonus, <sup>1</sup>Extended knee, R: right, L: left, RL: ambidextrous



#### **4. Summary of results**

##### **4.1 Teachers' ratings of mental health among school children in Kinshasa, DR Congo (Paper I)**

A total of 1187 school children aged seven to nine years old were evaluated by their teachers using the French version of the SDQ. According to the teachers' report, boys were reported as having more conduct problems and being more hyperactive than girls.

On the principal component analysis, the majority of the 25 items of the SDQ loaded on five factors, almost similar to the published factors. The mean scores of the SDQ items were significantly higher for boys than girls ( $p < 0.05$ ). Compared to the British published values, the mean scores of the different scales in this population were higher and the cut-off scores obtained were somewhat different to the published cut-offs ( $p < 0.05$ ). Using the 90<sup>th</sup> percentile cut-offs, about 10% of the studied school children had an abnormal score on the Total Difficulties Score of the SDQ and 15% had an abnormal score on the hyperactivity-inattention scale of the SDQ (SDQ-HI).

Low socioeconomic status, poor nutrition and illnesses were found to increase the risk for abnormal scoring and poor school performance. The highest risk effects of having poor school performance among children with abnormal scores on the SDQ were observed among those with abnormal scores on the SDQ-HI scale (OR: 9.5, 95% CI: 6.7 to 13.6).

##### **4.2 Co-existing symptoms and risk factors among African school children with hyperactivity-inattention symptoms in Kinshasa, DR Congo (Paper II)**

This study involved two hundred and eighty six children of whom, 144 were reported with and 142 without abnormal SDQ-HI scores (hyperactivity-inattention symptoms). The study aimed at exploring their health status, socio-demographic factors, and school performance as well as at exploring the co-existing symptoms of emotional and behavioural problems often associated with hyperactivity-inattention symptoms.

The clinical, including neurological examination was comparable in the two groups. The proportion of children with hearing and/or seeing difficulties was also comparable, as was their intellectual functioning.

Regarding the socio-demographic background, it was found that mothers of children with abnormal scores on the SDQ-HI scale were significantly younger at the childbirth (28 vs. 29 years old;  $p < 0.05$ ). The other socio-economic and nutritional characteristics were comparable (Table 4).

Family health problems such as hypertension, diabetes and sickle-cell anaemia were reported by 8% of parents of children with abnormal SDQ-HI scores compared to 3% of parents of those with normal SDQ-HI scores ( $p > 0.05$ ) (Table 5).

School difficulties were also more prevalent among children with abnormal SDQ-HI scores compared to their same-age peers with normal scores. Of those with abnormal SDQ-HI scores, 53% had repeated a grade and 52% needed extra-educational resources compared to 23% and 32%, respectively, of those with normal scores ( $p < 0.001$ ).

Children with abnormal scores on the SDQ-HI scale were more at risk to have abnormal scores on other scales of the SDQ (co-existing symptoms). Indeed, about three quarters (72%) had also abnormal scores on the other scales of the SDQ, the highest risk being on the conduct scale ( $p < 0.001$ ).

### **4.3 Attention deficit and hyperactivity disorder among school children in Kinshasa, DR Congo (Paper III)**

A total of 286 children were evaluated with the DBD. This group included 144 with abnormal scores on the SDQ-HI scale (hyperactivity-inattention symptoms) and 142 without hyperactivity-inattention symptoms as reported by the teachers (Paper I). A total of 28 children had ADHD symptoms according to the DSM-IV, of which 24 (86%) were classified in the ADHD-combined subtype. Twenty-two (79%) and 6 (21%) of them belonged respectively to the groups of the 144 children with hyperactivity-inattention symptoms and the 142 without symptoms according to



the SDQ-HI scale. These 28 children with ADHD symptoms were compared to a control group of 157 children without symptoms using a case-control approach (Paper III).

Based on the prevalence of ADHD symptoms in the two groups of children with and without abnormal scores on the SDQ-HI scale, the estimated prevalence of ADHD symptoms in the total population of school children was 6%. The risk for ADHD symptoms was four times higher for children previously identified with abnormal scores on the SDQ-HI scale (OR: 4.1, 95% CI: 1.6 to 10). The internal consistency of the SDQ-HI and the DBD items, evaluated with the Cronbach's alpha coefficient was satisfactory.

The parents, especially the mothers were the main respondents (60%) regarding child characteristics. Neither the parents' educational level nor their occupation influenced the presence of ADHD symptoms. The household was composed of 8 persons on average, including an average of 4 children per house, the studied child being on average the 4<sup>th</sup> born. Based on information provided by the parents, most families (95%) were classified in the middle socioeconomic class. Interestingly, children with ADHD symptoms were also reported to have a better nutritional status ( $p < 0.05$ ) (Table 4). However, this was not corroborated by the clinical examination of weight, which was similar in all the children ( $p > 0.05$ ).

Family health problems such as sickle-cell anaemia, hypertension and diabetes were found to increase the risk for ADHD symptoms (Table 5).

In general the perinatal and medical history were normal for more than 95% of the children and did not influence the presence of ADHD symptoms ( $p > 0.05$ ). About half of the children with ADHD symptoms (46%) were described as rowdy by their parents, whereas a quarter (27%) was described as such among those without ADHD symptoms.

Children with ADHD symptoms started primary school at a younger age (5 years vs. 6 years old) and had lower mean school performance compared to their same age peers without such symptoms (2.0 vs. 2.4) ( $p < 0.05$ ).

#### **4.4 Cognition in African children with ADHD (Paper IV)**

This paper reports results of the 185 school children (28 cases with ADHD symptoms and 157 controls without symptoms) on selected neuropsychological tests. According to the Raven scores, two children were mentally retarded and therefore excluded from further analysis. The Raven's Coloured Progressive Matrices was used to measure the intellectual functioning. The proportions of children with Raven scores one standard deviation below the mean score of the sample were comparable in the two groups (7% vs. 8%) (OR: 0.9; 95% CI 0.2 to 4.3).

All children performed similarly on the tests assessing attention, memory and executive functions. However, children with ADHD symptoms were less accurate on the tasks evaluating motor skills and needed more time to complete the task adequately (75 seconds vs. 72 seconds;  $p < 0.05$ ).

In the factor analysis, the Eigenvalues levelled off at a three-factor model that explained 51% of the total variance. The factors were labelled executive functions, memory functions and sustained attention. The tests of sustained attention (Cats and Faces Test and Statue Test) and the tests of attention with a memory component (Knox Cube Test, Digit Span Test, Coding B Test) loaded on a different factor. The factor of the sustained attention tests was named attention and the factor of attention tests with memory component was named memory. The tests of intellectual function, visual cognition and problem solving ability were allocated to a common factor together with the tests of motor skills; this factor was named executive function.

This study revealed that the studied African school children with ADHD symptoms have motor skills impairments, but overall good cognitive functioning.

Table 4 Nutritional and socio-economic status of school children aged seven to nine years old as classified by parents in Kinshasa, DR Congo

Variables	Hyperactivity- Inattention symptoms		ADHD symptoms	
	Yes	No	Yes	No
	N (%)	N (%)	N (%)	N (%)
<i>Nutrition</i>				
Bad	0 (0)	1 (1)	0 (0)	1 (1)
Good	99 (69)	98 (69)	13 (46)	110 (70)
Very good	45 (31)	43 (30)	15 (54)*	46 (29)
<i>Socio-economic status</i>				
Poor	0 (0)	4 (3)	0 (0)	4 (2)
Middle	143 (99)	137 (96)	28 (100)	152 (97)
Rich	1 (1)	1 (1)	0 (0)	1 (1)

\*  $p < 0.05$

Table 5 Family health problems as reported by parents of seven to nine-year-old school children in Kinshasa, DR Congo

Variables	Hyperactivity- Inattention symptoms		ADHD symptoms	
	Yes N (%)	No N (%)	Yes N (%)	No N (%)
Anaemia	1 (1)	0 (0)	1 (4)	0 (0)
Diabetes	4 (3)	1 (1)	2 (7)	1 (1)
Hypertension	7 (5)	3 (2)	1 (4)	4 (3)
Total	12 (8)	4 (3)	4 (14)*	5 (3)

\*  $p < 0.05$

#### 4.5 Combined results

In Paper I, 1187 school children were evaluated with the SDQ. Of them 183 (15%) were identified with an abnormal score on the hyperactivity-inattention scale of the SDQ (SDQ-HI) and underwent further investigation. In Paper II, 144 school children with abnormal scores on the SDQ-HI were compared to a control group of 142 school children randomly selected. Of these 144 children, 55 (38%) also had an abnormal score on one other scale of the SDQ, with 23 (16%) on the conduct and 20 (14%) on the emotional scales. Poor school performance was more common among the children with abnormal scores on the SDQ-HI. In paper III, 28 (10%) school children were identified with ADHD symptoms, of them 22 (15%) among those with abnormal scores on the SDQ-HI and 6 (4%) among the controls. These 28 children compared to a control group of 157 children did not differ on the socio-demographic background variables but did have poorer school performance and were more at risk to have family health problems. In Paper IV, the neuropsychological testing of the 28 children with ADHD symptoms showed that they had motor skills impairment and inhibition deficiency.

Table 6 compares the main findings of children with hyperactivity-inattention and ADHD symptoms vs. those without symptoms.

Table 6 Main findings in children with hyperactivity-inattention and ADHD symptoms

Variables	Hyperactivity- Inattention symptoms		ADHD symptoms	
	Yes	No	Yes	No
Poor school performance	+	-	+	-
Co-morbidities	+	-	not evaluated	
Family health problems	-	-	+	-
Start school < 6 years	-	-	+	-
Clinical examination	normal	normal	normal	normal
Executive dysfunctions	not assessed		-?	-
Response inhibition deficiency	not assessed		+	-
Motor impairment	not assessed		+	-

## **5. Discussion**

To the best of our knowledge, this thesis is based on the set of first studies that have tried to explore mental health and estimate the prevalence of ADHD among school children in Kinshasa, an African urban setting, using an epidemiological, a clinical and a neuropsychological approach. The present discussion will cover some methodological considerations, the major findings, and their implications as well as the future prospects.

### **5.1 Methodological considerations**

Data were collected through the teachers' reports on children mental health and behaviour, a semi-structured interview with parents, a clinical examination, and a neuropsychological evaluation. These approaches might be subject to numerous sources of error, such as sampling bias, social desirability, measurement bias, which may decrease the quality and limit the generalisability of the findings. Table 7 presents the potential bias and limitations of the present study.

#### **Potential bias**

##### **- Selection bias**

The cluster sampling procedure of the selected schools (Paper I) was done to minimize bias and increase the feasibility of the study. However, the exclusion of schools lacking lists of pupils leaves a possibility of a small selection bias, though there was no difference between the excluded and studied schools in term of the school characteristics, schooling program and number of pupils. Another limitation is that one of the selected schools was a girl's school, which may explain the lack of significant gender difference in the hyperactivity-inattention and ADHD groups. The proportion of children out of school, the younger age of the studied children, and the limited power and lack of variability in the sample of 28 children with ADHD symptoms limited the generalisability of the findings. The lower grades were chosen to minimize the number of children out of school, as the school attendance is somewhat higher in these grades. There is a possibility that those who cannot afford the schooling fees may be out of school, however, this is unlikely as primary school is compulsory and children are not excluded from

school. Those who do not pay do not receive their final results at the end of the year. Also most parents set great value on education, which is seen as key for a better life. Although, the estimated prevalence of ADHD symptoms has a limited external validity, we believe that our estimate is close to the reality and worth considering as it provides valuable information. In addition, it comes from a large study of randomly selected children in a multiethnic urban setting in Africa, which is clearly an advantage. This study did not aim at estimating a population-based prevalence at school age, but rather tried to estimate the prevalence among school children.

- Information bias:

The use of teachers as the sole informants for children behaviour (Papers I & II) may bring some limitations in the validity of the information gathered. However, we believe that teachers' reports are highly valuable in this multilingual setting. The use of teachers as sole informants in our studies was justified by important limitations such as some parents' literacy problems in French and the limited resources in term of time and funds. Indeed, involvement of parents would have required the translation-back-translation procedure of the questionnaires into the four national languages, or at least in one of them which, is mainly spoken in Kinshasa. The multiethnic and linguistic varieties of the country, and the study area have been described in the method section of Paper I.

We believe that reports from teachers are objective as they refer to behaviours that are considered adaptive and normal for the studied age group. Furthermore, reports from parents (usually mothers) are highly correlated with maternal mental health (Lesesne et al., 2003). Parents were involved to report the different background factors (Papers II & III). Results from the parents' interview in these papers may suggest that there is an association between children mental health problems and parental psychosocial distress reported as family health problems. Based on our findings, teachers may be considered as useful and valuable informants in African urban settings. The use of teachers as informants avoids the difficulties and limitations of performing research in settings with diverse languages and cultures. The use of an official language for education in most African countries may constitute an asset to overcome the linguistic barrier. However, reports from parents are inevitably very important prior to establishing the clinical diagnosis.

## **Reliability and validity**

In the present research study, two scales were used to evaluate mental health and behaviour among school children in an African urban setting. The use of scale or test brings to mind the concepts of reliability and validity. Whether or not our findings are reliable and valid remain questionable, as we did not perform a test-retest paradigm and an extensive psychiatry evaluation to ascertain the clinical diagnosis. These procedures were not done due to limited time and resources.

### - Reliability

Reliability is the tendency of measures to yield consistent results over repeated trials (Rutter et al., 2004). It concerns the replicability of measures and the extend to which each measurement is affected by random error. The typical procedures to estimate reliability are the test-retest paradigm, inter-rater agreement, and techniques based on correlation among items composing a questionnaire (internal consistency). This reliability is assessed by specific statistics such as Kappa coefficient and Cronbach's alpha coefficient. In our studies (Paper I, II & III), we have used the Cronbach's alpha coefficient to assess the reliability of the SDQ and DBD. The high Cronbach's alpha coefficient indicates that the items included in the scales are highly correlated, thus reliable, and measure the same underlying concept.

### - Validity

Validity refers to the degree to which an instrument measures what it is designed to measure (Rutter et al., 2004). Construct validity is the theoretical type of validity. It concerns the extend to which individual items or measure inter-correlate or group together to produce derived higher order constructs. Factor analysis is often used for this validity (Rutter et al., 2004). In our studies (Papers I & IV), the factor analysis was used to assess the validity of the measurements used. The findings suggested that the rating scales and the tests used were constructively valid. The factor structure as obtained from the factor analysis may be considered as a construct validation addressing the degree of confidence that could be placed in the inference drawn from scores and scales. However, the social desirability may constitute an important threat to the construct validity. In the present study, the social desirability was very unlikely to occur due to the administration method of the rating scales. Indeed, teachers were given the questionnaires to



be filled individually at their convenience and these ones were collected later on based on a timetable agreement.

Table 7 Listing of potential bias and limitations of the study

Bias and limitations	Reasons
1) Potential bias	
Selection bias	Exclusion of schools lacking pupil's list Random selection of one girl's school Only children in school were studied
Information bias	Teachers were the only informant on the child's behaviour
2) Reliability	Evaluated with Cronbach's alpha coefficient only
3) Validity	
Internal validity	Only the construct validity were assessed
External validity	Limited power of the ADHD sample Lack of variability Only population of younger school children (7-9 years old)

## 5.2 Majors findings

### Usefulness of SDQ

Paper I explored the usefulness of the SDQ to screen for mental health problems among school children in an African urban setting. In addition, this study looked at the relationship between socio-demographic characteristics, illness, nutrition, school performance and mental health.

In the DR Congo, as in many other African countries, mental health issues are given low priority in health service policies (Gureje et al., 2000), which lead to lack of recognition. Besides that, although there are varieties of behavioural scales commonly used to screen for mental health

problems, the majority of them have not yet been extensively evaluated in Africa. Their psychometric properties therefore remain unknown in the continent.

In this study, we piloted the use of the SDQ, a short behavioural questionnaire. Results from the study, supported its reliability and construct validity, as well as its usefulness to screen for mental health problems among school children in this African urban setting. In line with other studies, the scale showed a good internal consistency (Cronbach's alpha coefficient) and construct validity (Marzocchi et al., 2004; Obel et al., 2004; Woerner et al., 2004). In addition, the cut-off score for the hyperactivity scale was similar to the published cut-off. However, one may consider the use of cut-off scores as a limitation to the findings as it may lead to classification errors for scores just above and below the cut-off point (Rutter et al., 2004). Nevertheless, the similar cut-offs for the hyperactivity scale allowed us to perform further studies on children identified to be likely to have hyperactivity-inattention symptoms.

Our results suggested that SDQ might be a useful behavioural screening questionnaire for school children to be used in urban Africa.

### **Co-existing symptoms of hyperactivity-inattention**

Results of Paper II indicated that hyperactivity-inattention symptoms occur with a range of co-existing emotional and behavioural symptoms, the most commonly reported being conduct problems. These findings are in line with other community-based studies that have previously suggested a relatively high co-morbidity between attentional problems and conduct or oppositional defiant disorders (Jensen et al., 1997).

### **SDQ vs. DBD**

Compared to the DBD, which is a DSM-IV based questionnaire, the use of SDQ in this population of school children seemed to report more children as likely to have hyperactivity-inattention symptoms. The Spearman inter-teacher correlation between the two questionnaires was low ( $r_s = 0.2$ ,  $p < 0.002$ ). Among the 144 children identified with an abnormal score on the SDQ-HI, only 22 (15%) were reported with ADHD symptoms according to the DSM-IV (OR: 4; 95% CI: 1.6 to 10). This finding suggests that the use of SDQ for detecting hyperactivity-inattention symptoms among school children need to be considered cautiously. However, the present finding may also support the need of using the extended version of the SDQ, which comprises an impact supplement questionnaire that enquires about chronicity, distress and social

impairment (Goodman, 1999). Indeed, one could expect a lower identification of children with the use of the extended version of the SDQ. Future researches with the extended version of the SDQ are therefore needed.

### **School performance**

Poor school performance has been an important concern for children with mental health problems, especially for those with hyperactivity and inattention problems. They lead to serious academic impairment at every stage of development. The impact on school and work performance, and on diverse aspects of daily life such as social activities, peer and family relationship is important. Educational underachievement is commonly encountered and can be explained by a combination of factors leading to poor attention (Rutter et al., 2004). Several studies have reported that children with ADHD are more likely to get lower marks, repeat a grade in school, require academic tutoring and have learning disabilities (Barkley, 1998; Harpin, 2005; Mannuzza et al., 1998). These findings were confirmed by our studies (Papers I, II & III).

Besides mental health problems, there are other factors that may interact with school performance, such as nutrition or socioeconomic status. In Paper I, poor nutritional and socioeconomic statuses were reported to be risk factors for poor school performance. The lack of nutritional and socioeconomic variability in the samples of Papers II & III did not allow us to ascertain such an association for children with either hyperactivity-inattention or ADHD symptoms.

### **Sociodemographic, socioeconomic and other factors**

Different conditions, such as poverty, malnutrition, social problems and infectious diseases may lead to infant mental health distress (Richter, 2003). Poor nutrition and illness were found to be associated with mental health problems (Paper I). These findings, however, were not confirmed by further studies (Papers II & III). Indeed, the lack of nutritional and socioeconomic variability in these studies did not allow us to draw such an association. On the other hand, these findings (Papers II & III) may support the presence of hyperactivity-inattention and ADHD symptoms, respectively, as an independent condition. Moreover, the clinical examination of the children was normal and did not suggest any clinical condition that could explain the presence of symptoms (Papers II & III).

Several studies have reported an association between childhood disorders, such as ADHD, and conditions that may affect parental mental health and the family environment (Elgen et al., 2002; Lesesne et al., 2003; Omigbodun, 2004). This study also revealed that psychosocial adversities, reported as family health problems, were associated with ADHD symptoms (Paper III). However, the validity of these findings should be interpreted cautiously due to the limited number of families that have reported such medical conditions. Moreover, the evidence and the direction of this association are still uncertain (Thapar, A. K. et al., 2003).

Our findings suggested that mental health problems in general were strongly correlated with poor school performance and parental psychosocial distress. This finding provides credible information that needs to be considered in the management of ADHD symptoms in an African urban setting.

### **Estimated prevalence of ADHD symptoms**

The estimated prevalence of ADHD symptoms presented in Paper III is consistent with the reported prevalence rates of school-aged children (American Psychiatric Association, 1994; Voeller, 2004). However, higher prevalences have also been reported (Brown et al., 2001). The differences in rates are due to the definitions and the different approaches used, such as the questionnaires or interviews, the diagnostic criteria from ICD-10 or DSM-IV, the sampling method, the use of teachers only, parents only or both, and the nature of the population studied (Rutter et al., 2004). Studies that have used DSM based definitions, as the present study, reported prevalence rates in the range of 5-10% (Swanson, J M et al., 1998). However, our 6% estimated prevalence should be taken cautiously, as it is based only on 7–9 years old school children. It is therefore questionable whether the studied children are representative of the school-aged population of the country. This study however does not give a population-based estimate of school-aged children in the DR Congo. Another limitation of the estimated prevalence is the lack of an extensive psychiatric evaluation to ascertain the ADHD diagnosis.

The present finding indicated that ADHD symptoms do exist among school children in Kinshasa, an African urban setting, and the symptoms were as common as elsewhere. It also suggested that cultural and ethnic issues might not be considered as a limitation to performing research, but rather as an asset to better understand the cross-cultural psychopathology. Indeed, several psychopathology assessment tools have been found to function in much the same way across

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cultures, provided that linguistic, conceptual, perceptual and diagnostic equivalence are ensured (Rutter et al., 2004).

Further epidemiological studies on population-based samples as well as clinical studies, including extensive psychiatric evaluation and therapeutic trials are needed to better understand the concept of ADHD in Africa.

### **Neuropsychology of ADHD symptoms**

Paper IV explored the performance of children with ADHD symptoms on selected neuropsychological tests. These non-verbal tests were selected to facilitate their application in a multilingual setting and to measure aspects of executive functions, attention and memory functions, and motor skills. The results showed that school children with ADHD symptoms in this African urban setting have overall good cognition, good executive functioning but do exhibit motor skills impairment. Although the tests selected to measure executive functions did not confirm executive dysfunctions in children with ADHD symptoms, this doesn't exclude that they are impaired on other aspects of executive functions. Indeed, they showed signs of response inhibition deficiency, an indication of executive dysfunctions. In addition, our results showed that the selected tests covered the same functions as known from European and North American studies.

Overall, the results of this study suggested that the neuropsychological profile of children with ADHD symptoms in this African urban setting is similar to that described outside the African continent. These findings remain in line with several other studies and lend support to the validity of the neuropsychological profile of children with ADHD symptoms across cultures (Scheres et al., 2004). However, the findings should be treated with caution, taking into account the cultural differences (Mulenga et al., 2001) and the effect of age on some of the subtests (Klenberg et al., 2001; Korkman et al., 2001).

The selection of neuropsychological tests need to consider the facility of application and understanding in multilingual settings, keeping in mind that several factors may contribute to the performance or impairment of children with ADHD symptoms.

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## **7. Appendices**

- 1) The Strengths and Difficulties Questionnaire (SDQ)
- 2) The Disruptive Behaviour Disorder Rating Scale (DBD)
- 3) The Parents' Interview Questionnaire





# Strengths and Difficulties Questionnaire

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of the child's behaviour over the last six months or this school year.

Child's Name .....

Male/Female

Date of Birth .....

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Restless, overactive, cannot stay still for long	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often complains of headaches, stomach-aches or sickness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shares readily with other children (treats, toys, pencils etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often has temper tantrums or hot tempers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rather solitary, tends to play alone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generally obedient, usually does what adults request	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Many worries, often seems worried	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helpful if someone is hurt, upset or feeling ill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Constantly fidgeting or squirming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Has at least one good friend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often fights with other children or bullies them	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often unhappy, down-hearted or tearful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generally liked by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Easily distracted, concentration wanders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nervous or clingy in new situations, easily loses confidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kind to younger children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often lies or cheats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Picked on or bullied by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often volunteers to help others (parents, teachers, other children)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thinks things out before acting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steals from home, school or elsewhere	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gets on better with adults than with other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Many fears, easily scared	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sees tasks through to the end, good attention span	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Signature .....

Date.....

Parent/Teacher/Other (please specify:)

**Thank you very much for your help**

### Teacher/Parent DBD Rating scale

Child's name:

Sex: M/F

Grade:

Age:

Completed by:

School:

Date completed:

Check the column that best describes this child. Please put a question mark next to any item for which you don't know the answer.

	Not at all	Just a little	Pretty much	Very much
1. Often interrupts or intrudes on others (e.g, butts into conversations or games)				
2. Often talks excessively				
3. Is often easily distracted by extraneous stimuli				
4. Often fidgets with hands or feet or squirms in seat				
5. Often doesn't seem to listen when spoken directly				
6. Often blurts out answers before questions have been completed				
7. Often has difficulty playing or engaging in leisure activities quietly				
8. Often fails to give close attention to details or makes careless mistakes in school, work or other activities				
9. Often leaves seat in classroom or in other situations in which remaining seated is expected				
10. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behaviour or failure to understand instructions)				
11. Often has difficulty sustaining attention in tasks or play activities				
12. Often has difficulty awaiting turn				
13. Is often « on the go » or often acts as « if driven by a motor »				
14. Often loses things necessary for tasks or activities (e.g toys, school assignments, pencils, books, or tools)				
15. Often runs about or climbs excessively in situations in which it is inappropriate				
16. Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)				
17. Often has difficulty organising tasks and activities				
18. Is often forgetful in daily activities				



- 
1. How many children of 0-18 yrs old live in your house?

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  2. How many adult of 18 + live in your house?

---

  3. How many people in total live in your house?

---

  4. How many children do you have?

---

  5. Rank of the studied child in the family:

---

  6. Does the child live with his/her parents? Yes, both Father Mother Other

---

  7. Are both parents alive?  Yes  No

---

<b>Parents education</b>	Primary	High	University
8. Mother	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Father	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Status of the mother	<input type="checkbox"/> (1st wife) <input type="checkbox"/> Other		
11. Father's profession?			
12. Mother's profession?			
13. From monoparental family?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
14. Are parents divorced?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	

**Antecedents**

15. Mother age at birth:

---

16. Father age at birth:

---

	Normal	Abnormal	Specify
17. Pregnancy?	<input type="checkbox"/>	<input type="checkbox"/>	
18. Mother smoking during pregnancy	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
19. Delivery?	<input type="checkbox"/>	<input type="checkbox"/>	
20. Weight of your child at birth?			
21. Neonatal period?	<input type="checkbox"/>	<input type="checkbox"/>	
22. Was your child psychomotor development normal?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
23. Does your child ever been admitted to hospital?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
24. Do you have a particular health problem in your family?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
25. At what age does your child has started primary school?			

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26. Describe the child:

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<b>Health status</b>	Yes	No	Don't know
27. Does your child see well to the blackboard?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. Does your child have a hearing problem disturbing his/her understanding?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Does your child have a particular health problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. If yes, which?			
31. Does your child physically disabled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Poor	Good	Very good
32. How is your child nutritional status?			
	Poor	Middle	Rich
33. What is your socio-economic status?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Yes	No	Don't know
<b>Learning disabilities</b>			
34. Does your child repeat the grade?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Does your child need extra courses?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Bad	Good	Very good
36. What is your child average in school?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. How is your child in reading?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. How is your child in spelling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. How is your child in writing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. How is your child in mathematics?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. How is your child in geometric?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. How is your child in manual work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Bad	Suited	Happy
43. How is your child mood?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>