Paper II

Co-existing symptoms and risk factors among African school children with hyperactivity-inattention symptoms in Kinshasa, Democratic Republic of Congo

Submitted

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CO-EXISTING SYMPTOMS AND RISK FACTORS AMONG AFRICAN SCHOOL CHILDREN WITH HYPERACTIVITY-INATTENTION SYMPTOMS IN KINSHASA, CONGO

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Abstract

The *aims* of the study were to explore hyperactivity-inattention symptoms and co-existing symptoms of emotional and behavioural problems among African school children and their relationship with health status, socio-demographic factors, and school performance. *Method:* A case-control approach was used. The Strengths and Difficulties Questionnaire (SDQ) was used to explore the co-existing emotional and behavioural symptoms and a semi-structured interview with parents to explore the socio-demographic variables. The sample included 357 school children at the age of seven to nine years: 183 children were defined as cases, defined by abnormal scores on the SDQ hyperactivity-inattention scale (SDQ-HI) and 174 randomly selected children among those with normal scores on the SDQ-HI were defined as controls. No age and gender differences were noticed between the two groups. *Results:* A younger maternal age at childbirth, and poor school performances were more frequent among cases than controls. Three quarter of the hyperactive-inattentive children had co-existing symptoms according to SDQ, the most common being conduct problems. *Conclusion*: As in other cultures, co-existence of hyperactivity-inattention symptoms and emotional and behavioural problems was found in this African setting. Further validation of behavioural screening instruments in African children is called for.

Key words: Hyperactivity-inattention, SDQ, co-existing symptoms, socio-demographic factors.

Introduction

Clinical and epidemiological studies of children with attention deficit and hyperactivity disorder (ADHD) suggests frequent co-existing disorders such as conduct, emotional and anxiety disorders (6, 21, 26). The overall prevalence of these co-existing disorders varies and may depend on the sample studied (9). However, 44 % of ADHD children may have at least one co-existing disorder (2).

In Africa, little is know about ADHD and co-existing disorders. Besides that, there is almost no available data on mental health among children and the influence of socio-demographic factors. To the best of our knowledge, most of the clinical tools used to assess mental health worldwide have not been validated in this part of the world. In an earlier study of mental health among African school children (14), a behavioural questionnaire, the Strengths and Difficulties Questionnaire (SDQ) developed by Goodman and colleagues, was used (10). The questionnaire comprises 25 items yielding scores for five sub-scales of emotional, conduct, hyperactivity-inattention, peer and prosocial problems. Although the study was not designed to validate the instrument among African children, the factor structure obtained was similar to the SDQ factor structure in European studies (11, 18, 25). In addition, the 90^{th} percentile cut-off on the hyperactivity-inattention scale was similar to the published cut-off score for possible cases, published by Goodman and collaborators (14).

To further extend the knowledge about African children with symptoms of hyperactivity-inattention, the present study was conducted: 1) to explore the health status, socio-demographic factors, and school performance of African children with hyperactivity-inattention symptoms defined as having an abnormal score on the SDQ hyperactivity-

inattention scale (SDQ-HI), 2) to explore the co-existing symptoms of emotional and behavioural problems associated with hyperactivity-inattention symptoms among African school children.

Subjects

Study area

A detailed description of the study area has been given in a previous paper (14). In brief, the study was conducted in Kinshasa between November 2002 and March 2003. Kinshasa is the capital and largest city of the Democratic Republic of Congo (DR Congo) and has an estimated population of five million.

Population

The present study is based on data collected as part of a research program on mental health among school children in Kinshasa, the DR Congo, which involves a cohort of seven to nine years old children. The study was performed in two steps. The present study reports results of the second step.

1. The first step was a cross-sectional study conducted from July to September 2002 (14). Through a cluster sampling method, at total of 1187 school children (502 boys and 685 girls) at the age of seven to nine years old were recruited in randomly selected schools. Parents' committee and head masters were asked to give permission for the children's participation in the study. Teachers were asked to complete the French version of the Strengths and Difficulties Questionnaire (SDQ) (10). To avoid

problems caused by possible parental illiteracy in French, the questionnaires were administered only to the teachers in the present step. School performance and general health were also evaluated through a questionnaire specially designed for that purpose. The teacher response rate was 100%. Using the 90th percentile cut-offs (10th for the prosocial scale) on the SDQ sub-scales, scores equal or above the cut-offs were considered abnormal. It was found that one hundred and eighty-three children were reported with abnormal scores on the SDQ hyperactivity-inattention scale (SDQ-HI). They were therefore involved in a case-control study for further investigations.

2. The second step – the present study – using a case-control design was conducted from November 2002 to March 2003. The sample included 357 school children at the age of seven to nine years: 183 children with abnormal scores (i.e. above the 90 percentile in the whole sample) on the SDQ-HI scale (cases) and 174 randomly selected children among those with normal scores (i.e. below the 90 percentile) on the SDQ-HI scale (controls). Each parent/caretaker of a selected child was contacted and visited at home for an interview. A semi-structured interview was performed using a questionnaire specially designed to assess the family socio-demographic characteristics and background. All the children were subject to a clinical examination.

The project 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.

Methods

Health status

All children were subject to a clinical examination, including neurological assessment and anthropometric measurements, in a room specially prepared at school for that purpose. Visual acuity was measured by means of the Snellen chart and hearing deficits were assessed by asking the children if they had hearing difficulties and by clinical evaluation. The first author (EK) performed the clinical examination.

The *Raven's Coloured Progressive Matrices* (20) was included as a measure of intellectual function and used to define mental retardation (MR) in children with a result two standard deviations below the mean score of the whole sample.

Socio-demographic factors and school performance

The questionnaire specially designed for the parents/caretakers interview was first piloted to ensure uniformity in the questioning technique and to refine background questions. The following information was gathered: 1) Household composition; 2) Mother's marital status: being the first wife or not; 3) living with both parents or single-parent home, divorced or dead parents; 4) Parents' education and profession/ occupation; 5) Parents' age at the child's birth; 6) mother smoking or not during pregnancy; 7) Perinatal factors (pregnancy, delivery, birth weight, neonatal period and child growth/development); 8) the child's medical history and the presence of particular disorders in the family; 9) the child's global health (seeing and hearing difficulties, physical disability, the child's nutritional status), and socio-economic status as perceived by parents; 10) the child's school performance and learning disability as perceived

by parents; 11) the parents' description of their child's behaviour and temperament. The questionnaire consisted of both close- and open-ended questions. Questions 9 and 10 were close-ended questions rated from 1 (non-optimal) to 3 (optimal), whereas the remaining questions were both close- and open-ended.

Parents/caretakers of each selected child were officially contacted through the head master of the school. They were informed about the interviewer's planned visit and asked for consent to participate. Those who consented were visited at home. At the same time informed consent to examine each child was individually obtained from parent or primary caretaker.
A single interviewer collected all the information from parents/caretakers in order to avoid bias in data collection. The interviewer, who was a graduate from the National Pedagogic Institute of Kinshasa and trained in interviewing, was specifically trained for five days with this particular questionnaire. Both the interviewer and the clinician were blinded to the child's scores on the SDQ-HI scales.

Mental health

Mental health profile of the included children was assessed using the emotional, conduct, peer relation and prosocial subscales from the SDQ questionnaire (10). A total difficulties score (TDS) was calculated from the sum of all the subscales, except the prosocial subscale. A co-existing symptom was defined as having a score equal or above the 90^{th} percentile cut-off (based on the whole case and control sample) on the emotional, conduct and peer relation subscales, and equal or below the 10^{th} percentile cut-off score for the prosocial subscale.

Statistical analysis

Mean group differences were compared using T-tests. Differences in proportions for outcome variables between groups were compared using Pearson Chi-Square tests and odds ratios were used to obtain risk estimates. Fisher's Exact Test was used when appropriate. Logistic regressions were used for bivariate analyses. All analyses were two-tailed and the results were considered statistically significant for a *p*-value less than or equal to 0.05. The Statistical Package for the Social Sciences (SPSS) version 12.0 was used for data analyses.

Results

Sample characteristics

Of the 183 children with abnormal SDQ-HI scores (cases), 39 were excluded due to non-consent or loss to follow-up, whereas 32 children among the 174 with normal SDQ-HI scores (controls) were excluded for the same reasons.

The studied sample comprised 144 cases and 142 controls, among which 129 were boys and 157 girls. Their mean age was 101 months (SD 9). No age (Difference of the mean: 0.0; 95% CI: - 0.2 to 0.2; p = 0.9) or gender (OR: 1.9; 95% CI: 0.7 to 1.9; p = 0.5) differences were found between the cases and controls.

Health status

Both cases and controls were comparable regarding hearing and seeing difficulties (Table 1). The results from the clinical examination were also comparable (Pearson Chi-Square $p > 0.05$), as was the anthropometric measurements (Table 2).

(Table 1 here)

According to the Raven score, two cases and one-control child were defined as mentally retarded (i.e. 2 SD below the mean for the whole sample). The intellectual function as measured by the Raven score was comparable between cases and controls (difference of the mean: 0.7; 95% CI: - 0.3 to 1.8; $p = 0.2$). The mean Raven score was also comparable between the cases ($n = 40$) and the controls ($n = 100$) with normal scores on the other SDQ subscales: 14 vs. 16 (difference of the mean: 1.2; 95% CI: – 0.4 to 2.9; $p = 0.1$). Comparable results were also found between the cases with normal scores on other SDQ subscales and those with abnormal scores on the conduct subscale (difference of the mean - 1.4; 95% CI – 3.2 to 0.3; $p = 0.1$). Similar findings were noticed between the cases with normal scores on other SDQ subscales and those with abnormal scores on the emotional subscale (difference of the mean 0.2; 95% CI – 2.0 to 1.7; $p = 0.8$).

Socio-demographic factors and school performance

In general, none of the socio-demographic characteristics evaluated were found to be associated with abnormal SDQ-HI scores (hyperactivity-inattention symptoms) (Tables 2 & 3). However, young maternal age at childbirth was found to be associated with hyperactivity-inattention symptoms (Table 2). Furthermore, according to parents report, children with abnormal SDQ-HI scores had significantly more school difficulties and poorer school

performance than those without (Table 1). Their average school performance in reading, spelling, writing and mathematic was significantly lower than among the control children (difference of the mean: 0.3; 95% CI: 0.2 to 0.4; p = 0.001). School performance was comparable between the cases with and without abnormal scores on any other subscale (difference of the mean: 0.1; 95% CI: -0.1 to 0.4; p > 0.05).

(Table 2 & 3 here)

Mental health

Among the cases, 40 (28%) children did not obtain abnormal scores on any other SDQ subscale (co-existing symptoms), whereas among the 142 controls, 100 (70%) children did not obtain abnormal scores on any subscale, a significant odds ratio of 6 (Table 4). The cases had an increased risk of abnormal scores on the other SDQ subscales, the highest risk being for conduct problems. About one quarter of the cases did obtain abnormal scores on two subscales and about a tenth on more than two subscales (Table 4). In addition, the proportions of children with abnormal scores on SDQ subscales in any combinations were higher among the cases than the controls (Table 4).

(Table 4 here)

Discussion

The present study is the first to explore the health status, socio-demographic factors and co-existing symptoms in African school children with hyperactivity-inattention symptoms using the Strengths and Difficulties Questionnaire. Children with hyperactivity-inattention symptoms showed a higher risk of having a younger mother at birth, and school difficulties compared to the controls. Co-existing symptoms, defined as abnormal scoring on other SDQ

subscales, were more common among children with hyperactivity-inattention symptoms than controls. Children with hyperactivity-inattention symptoms most often had conduct problems.

It is known that the hyperactivity and inattention symptoms may be induced by different somatic conditions (28). In the present study, the children with hyperactivity-inattention symptoms were comparable to the controls regarding such conditions. No somatic conditions such as malnutrition, anaemia, malaria or other infectious diseases that could explain the presence of hyperactivity-inattention symptoms were identified among the children. Moreover, the clinical examination was comparable and none of the children had perinatal or medical histories with likely explanation of the symptoms found. These findings suggest that the hyperactivity-inattention symptoms in the children of the present study were not induced by somatic conditions.

Intellectual deficits and the inability to cope with academic demands may produce hyperactivity and inattention symptoms (2). In the present study, cases and controls were intellectually comparable making such an explanation for the findings in the present study unlikely. Therefore our findings are probably not attributable to inability to cope with, or to being overwhelmed by school demands.

In line with other studies we found that children with hyperactivity-inattention symptoms had poorer school performance compared to controls (3, 27). Indeed, school performance requires persistence in work-related tasks, sustained attention, mental effort, behavioural restraint, and adaptation to rules. These conditions are known to be impaired in children with hyperactivity and inattention symptoms, and related to poor school performance. These findings may

support our findings on the clinical and intellectual assessment of children with hyperactivity-inattention symptoms and suggest that they constitute a specific behavioural entity.

The affective quality of the home environment and psychosocial factors may predict and influence the presence of hyperactivity-inattention symptoms (16, 19). Family health problems, in the form of parental or siblings' chronic diseases seemed to be related to the presence of child hyperactivity-inattention symptoms, however the association was not significant. This may be explained by the impact of the parents' mental well being on the affective climate at home. Socio-demographic factors have been found to predict behavioural problems (5, 17). In the present study, we were unable to find such association. This may be explained by the absence of such explanatory mechanisms in this population, or the lack of identification of the appropriate environmental risk factors. However, our findings remain in line with two studies of Ethiopian children and one of American children from Caucasian and non-Hispanic families (1, 4, 15).

Attention deficit and hyperactivity disorder (ADHD) frequently occurs with a wide range of co-existing disorders such as conduct disorder, anxiety, depression, and learning disabilities (8, 24). In a Swedish community-based study of school children, it was reported that 87% of ADHD children also met the criteria for at least one, and 67% for two or more co-existing disorders (13). In the present study, although our hyperactive-inattentive children do not have an ADHD diagnosis, it was found that they were more at risk of having abnormal scores in other SDQ subscales. Indeed, almost three quarters of them also had abnormal scores on another SDQ subscale, typically on the conduct subscale. These findings are in line with several other studies (7, 22, 23) and supports a view that hyperactivity-inattention problems is only one aspect of this problem complex. Further studies are needed to better understand the

co-existing disorders profile of these African children with hyperactivity-inattention symptoms.

The strength of this study is that it is one of the first studies to report symptoms on different subscales of the SDQ and the association with socio-economical status. Furthermore, the study has used a community-based sample (however only school attendants), which avoids biases commonly found with the inclusion of clinic-referred samples. None of the children involved in the study were previously referred by teachers for attentional or hyperactivity problems. The interviewer and the clinician were blinded to the child status. The main limitation of this study is the potential for bias related to the use of teachers' report alone. Children were considered as having hyperactivity-inattention symptoms based only on teachers' reports. Ideally, the symptoms should have been confirmed by an extended psychiatric evaluation. Furthermore, there is a need to validate SDQ in this cultural setting, an extremely demanding task in a multilingual setting like Kinshasa. The use of the 90 percentile as a cut-off for suspected diagnosis might have under- or overestimated the symptom load in children included in the present study. Further studies should use a more extended algorithm, including information about symptoms as well as impact scores as recommended by Goodman (12).

To conclude, the present study revealed that poor school performance is associated with hyperactivity-inattention symptoms. The most common co-existing problems with hyperactivity-inattention symptoms were conduct problems.

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Table 1. Health characteristics and school difficulties among children with abnormal scores[1] on the hyperactivity-inattention scale of the Strengths and Difficulties Questionnaire (SDQ-HI) indicating hyperactivity-inattention symptoms (cases) at seven to nine years of age in Kinshasa compared to those with normal SDQ-HI scores (controls) as reported by parents.

Variables	Cases (N=144) N (%)	Controls (N=142) N (%)	OR	95% CI	*p*
Health characteristic					
Visual difficulties	19 (13)	12 (9)	1.6	0.8 – 3.5	0.2
Hearing difficulties	8 (5.6)	10 (7)	0.7	0.3 – 2.0	0.6
Physical disability	0 (0)	1 (0.7)	-	-	0.3
School difficulties [2]					
Repeated a grade	75 (53)	33 (23)	3.7	2.3 – 6.3	0.00*
Need extra courses	74 (52)	45 (32)	2.3	1.4 – 3.8	0.00*

*Pearson Chi-square $p < 0.05$

[1]Scores above the 90th percentile cut-offs (abnormal scores) on the hyperactivity inattention scale of the Strengths and Difficulties Questionnaire (www.sdqinfo.com)

[2]N=142 for cases and 141 for controls.

Table 2. Socio-demographic and health characteristics of school children with abnormal scores[1] on the hyperactivity-inattention scale of the Strengths and Difficulties Questionnaire (SDQ-HI) indicating hyperactivity-inattention symptoms (cases) at seven to nine years of age in Kinshasa vs. school children with normal SDQ-HI scores (controls) as reported by parents or measured during the clinical examination.

Variables	Cases (N=144) Mean (SD)	Controls (N=142) Mean (SD)	Difference of mean (95% CI)
Child age (months)	101 (9)	101 (9)	0.1 (-2 to 2)
Family size	9 (4)	9 (3)	-0.5 (-1 to 0.4)
Number of children	5 (2)	5 (2)	0.4 (-0.2 to 0.9)
Rank of the child	3 (3)	4 (2)	0.4 (-0.1 to 0.9)
Mother age at birth (years)	28 (7)	29 (6)	1.6 (0.2 to 3.1)*
Father age at birth (years)	36 (9)	37 (7)	0.8 (-0.9 to 2.6)
Child birth weight (grams)	3106 (488)	3151 (534)	46 (-73 to 165)
Age at starting school (years)	6 (0.5)	6 (0.5)	0.1 (-0.0 to 0.2)
Height (cm)	130 (7)	131 (9)	0.9 (-0.9 to 2.9)
Weight (Kg)	26 (4.5)	26 (4.9)	0.5 (-0.6 to 1.6)
Head circumference (cm)	52 (1.5)	52 (1.5)	0.1 (-0.3 to 0.4)
Left upper arm circumference (cm)	17 (1.9)	18 (1.8)	0.2 (-0.2 to 0.6)

* p <0.05

[1]scores above the 90th percentile cut-offs (abnormal scores) on the hyperactivity inattention scale of the Strengths and Difficulties Questionnaire (www.sdqinfo.com)

Table 3. Socio-demographic factors and perinatal characteristics of school children aged seven to nine years of age with abnormal scores[1] on the hyperactivity-inattention scale of the Strengths and Difficulties Questionnaire (SDQ-HI) indicating hyperactivity-inattention symptoms (cases) vs. school children with normal SDQ-HI scores (controls) in Kinshasa.

Variables	Cases (N=144) N (%)	Controls (N=142) N (%)	Bivariate analysis OR	95% CI	*p*
Respondent					
Child's mother	74 (51)	69 (49)			
Child's father	10 (7)	22 (15)			0.9
Both parents	0 (0)	3 (2)			0.7
Others	55 (38)	49 (35)			0.2
Family characteristics					
Large family size	111 (77)	106 (75)	1.14	0.6 to 2	0.6
Both parents alive	133 (92)	130 (92)	0.89	0.4 to 2	0.8
Single-parent home	24 (17)	22 (15)	1.09	0.6 to 2	0.8
Divorced parents	9 (6)	11 (8)	0.79	0.3 to 3	0.6
Mother's status (1st wife)	118 (82)	123 (87)	1.43	0.7 to 3	0.3
Family health problem	12 (8)	4 (3)	3.14	0.9 to 10	0.07
Father's education					
Primary level	6 (4)	8 (6)			
Secondary level	63 (44)	59 (41)	1.1		0.8
Above secondary level	75 (52)	75 (53)	1.2		0.8
Mother's education					
Primary level	14 (10)	18 (13)			
Secondary level	107 (74)	92 (65)	1.4		0.4
Above secondary level	23 (16)	32 (23)	0.8		0.8
Perinatal and medical history					
Pregnancy problems	5 (4)	6 (4)	0.81	0.2 to 3	0.7
Smoking during pregnancy	0 (0)	1 (0.7)	-	-	0.3
Abnormal delivery	4 (3)	13 (9)	0.28	0.1 to 0.9	0.02*
Birth weight <2,500g	24 (17)	23 (16)	1.04	0.5 to 2	0.9
Abnormal neonatal period	0 (0)	1 (0.6)	-	-	1.0
Infant abnormal development	0 (0)	1 (0.7)	-	-	0.3
Hospital admittance	21 (15)	15 (11)	1.45	0.7 to 3	0.3

* $p < 0.05$

[1]Scores above the 90th percentile cut-offs (abnormal scores) on the hyperactivity inattention scale of the Strengths and Difficulties Questionnaire (www.sdqinfo.com)

Table 4. Proportion of cases[1] and controls identified with abnormal scores[2] (symptoms) on the different subscales of the Strengths and Difficulties Questionnaire (SDQ) among the 286 school children aged seven to nine years old in Kinshasa. Also the proportions of cases and controls without abnormal scores on any of the SDQ subscales are given.

SDQ scales symptoms	Cases[1] N=144 N (%)	Controls N=142 N (%)	OR (95% CI)
Abnormal score on no other subscale	40 (28)	100 (70)	6.2 (3.7 to 10)*
Abnormal score on one other subscale	55 (38)	31 (22)	2.2 (1.3 to 3.7)*
Emotional only	20 (14)	14 (10)	
Conduct only	23 (16)	5 (4)	5.2 (1.9 to 14)*
Peer only	4 (3)	6 (4)	
Prosocial only	8 (6)	6 (4)	
Abnormal score on two other subscales	30 (21)	5 (4)	7.2 (2.7 to 19)*
Emotional + conduct	7 (5)	1 (1)	
Emotional + peer	7 (5)	2 (1)	
Emotional + prosocial	3 (2)	1 (1)	
Conduct + peer	6 (4)	0 (0)	-*
Conduct + prosocial	4 (3)	0 (0)	-*
Peer + prosocial	3 (2)	1 (1)	
Abnormal score on 3 or 4 other subscales	19 (13)	3 (2)	7.0 (2.0 to 24)*
Emotional + conduct + peer	7 (5)	1 (1)	
Emotional + conduct + prosocial	1 (1)	0 (0)	-
Emotional + peer + prosocial	4 (3)	1 (1)	
Conduct + peer + prosocial	3 (2)	0 (0)	-
Emotional + conduct + peer + prosocial	4 (3)	1 (1)	

Subscales in any combinations			
Emotional in any combination	53 (72)	91 (43)	3.4 (1.9 to 6)*
Conduct in any combination	55 (87)	89 (40)	10.3 (4.7 to 23)*
Peer in any combination	38 (72)	106 (46)	3.0 (1.6 to 6)*
Prosocial in any combination	30 (75)	114 (46)	3.5 (1.6 to 7)*

*Pearson Chi-square p <0.05

[1]Children with scores above the 90th percentile cut-offs (abnormal scores) on the hyperactivity inattention scale of the Strengths and Difficulties Questionnaire (www.sdqinfo.com)

[2]Scores above the 90th percentile (10th for prosocial) cut-offs