ORIGINAL ARTICLE

Early adolescent outcome of attention-deficit hyperactivity disorder in a Chinese population: 5-year follow-up study

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Objective To examine early adolescent outcome of attention-deficit hyperactivity disorder in local Chinese children.

Design Cohort study.

Setting A university teaching hospital in Hong Kong.

Participants A cohort of Chinese children with attention-deficit hyperactivity disorder diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders (4th edition) who attended a day hospital between January 1998 and December 2003.

Main outcome measures Data on psychopathology, academic attainment, delinquency, substance use, and other psychosocial functioning collected from multiple informants and official records. Performances of subjects were compared with a group of community controls.

Results A total of 150 children with attention-deficit hyperactivity disorder were reassessed 6 years after initial intake assessment (mean age, 14 years; follow-up rate, 86%). Compared with the controls, their externalising and internalising disturbances were 4 and 1.5 times more common, respectively. Adolescents with attention-deficit hyperactivity disorder were more likely to smoke cigarettes and use illicit drugs. Their academic attainment was below age norms with more than one fourth repeating grades; 7% of them had been arrested by the police compared with none of the controls. They faced more difficulties in the family environment and social problem–solving. There were discrepancies between parent and patient reports about their attention-deficit hyperactivity disorder symptoms, and officially recorded youth reports of delinquency.

Conclusion Local Chinese children with attention-deficit hyperactivity disorder are at significant risk of multiple forms of adolescent maladjustment. Their outcome profile is similar to that reported in the West.

Introduction

Attention-deficit hyperactivity disorder (ADHD) is an increasingly familiar term in local communities. It represents the majority of patients seen in child psychiatry clinics in Hong Kong. The prevalence of ADHD in Hong Kong is 6.1% in Primary 1 schoolboys and 3.9% in early adolescence.[1,2] These rates are similar to those reported worldwide.[3]

Follow-up studies in the West have consistently reported a wide range of disturbances during the adolescent period of ADHD children. Not only do the core ADHD symptoms persist, but other problems may become manifest, including: antisocial behaviour, academic under-achievement, substance abuse, and social maladjustment.[4-10]

Unlike individualistic cultures in the West, child-rearing in Chinese societies is influenced by Confucian ideology, which places emphasis on social norms and interpersonal harmony. Chinese parents are more authoritarian and exercise greater control. Academic achievement is emphasised, dependence is encouraged, and aggression is strongly condemned.[11-13] Chinese children are given more homework than those in the West and spend more time receiving after-school tutoring.[14,15] Symptoms of ADHD thus impose additional challenges for Chinese children. Our culture considers parents to be responsible for proper behaviour of their children; having a behaviourally disturbed child

Key words
Adolescent behavior; Attention deficit disorder with hyperactivity; Child behavior disorders; Follow-up studies; Juvenile delinquency

Hong Kong Med J 2010;16:257-64

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專注力不足／過度活躍症的早期青少年概況：五年跟進研究

目的 探討專注力不足／過度活躍症對青少年早期發展的影響。

設計 群組研究。

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參與者 1998年1月至2003年12月期間前往一所日間醫院，經《心理疾病診斷統計手冊（第四版）》診斷為專注力不足／過度活躍症的兒童群組。

主要結果測量 從多渠道及官方紀錄搜集有關他們精神健康狀況、學術表現、違法行為、藥物濫用及其他心理社交表現的資料，並與社區對照組別比較。

結果 共150位患有專注力不足／過度活躍症的兒童在首次參與研究的6年後再次接受評估；他們平均年齡14歲，跟進比率86%。與對照組比較，患者在青少年期有外顯性及內顯性問題的比率分別高出4及1.5倍。患者在青少年期有較大機會吸煙及濫藥。患者學術表現比同齡學生為低，當中四分之一曾經留級。對照組別沒有違法紀錄，而7%患者曾被警方拘捕。患者在家庭環境及其他心理社交表現皆面對困難。家長及青少年報告的專注力不足／過度活躍症的表徵有差異，而青少年報告與官方記錄的違法行為亦同樣有差異。

結論 本地患有專注力不足／過度活躍症的兒童在成長過程中須面對各種適應困難的風險。結果概況與西方研究相若。

is commonly interpreted as parental inadequacy. Parental shame leads to family containment and delays in seeking help.[16-18] In the same vein, Chinese school teachers have a high threshold for referring children for professional help.[19] The outcomes of a psychiatric disorder can vary in different cultural contexts. For instance, schizophrenic patients in developing countries were shown to have a better prognosis in terms of more recoveries and less relapses than those in developed countries.[20] Childhood development is a dynamic process between nature and nurture,[21] the importance of the sociocultural environment could hardly be overestimated.

Given the differences in psychosocial contexts, it is premature to assume that ADHD runs a similar course in Chinese children as in the West. To the best knowledge of the authors, there has been no longitudinal study of Chinese ADHD children. The developmental impact of this disorder remains a core clinical question that both parents and clinicians need to answer. This study was designed to describe the early adolescent outcomes of a systematically diagnosed group of Chinese ADHD children in Hong Kong, and to compare them with community controls.

Methods

Subjects

Hyperactive subjects were recruited from the day hospital of the child and adolescent psychiatric unit of Queen Mary Hospital. They were first seen in the out-patient clinic before admission to the day hospital. Children with ADHD underwent a standardised, comprehensive assessment in the day hospital and subsequent training was arranged according to the assessment results. The present cohort consisted of all Chinese ADHD children who attended the day hospital from January 1998 to December 2003. Diagnosis was based on Diagnostic and Statistical Manual of Mental Disorders (4th edition) [DSM-IV] criteria of ADHD, using the clinical history, standardised questionnaire ratings from both teachers and parents, structured clinical observations made over eight half-day sessions, and consensual decisions made during weekly team meetings.

Review of clinical records identified 222 ADHD subjects in the aforesaid period (Fig). Patients with severe sensory or motor dysfunction, mental retardation, autistic disorder, and those still studying at primary schools at the time of follow-up were excluded. At follow-up assessment, the subjects were aged between 12 and 16 years. They were contacted by letter, followed by a phone call. The techniques of securing subject recruitment were adapted from the Cambridge Study of Delinquent Development.[22] On average, five phone calls were made to a subject and his/her parents. Long distance calls, internet phone, and emails were employed to contact subjects who studied abroad. Eleven subjects were not contactable either because they rebuffed our calls or migrated to other countries. The reasons for refusal (n=21) included bad memories, worry about stigmatisation, or concerns about privacy. Data about 190 (86%) of the subjects were successfully collected. The mean follow-up period was 6 (range, 3-9) years. Data about 19 subjects were excluded from analysis because they were older than 16 years or were still studying in a primary school.

During the follow-up period, a community control group was recruited from two local secondary schools (a co-educational and a boy's school). The two schools were in the first and second banding of the local education system, implying that they enrolled more academically competent students. One class was randomly selected from each level of Secondary 1 to 3 classes, with an extra class of Secondary 4 students being randomly selected from the boy's school to match the age of ADHD subjects. With these criteria, 270 students were randomly selected, and 238 parent-student dyads (88%) were successfully recruited. Data were not analysed if a student was older than 16 years (n=8) or had had psychiatric care in the past (n=2). Thus, there were 171 boys and 57 girls who remained for group comparison.

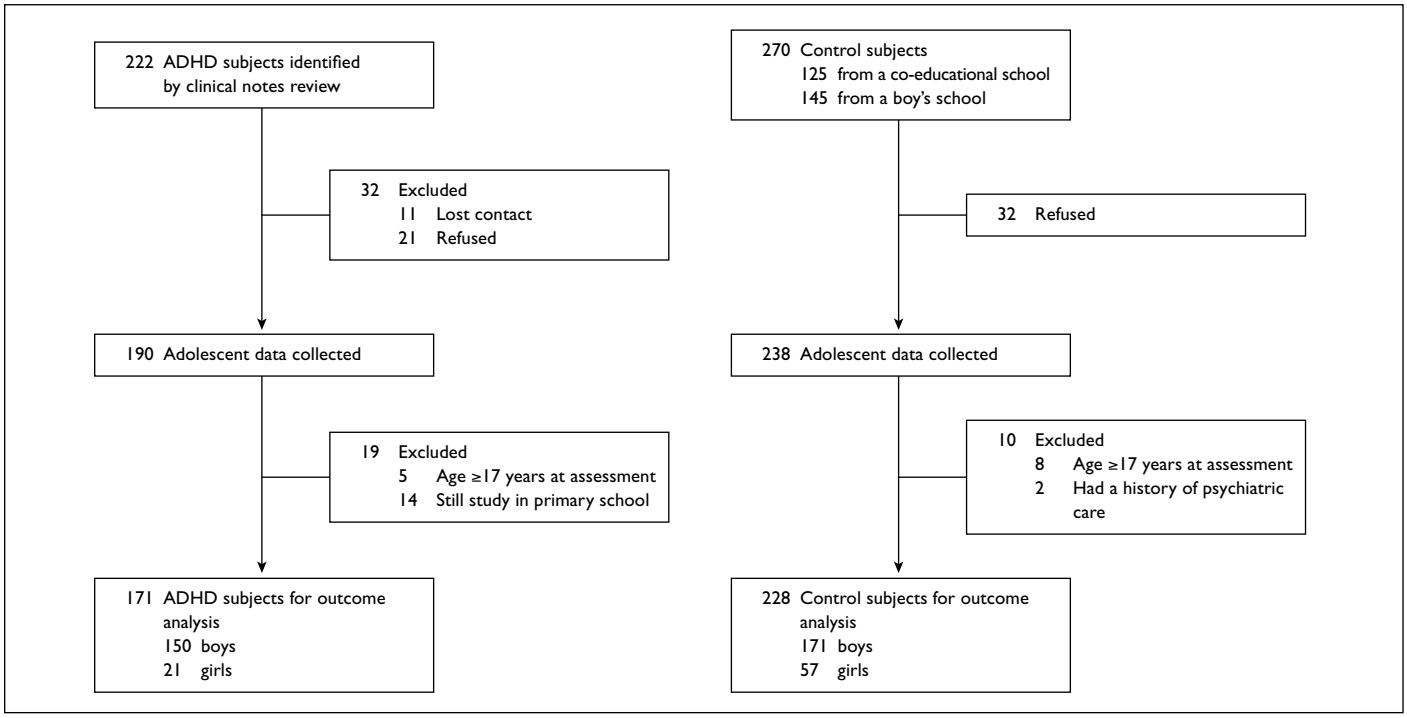

FIG. Recruitment of attention-deficit hyperactivity disorder (ADHD) and control subjects

Procedures

The ADHD and the control subjects completed their assessments at the day hospital and their schools, respectively. Informed written consent was obtained from the subjects and their parents/legal guardians. The research protocol was approved by the Hospital Independent Review Board.

Outcome measures

Adolescent psychopathology

Psychopathology was assessed by the Child Behaviour Checklist (CBCL) and the Youth Self Report (YSR).[23,24] Both were translated and validated for use among children in Hong Kong, with good test-retest reliability and criterion validity.[25] Age- and gender-standardised local norms were established. A clinical case was defined by T-scores of 64 or more in the broadband and total problem scores of either CBCL or YSR. Self- and parental-reporting of ADHD symptoms were assessed by an 18-item DSM-IV ADHD symptom checklist.

Antisocial behaviour

Official records of criminal offences, arrests, and sentences were obtained from Hong Kong Police. In addition, a self-reported Misconduct Scale (Misconduct Score) was employed to measure the frequency of involvement with regard to 17 so-called "deviant behaviours" in the previous 6 months. Previous local and cross-cultural studies had demonstrated the high internal consistency of the Misconduct Scale.[26,27]

Substance use

Drinking, smoking, and use of illicit substances were assessed with questions adapted from a local government survey involving 95 000 secondary school students.[28] Local normative data on past and regular use of multiple substances were available.

Academic performance

The Hong Kong Attainment Test (HKAT [Pre-S1]) is a territory-wide standardised academic assessment for all Secondary 1 students of local schools. Students were assigned percentile ranks (range, 1-100) according to their performance with reference to that of their peers. This test provided objective, standardised, and level-adjusted information on each subject's academic performance. Thirty-three subjects who studied in international schools did not take the test.

Psychosocial adjustment

Self-esteem was measured with a Chinese version of Rosenberg Self-Esteem Scale.[29] Correlation with other self-perception measures and its internal consistency (alpha, 0.68-0.77) had been demonstrated.[30] Problem-solving orientation was assessed with the Chinese-Social Problem–Solving Inventory-R (C-SPSI-R) through 25 statements on a 5-point Likert scale.[31,32] Scores were calculated for five dimensions of

problem-solving orientation: Positive Problem Orientation, Negative Problem Orientation, Rational Problem Solving, Impulsivity/Carelessness Style, and Avoidance Style (Cronbach's alpha, 0.65-0.88; Pearson's *r* test-retest reliability, 0.48-0.79).[31] The total competence T-score of the CBCL was also examined as a general measure of psychosocial competence.

Family environment

Perceptions of one's family were examined with the Conflict and Cohesion Scales of the Family Environment Scale (Cronbach's alpha, 0.66-0.80).[33,34]

Data analyses

Statistical analysis was performed with Statistical Package for the Social Sciences (Windows version 15.0; SPSS Inc, Chicago [IL], US). The childhood parameters of ADHD subjects were examined for representativeness. Attention-deficit hyperactivity disorder–control comparisons were performed with the *T*-test on continuous outcomes and with Chi squared or Fisher's exact tests on categorical outcomes. All statistical tests were two-tailed, and statistical significance set at <0.05.

Too few ADHD girls were available for separate

TABLE 1. Childhood characteristics of reassessed and lost boys with ADHD*

Childhood characteristics	Reassessed (n=150)		Lost (n=29)		χ^2 / *t*
	%	Mean (SD)	%	Mean (SD)	
Age at intake (years)		8.0 (1.6)		7.7 (1.6)	-0.74
Intelligent level (FIQ)		103.0 (14.6)		105.0 (13.5)	0.30
Psychopathology					
CBCL total T-score		63.0 (9.1)		65.7 (8.4)	1.44
CBCL internalising T-score		58.6 (10.6)		61.3 (9.6)	1.24
CBCL externalising T-score		64.4 (8.8)		66.8 (10.1)	1.28
CBCL total competence T-score		34.1 (12.4)		33.0 (15.1)	0.43
TRF total T-score		62.4 (7.3)		63.7 (8.2)	0.71
TRF internalising T-score		56.8 (9.5)		55.8 (10.6)	-0.42
TRF externalising T-score		61.8 (8.7)		62.4 (8.1)	0.27
DSM-IV ADHD count (parent)		12.1 (3.3)		13.1 (3.8)	1.27
DSM-IV ADHD count (teacher)		8.7 (4.3)		10.0 (3.6)	1.17
Co-morbid disorders					
ODD/CD	51		45		0.41
Dyslexia	17		17		0.00
Language developmental disorder	14		14		0.00
Parent and family factors					
Father's age		41.8 (5.8)		43.0 (9.0)	0.88
Father with low education	39		42		0.07
Father with low job status	62		64		0.08
Father with psychiatric disorder	3		3		0.06
Mother's age		38.0 (4.9)		39.5 (4.7)	1.43
Mother with low education	32		32		0.00
Mother with psychiatric disorder	13		10		0.12
Marital disharmony	24		28		0.01
Single parent family	11		10		0.00
More than 3 siblings	1		3		0.67
Treatment factors					
Received medication Rx	87		69		5.60†
Received psychosocial Rx	64		69		0.26
Duration of psychiatric care (months)		46.9 (30.1)		24.2 (22.3)	-3.84‡

* ADHD denotes attention-deficit hyperactivity disorder, CBCL Child Behaviour Checklist, CD conduct disorder, DSM-IV Diagnostic and Statistical Manual of Mental Disorders (4th edition), FIQ full intelligence quotient, ODD oppositional defiant disorder, Rx treatment, SD standard deviation, and TRF Teacher Report Form

† P<0.05; independent sample *t* test (2-tailed)

‡ P<0.001; independent sample *t* test (2-tailed)

analysis for gender effects, so their outcomes were not examined. In this paper, we focus on the adolescent outcomes of the 150 ADHD and 171 control boys.

Results

The successfully reassessed subjects (n=150) were not different from the lost subjects (n=29) in terms of demographic background, individual characteristics, or psychopathologies at the time of case intake. However, they were more likely to have received medication/treatment and attended the clinic longer (Table 1).

The ADHD and control groups were of comparable age and social background (Table 2). Compared with the controls, the ADHD subjects

TABLE 2. Comparison of outcomes in adolescent ADHD and control subjects*

Adolescent outcomes	ADHD (n=150)		Controls (n=171)		χ^2 / *t*
	%	Mean (SD)	%	Mean (SD)	
Subject age (years)		13.9 (1.3)		13.9 (1.2)	-0.09
Single parent family	17		13		0.88
Large sibling size (>3)	3		4		0.12
Low income family	26		19		2.49
Adolescent psychopathology					
Total problem caseness	33		19		8.50†
Internalising caseness	18		8		8.21†
Externalising caseness	32		6		36.0‡
DSM-IV ADHD counts (parent)		8.1 (4.4)		2.6 (3.5)	12.3‡
DSM-IV ADHD counts (youth)		4.8 (4.0)		4.2 (3.7)	1.48
Antisocial behaviour					
History of arrest	7		0		12.3‡
Self-reported Misconduct Score		8.1 (8.7)		8.4 (6.4)	-0.49
Substance use					
Ever smoked cigarettes	13		5		5.61§
Regular smoking	5		1		6.67†
Ever used illicit drugs	3		0		4.62§
Regular use of illicit drugs	1		0		1.15
HKAT mean percentile rank					
Chinese		34.1 (27.9)		55.8 (19.2)	-4.44‡
English		40.7 (29.1)		59.4 (20.5)	-3.71‡
Mathematics		41.8 (32.1)		60.0 (24.2)	-3.20†
Grade repetition	28		11		14.8‡
CBCL competence total T-score		40.0 (12.6)		42.6 (9.7)	-2.04§
Rosenberg Self-Esteem		18.6 (3.9)		18.9 (4.3)	-0.76
C-Social Problem–Solving Inventory-R					
Positive problem solving		10.4 (4.7)		11.3 (4.5)	-1.79
Rational problem solving		9.0 (4.4)		10.1 (4.2)	-2.38§
Negative problem solving		5.7 (4.4)		6.4 (4.3)	-0.47
Avoidance style		6.4 (4.8)		6.2 (5.0)	-0.67
Impulsivity/carelessness		5.5 (3.6)		4.5 (3.3)	2.46§
Family Environment Scale					
Conflict scale		3.1 (2.0)		2.6 (2.1)	2.31§
Cohesion scale		6.1 (2.3)		6.8 (2.1)	-2.99†

* ADHD attention-deficit hyperactivity disorder, CBCL Child Behaviour Checklist, DSM-IV Diagnostic and Statistical Manual of Mental Disorders (4th edition), HKAT Hong Kong Attainment Test, and SD standard deviation

† P<0.01; independent sample *t* test (2-tailed)

‡ P<0.001; independent sample *t* test (2-tailed)

§ P<0.05; independent sample *t* test (2-tailed)

grew up to be 4 and 1.5 times more likely to suffer externalising and internalising disturbances, respectively. Parent-rated ADHD symptoms were higher for ADHD subjects than the controls. Self-ratings by the ADHD subjects, however, endorsed far fewer symptoms and were not different from the controls.

Parallel to the finding of more externalising disturbances, 10 (7%) of the ADHD boys had been arrested by police for 16 offences. Three were involved in violent crimes, in five the crimes entailed theft or deception, and two were self-proclaimed triad membership. Four of them had repeated offences of a similar nature. The youngest and mean age of these offenders were 11 and 13 years, respectively. Eight boys were in receipt of a Police Superintendent Caution, whereby they had to report to and were under the supervision of the police, and charges were dropped for the other two boys. Similar to the self-reported ADHD symptoms, adolescent ADHD subjects endorsed the same level of misconduct score as the controls.

Compared with the controls, the ADHD subjects grew up to be 1.5 times more likely to have ever smoked and 8 times more likely to smoke regularly. None of the controls reported the use of illicit substances, whereas four (2.7%) and one (0.7%) of the adolescent ADHD subjects reported ever and regular use of illicit drugs, respectively. The substances included methamphetamine, cough mixtures, ecstasy, cannabis, organic solvents, and ketamine.

On average, the ADHD subjects ranked 20 percentiles lower than the controls, across all three academic subjects. More than a quarter repeated a grade, which was nearly 3 times more frequent than among controls. Post-hoc analyses found ADHD subjects without co-morbid dyslexia remained significantly worse academically than the controls.

Parent-rated CBCL total competence scores found the adolescent ADHD subjects less competent. Of the five subscales of C-SPSI-R, ADHD subjects rated themselves less rational and more impulsive. They perceived their families as more subject to conflicts and less cohesive. Nevertheless, their global self-esteem was not different from that of the controls.

Discussion

To our knowledge, this is the first comprehensive follow-up study of a large group of Chinese ADHD children. Ascertainment of psychosocial disturbances at both intake and follow-up adopted a standardised, multi-informant, and multi-dimensional approach. Notably, in their early adolescence Chinese ADHD children encountered problems in behavioural and emotional adjustment, academic attainment, problem-solving, and family functioning, whilst also exhibiting anti-social behaviour and substance use.

Methodological issues

Our ADHD subjects were recruited from a local child psychiatry day hospital. Although it served 20% of the child population in Hong Kong, the representativeness of the sample merits careful consideration. Instead of an out-patient sample, this group was selected for its standardised and comprehensive assessment, which instilled better confidence in the ascertainment of psychopathologies. These patients were attending the day-hospital for various reasons, and did not necessarily represent a more disturbed group. Nevertheless, generalising the present findings to other local clinics or Chinese communities should be exercised with caution.

Our control sample was recruited at follow-up assessment. Their higher academic competence was reflected in their above-average HKAT (Pre-S1) scores, which could tend to overestimate differences between the average population and those with ADHD. However, this argument was not supported by outcomes in that local population norms were available for reference. First, the percentage of ADHD subjects scoring above the cut-offs in Achenbach's questionnaires far exceeded the expected local norm. Second, the ADHD adolescents ranked 8 to 16 percentiles lower academically than the population mean of 50 in the HKAT (Pre-S1). Third, police statistics reported an official arrest rate of 0.86% in the local juvenile population, which was 7 times lower than that in our ADHD group.[35] Local surveys reported rates of 6.6 to 19.4% and 1.7 to 2.9 % for respective lifetime tobacco and psychotropic substance use among Hong Kong students of different age-groups (12-16 years).[28] The corresponding rates of 12.8% and 2.7% in our ADHD subjects fell within these ranges, but were high if their relatively young ages were considered. In short, our ADHD subjects grew up with more habits considered as antisocial than ordinary teenagers in the local community.

Despite our relatively short follow-up period (about 6 years), the follow-up rate was only 86%. According to the baseline assessments, the lost subjects received significantly fewer medications/treatments, had shorter periods of psychiatric care, and showed a non-significant trend towards higher symptom scores. It is likely that the more disturbed cases who did not respond well to treatment were lost differentially. It is also possible that those who were more compliant to treatment in childhood were more willing to participate in the follow-up study. In either scenario, the successfully reassessed ADHD subjects could have been biased toward more optimistic outcomes. A more disturbing picture might have ensued if the complete ADHD cohort could have been reassessed.

The developmental impact of attention-deficit hyperactivity disorder in the Chinese population

Compared with similar follow-up studies in the

West, the Chinese ADHD subjects in this study had relatively lower rates of psychopathology, juvenile delinquency, and substance abuse. In Mendelson et al's early cohort,[36] 18% of the hyperactive subjects had appeared in court by early adolescence. Satterfield et al[5] reported arrest rates of 36 to 58% in hyperactive subjects in different social classes (vs 2-11% in controls). Moffitt and Silva[37] found that nearly 60% of ADHD children became delinquent adolescents. Farrington et al's epidemiological study[6] found a juvenile conviction rate of 45% among a subgroup of hyperactive children with early-onset conduct problems. Barkley et al[7] diagnosed 44% of his hyperactive child subjects as suffering from conduct disorder at the age of 15 years (vs 2% in controls); nearly half of them with self-reporting involvement in shoplifting and 21% in fighting or assault (vs 15% and 2% respectively, in controls). The arrest rate of 7% for Chinese ADHD boys in this study appears low, but is many times higher than the local juvenile delinquency rate. Similarly, only four of our ADHD subjects used illicit drugs. Compared with illicit substance use in 15% of ADHD and control teenagers in Biederman et al's study[9] and drug-related activities in 14% of ADHD subjects in Barkley et al's cohort,[7] the rate of substance use in our ADHD subjects was low. Nonetheless, the risk was high compared with the controls, and the relatively low rates of illicit substance use (3-4%) reported in local teenagers.[28] Likewise, relative to western counterparts, the rate for psychopathologies in our ADHD subjects at adolescence was low. One possible reason for the low rate of delinquency and substance use was that the youngsters in the present sample had not yet reached the age of maximum risk. A more problematic picture might have emerged had they been assessed at an older age. Nonetheless, judging from the low rate of substance abuse detected in our local survey and low juvenile delinquency reported in government statistics, the possibility of a cultural difference in attitudes towards reporting problem behaviours or judiciary policy could not be excluded. A possible cultural difference in the developmental risk of these adverse outcomes warrants further study.

In contrast to Weiss et al's alarming report of 70% hyperactive adolescents had repeated at least one study grade and 10% were placed in special classes,[38] only 28% of our Chinese subjects had repeated a study grade. This was similar to the 29% reported by Barkley et al[7] and 37% reported by Biederman et al.[8]

The long-held belief of low self-esteem in children with ADHD was not fully supported by the conflicting findings of previous studies.[39] Neither did we detect low self-esteem among our Chinese subjects. Despite the emphasis on academic achievement and adherence to social norms in Chinese culture, self-esteem problems were not evident in our sample. Further follow-up is needed to examine whether self-esteem is preserved following their maturity.

Even though the ADHD adolescents did not admit to having many of the known ADHD symptoms, they rated themselves as less rational and more impulsive on social problem–solving than the controls. Similar to the findings reported by Biederman et al,[8] our ADHD subjects perceived their families as more liable to conflict and less cohesive. This similarity is more striking, knowing the cross-cultural differences in emphasis on the upbringing of children.

As a whole, the pathoplastic effects of ADHD on various outcomes of early adolescent development in Chinese children point in the same directions as their western counterparts, even though low absolute rates were detected. Given that ADHD imposes similar developmental risks across diverse socio-cultural groups, our findings add weight to the cross-cultural comparability of the ADHD concept.

Implications

One interesting finding from this study was the discrepancy between youth- and parent-reported ADHD symptoms, and self-reported misconduct and official records of delinquency. Previous studies have suggested self-reports of externalising problems by hyperactive youths are often less pronounced than those reported by their parents/teachers.[40,41] Notably, in our study the youths rated their family environment and social problem–solving abilities poorly, and self-reported more substance misuse. This discrepancy could not be readily explained by youths failing to report their socially undesirable behaviours. Rather, we suggest that these adolescents were less sensitive to their own behaviour, though they were good factual reporters. The nature of this discrepancy needs to be better understood, and the adoption of a multi-informant approach is warranted in future follow-up studies.

The diverse negative impacts of ADHD on adolescent development indicate the need for early, aggressive treatment. Given the heterogeneity of outcomes, a search for predictors and mediators of outcomes may help identify who needs what types of treatment. Follow-up studies at a later developmental stage may clarify whether the gloomy early adolescent outcome endured by Chinese ADHD children is merely transient turmoil or the beginning of a deviant developmental trajectory.

Acknowledgements

We thank the staff of the child psychiatric day hospital at Queen Mary Hospital for helping with the data collection, the Hong Kong Education Department for providing data from pre-secondary test results, the Hong Kong Police Department for providing official criminal records, and the adolescents and their parents for using their private time to share their pains and joys of growing up.

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