ATTENTION PROBLEMS IN CHILDHOOD AND SOCIOECONOMIC DISADVANTAGE 18 YEARS LATER: THE TEMPO COHORT

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Abstract

Background

Attention Deficit/Hyperactivity Disorder has been associated with socioeconomic difficulties later on in life. Little research in this area has been based on longitudinal and community studies.

Aims

To examine the relationship between childhoodattention problems and socioeconomic status 18 years later.

Method

Using a French community sample of 1103 youths followed from 1991 to 2009, we tested associations between childhoodattention problems and socioeconomic status between ages 22 and 35, adjusting for potential childhood and family confounders.

Results

Individuals with high levels of childhood attention problems had a nearly fourfold likelihood of subsequent socioeconomic disadvantage compared with those with low levels (odds ratio=3.82; 95%CI:1.92–7.58). This association remained statistically significant even after adjusting for childhood externalizing problems, low family income, parental divorce and parental alcohol problems.

Conclusions

This longitudinal population-based study shows an association between childhoodattention problems and socioeconomic disadvantage in adulthood. Taking into account ADHD and associated difficulties could help reduce the long-term socioeconomic burden of the disorder.

Declaration of interest

Dr Bouvard received financial support for the organization of scientific meetings and was also the main investigator in clinical trials for Shire and Lilly. In the UK, Dr Fombonne provided advice on the epidemiology and clinical aspects of autism to scientists advising parents, to vaccine manufacturers, and to several government committees between 1998 and 2001. Since 2004, Dr Fombonne has been an expert advisor to vaccine manufacturers and the US Department of Health and Social Services with regard to the autism thimerosal litigation.

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a behaviourally defined developmental condition with childhood onset and often symptomatic continuity throughout life. Its high prevalence of about 5% in youths and 2% in adults, plus its association with numerous negative outcomes, are the source of substantial burden in affected individuals, their families and society, with possible loss of workforce productivity. In particular, ADHD has been linked to a range of social and occupational difficulties, including academic underachievement, unstable employment, job inactivity, poor job performance, lower income and occupational status (1-11).

At least two main issues should be underlined regarding the link between ADHD and socioeconomic attainment. First, as in other common mental health disorders, social causation and health selection phenomena may apply to ADHD (12-14). When examining the link between ADHD and socioeconomic status it is therefore crucial to consider a broad range of potential early confounders,which many previous studies in the field failed to do. Notably, among family characteristics, parental socioeconomic status (SES) is related to children's psychological difficulties, making it a critical factor to take into account (15-17). In addition, parental psychopathology and instability may confound the relationship between ADHD and subsequent socioeconomic status (14, 18). Another set of possible early confounders are other frequently co-occurring childhood psychopathologies, including externalizing and internalizing problems, which are likely to contribute to subsequent socioeconomic disadvantage and confound the link between ADHD and subsequent SES (19, 20). A second shortcoming is that existing findings often arise from longitudinal studies of clinic-referred ADHD children and adolescent or from cross-sectional studies of adults with retrospective reports. Additional longitudinal population-based surveys are therefore needed to provide results that are generalisable to the community.

In this study, we test the hypothesis thatattention problems in childhood and adolescence (4-16 years) are associated with low SES in adulthood (22-35 years) independently from other factors (childhood psychopathology, low household income during infancy, family characteristics) in a community sample followed-up during an 18-year period.

Method

Sample

Data for this study come from two sources based in France: young adults participating in the TEMPO study and their parents who take part in the GAZEL cohort study. The GAZEL cohort study was set up in 1989 and included 20,624 men and women aged 35-50 years of age, employed

in a variety of occupations from manual worker to manager and living across France. Since study inception, the participants have been followed yearly via self-reported questionnaires. The TEMPO study was set up in 2009 among young adults (22-35 years) who had taken part in a study of children's psychological problems and access to mental health care in 1991. The original sample of children surveyed in 1991 was selected among 4-16 year olds whose parents were in the GAZEL study. The original sample (n=2,582) was stratified to match the socioeconomic and family size characteristics of French families in the 1991 census. (21, 22). In 2009, we asked parents of youths who had taken part in the 1991 survey to forward the TEMPO study questionnaire to their son/daughter. Of the 2,498 youths whose parents were alive and could be contacted, 16 had died since 1991 and 4 were too ill or disabled to answer. The overall response rate to the 2009 TEMPO questionnaire was 44.5% (n=1,103), which is comparable to response rates in other mental health surveys in France (23). Leading reasons for non-participation were non-transmission of the questionnaire by the parent (34.8%) or the youth's lack of interest (28.5%). Non-respondents were more likely to be male, to come from families that were divorced, had lower socioeconomic background and had parents who smoked tobacco and abstained from alcohol. Participants and non-participants did not vary with regard to parental or own overall psychological characteristics. The unemployment rate among TEMPO study members is comparable to that of young adults in the general population of France (24). The TEMPO study was approved by the French national committee for data protection (CNIL: Commission Nationale Informatique et Liberté).

Measures

Youths' mental health at baseline

Youths' psychopathology was assessed in 1991 when parents completed the Child Behaviour Checklist (CBCL) (25, 26). The French version of the CBCL was validated in previous clinical and epidemiological studies (27, 28). This widely used tool includes 118 items on youths' behavioural problems in the preceding 6 months. Each problem item is coded from 0 to 2. The CBCL makes it possible to construct empirically based scales (based on factor analyses that identify syndromes of co-occurring problem items) of internalizing, externalizing and attention problems (AP) (that is hyperactivity-inattention symptoms). Youths' internalizing score (Cronbach's alpha=.83) was based on three syndrome subscales: "anxious/depressed syndrome" (13 items), "withdrawn behaviour" (8 items), and "somatic complaints" (11 items). Youths' externalizing score (Cronbach's alpha=.84) was based on two syndrome subscales: "aggressive behaviour" (18 items) and "rule-breaking behaviour" (17 items). The AP scale (Cronbach's alpha=.72) comprised the following items: "cannot concentrate", "daydreams", "impulsive", "cannot sit still", "acts young", "confused",

"stares blankly", "poor school work". The AP scale has been shown to be a good predictor of ADHD diagnosis (Biederman, 1993). We found no evidence of the existence of separate factors for inattention and hyperactivity-impulsivity on the CBCL, therefore a single combined variable was used in the analyses (26). Data missing on each CBCL scale were imputed when less than one third were missing. We generated a dichotomous variable (high and low symptom levels) by using the 90th percentile of the score distribution, which is the recommended cut-off to differentiate cases and non-cases in community samples (29).

Family characteristics

Family data primarily come from parents' own yearly reports in the GAZEL study between 1989 and 2009. Low income at baseline was defined as <23,800 euros per year (sample median) versus ≥23,800 euros per year. Parental separation or divorce (yes versus no) was reported in the yearly GAZEL questionnaires. Parental depression (yes versus no) was defined as at least two parental self-reports of depression in yearly GAZEL study questionnaires or TEMPO participants' reports of parental lifetime depression ascertained using a questionnaire adapted from the NIMH-FIGS (Maxwell, 1992). Parental alcohol problems (high alcohol use present versus absent) was defined as at least two parental self-reports of high alcohol use in yearly GAZEL study questionnaire (>=21 glasses of alcohol/per week in women, >=28 glasses of alcohol/per week in men) and TEMPO participants' reports of parental alcohol dependence were ascertained using a questionnaire adapted from the NIMH-FIGS (Maxwell, 1992).

Youths' socioeconomic status at follow-up

Participants were asked to report their employment situation at the time of the study (student, in employment, unemployed, out of the labour force). Measuring the socioeconomic position of young adults who are transitioning between schooling and employment is challenging (Hanson and Chen, 2007). In France, as in other countries, young adults are a heterogeneous population who face unemployment and job insecurity at higher rates than the rest of the population (INSEE, 2006). In order to address this issue, we used a composite indicator of socioeconomic circumstances based on educational attainment and employment characteristics, as done in other studies (Lynch and Kaplan, 2000; Poulton et al., 2002; Melchior et al., 2007). We constructed an overall indicator of SES combining educational attainment, occupational grade, past 12-month employment stability and past 12-month experience of unemployment, each coded 0–2. Correlations between the four components of our socioeconomic indicator ranged from .03 to .47. To study associations between childhood attention problems and SES, we divided the SES distribution into tertiles: high,

intermediate, and low SES.

Analysis

We first described sample characteristics and situation at follow-up by level ofattention problems (AP) at study baseline. We then sought to estimate the strength of the association between childhood AP and SES 18 years later, controlling for potential confounders and restricting the study sample to participants who were on the labour market (i.e. students who by definition had not completed their education were excluded from the sample). Analyses were therefore performed using multivariate regressions (polytomous logistic models) adjusted for gender (male vs. female), age (continuous), family income (low vs. intermediate/high), parental divorce (yes vs. no), parental depression (yes vs. no), and high parental alcohol use (yes vs. no). To select predictors included in the final regression model, we first estimated age- and gender- adjusted relationships between independent variables and the study outcome (Wald x2/two-tailed analyses). Variables with $p<0.25$ were entered into the initial models. Backward selection (variables deleted when $p>0.05$) with control for confounding factors was then conducted. Finally, we tested relevant interactions between AP and independent variables kept in the final model. Multicollinearity diagnostics were tested using the criteria of Belsley. To test the robustness of the findings, several sensitivity analyses were conducted. Data were reanalysed: 1. adjusting for prior school difficulties (indexed as more than one grade retention versus one or less grade retention); 2. modifying the AP variable by dropping the item "poor school work" from the AP scale; 3. coding CBCL scores as z-standardized scores. Statistical significance was determined at a level of 0.05. All calculations were carried out using SAS version 9.1 (SAS Institute Inc., Cary, NC, USA).

Results

Table 1 provides the main sociodemographic features of the sample. Table 2 shows participants' situation at follow-up by level of AP at study baseline. Participants with high levels of AP were less likely to have graduated from secondary school. They were more often unemployed or inactive and had a lower socioeconomic status than their counterparts with low levels of AP. Table 3 provides the results of regression analyses for socioeconomic position at follow-up. The multivariate model (n=950) was significant (Wald $\chi^2=111.43$, $p<.0001$). AP, externalizing problems, low income at baseline, parental divorce and parental alcohol problems were significantly related to lower SES 18 years later. There was no significant interaction betweenAP and gender.

Sensitivity analyses conducted a) adjusting for prior school difficulties, b) dropping the item

“poor school work” from the AP scale, using standardized CBCL scoresyielded results consistent with our main findings (not shown).

Discussion

Summary of findings

In this longitudinal French community-based study,attention problems in childhood and adolescence were associated with lower SES in young adulthood. Of note, this association remained even after accounting for childhood externalizing problems and family risk factors including low household income and history of parental divorce and alcohol problems.

Comparison with previous findings

Our results based on a community sample are in line with prior research primary conducted in clinical populations. Beyondattention problems, several early risk factors appeared to contribute to socioeconomic disadvantage 18 years later; nevertheless, they were less stronglyassociated with the study outcome than attention problems. Consistent with prior research, in our study externalizing problems were associated with subsequent low SES (19). This association may be related to school failure, other frequent comorbidities like substance use disorders and non-compliance to rules and structured activities in the workplace. Additionally, with the exception of internalizing problems that were not associated with subsequent socioeconomic disadvantage, we found that family characteristics including low household income, parental divorce and parental alcohol-related problems predicted subsequent socioeconomic disadvantage, but did not account for the association between symptoms of attention problems and poor adult outcomes.

Putative mechanisms of the association betweenattention problems and socioeconomic disadvantage

ADHD could be linked to socioeconomic disadvantage through several pathways. At an early stage, ADHD is likely to contribute to academic underachievement through grade retention, need for special education, lower scores on achievement tests, and lower academic achievement. The association between ADHD and such academic problems could be due to children’s behavioural symptoms but also to other possible comorbid cognitive features, learning disabilities, or language disorders. Interestingly, as suggested in other studies, the negative relationship between ADHD and academic attainment remains after accounting for IQ, SES and comorbid disorders (6, 30, 31). Since academic underachievement adversely influences employment and educational possibilities (32), it

is a potential mediator of the association between ADHD and SES.

At a later stage, numerous features associated with ADHD, some of which persist even after attention problems decrease with age, are potentially related to workplace problems and work-related anxiety. Indeed, ADHD could lead to an inability to achieve the necessary skills to comply with job expectations, leading to poor work performance and difficulties in relationships with colleagues (33). First, ADHD core symptoms of inattention, poor concentration, distractibility, motor hyperactivity, and impulsivity may play a direct role in the occurrence of workplace difficulties. They could impact work performance and cooperation with colleagues through an inability to fulfil key work tasks, failure to remember or listen to instructions, excessive verbal or motor activity, and failure to inhibit responses. Second, the socio-emotional impairments found in ADHD, like poor self-regulation of emotions (i.e. emotional impulsiveness) and lack of empathy, may hamper social exchanges at work, leading to poor cooperation, turn-taking and sharing, and conflicts with colleagues (34, 35). Third, executive function deficits, which characterize 30-50% of ADHD patients (36), may compound difficulties in workplace functioning in addition to ADHD symptoms themselves. In fact, executive function deficits exhibit compromised response inhibition, working memory (particularly nonverbal and manipulative aspects), and planning. All these dysfunctions jeopardise the ability to solve problems and self-organize, leading to more decision-making confusion (34, 37, 38). Fourth, other neuropsychological impairments associated with ADHD like delay aversion, difficulties in self-motivation and timing deficits may also have negative consequences at work (38, 39). The inability to maintain an effort over immediate satisfaction versus more delayed consequences and a poor cross-temporal organization undermine the capacity to initiate and maintain behaviour across time, whereas this ability is often needed in job tasks. Finally, other consequences and associated characteristics of ADHD such as poor self-esteem and adult psychiatric comorbidity (i.e. anxiety, depression, antisocial behaviours, substance use disorders, and personality disorders) may induce functional impairment and maladjustment in job activities. However, in adults with ADHD, it has been suggested (8) that most of the time out of role could be imputed to ADHD itself rather than co-occurring disorders.

Strengths and limitations

The main strengths of this study are its community-based sample and the longitudinal follow-up over an 18-year period. However, its limitations should be considered when interpreting the findings. First, we used CBCL scores as proxies of psychiatric disorders. This precluded consideration of functional impairment, symptom duration, and ADHD subtypes. Nevertheless, CBCL scales have high levels of validity as compared with DSM clinical diagnoses (26), which

implies that symptoms identified with this instrument have clinical significance. Second, attrition was high in this longitudinal data set. Reassuringly, comparisons between participants and non-participants in 2009 did not show significant differences between participants and non-participants regarding psychological characteristics. Third, there was selective attrition since individuals with low SES at baseline were underrepresented because participants came from families where one parent had high job security, and families with a higher SES were more likely to participate at follow-up. This might have biased the study towards less severe cases and consequently may have produced more conservative results. Reassuringly, there were no significant differences regarding parental and youth psychopathology when comparing participants to non-participants in 2009. Fourth, we did not consider other potential confounding factors such as ADHD symptoms at follow-up, IQ levels, learning disability, executive dysfunction, bipolar disorder, child maltreatment, biological factors, and treatment status. However, this sample is likely to have been unexposed to psychostimulant medication due to the setting in France and the time period (40). A further limitation is that we did not consider adult ADHD in parents whereas it may influence parenting style and by this SES outcome in their children.

Implications

ADHD appears to be a potent early risk factor for subsequent low socioeconomic position. Since ADHD is a frequent chronic disorder, the value of taking it into account early on could be considered, with the hope of diminishing the impairment leading to subsequent engagement in deleterious socioeconomic trajectories. In addition, early detection of academic difficulties in ADHD children may be helpful. School support and specific remediation programs may help children with ADHD to improve their academic performances (41). Vocational assessment and work preparation could also be worthwhile before academic and occupational pursuit and orientation. Clinicians, parents, teachers and career counsellors should help youths and adults with ADHD choose academic and occupational tracks that match their strengths and weaknesses (3, 42).

At a later stage, consideration of ADHD problems in the workplace may be fruitful. Better identification of undiagnosed adults presenting ADHD could make them benefit not only from adequate individual interventions but also from occupational adjustment to favour their abilities and minimize their difficulties in their job function and environment. Interestingly, self-ratings of executive functioning, which appear more predictive of impairment in occupational functioning than executive function tests, could help in identifying difficulties in adults with ADHD (34). Such tools could help in assess individuals most at risk of work failure as well as in identifying specific targets for remediation. However cost-effectiveness studies of such procedures are needed. Finally,

another important area deserving attention are co-workers' and managers' social representations . Providing them knowledge about ADHD may transform their views of their affected colleagues and lead to a more tolerant, socially harmonious and efficient workplace.

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Table 1. Sociodemographic characteristics of the TEMPO sample (n=1103)	
Gender	
Male	41.2
Female	58.8
Age at baseline (years)	11.0 (3.7)
Age at follow-up (years)	28.9 (3.7)
Parental divorce	14.8
Parental depression	29.5
Parental alcohol problems	23.0
Low familial income at baseline	34.8
Participant situation at follow-up	
Student	9.3
Worker	82.0
Job seeker	7.4
Inactive	1.3

Values given as percentages or mean (standard deviation)

Table 2. Situation at follow-up by level ofattention problems (AP)

	AP≥90th centile group (n=110)	AP <90th centile group (n=993)	P
Diploma above secondary school graduation	57.3	80.2	<.0001
Participant situation at follow-up			
Student	4.6	9.8	.0007
Worker	79.7	82.6	
Job seeker	11.1	6.8	
Inactive	4.6	0.8	
Socioeconomic status in non-students (n=1001)			
Low	48.4	29.9	<.0001
Intermediate	37.9	36.7	
High	13.7	33.4	

Values given as percentages

Table 3. Multivariate modelling of socio-economic position in function ofattention problems and other covariates

Independent variables	OR 1 (95%CI)			OR 2 (95%CI)		
	High SES	Intermediate SES	Low SES	High SES	Intermediate SES	Low SES
CBCL problems						
Attention	1.0	2.86 (1.48-5.54)	4.66 (2.50-8.69)	1.0	2.51 (1.28-4.96)	3.82 (1.92-7.58)
Externalizing	1.0	1.95 (1.07-3.58)	2.69 (1.48-4.91)	1.0	1.68 (0.90-3.15)	2.10 (1.11-3.97)
Internalizing	1.0	1.07 (0.63-1.84)	1.45 (0.83-2.52)	1.0	-	-
Familial variables						
Low income	1.0	2.04 (1.44-2.90)	2.97 (2.05-4.29)	1.0	1.98 (1.38-2.82)	2.74 (1.87-4.00)
Parental divorce	1.0	1.35 (0.83-2.19)	2.28 (1.41-3.67)	1.0	1.16 (0.71-1.91)	1.81 (1.10-2.98)
Parental depression	1.0	0.96 (0.67-1.36)	1.16 (0.81-1.67)	1.0	-	-
Parental alcohol problems	1.0	1.52 (1.04-2.21)	1.70 (1.15-2.52)	1.0	1.49 (1.01-2.19)	1.69 (1.13-2.55)

OR 1, odds ratio adjusted for age and gender; OR 2, odds ratio adjusted for age, gender and other significant covariates; CI, confidence interval; CBCL, child behaviour checklist.