Pergamon

J. Child Psychol. Psychiat. Vol. 36. No. 2, pp. 279–303, 1995
Elsevier Science Ltd

0021-9630/95 $9.50 + 0.00

0021-9630(94)00122-7

Hyperactivity: Prevalence and Relationship with Conduct Disorder

Paul McArdle,* Gregory O'Brien† and Israel Kolvin‡

Abstract—This paper reports the prevalence of situational and pervasive hyperactivity using different definitions of 'caseness', and explores the relationship between situational and pervasive hyperactivity and conduct disorder, using a large data base from the North of England. The prevalence of hyperactivity, and its relationship with conduct disorder, varied according to whether hyperactivity was pervasive or situational, according to the age of the child and to the definition of hyperactivity 'caseness'. Among younger children only, school based situational and pervasive hyperactivity had comparable comorbidity with other available evidence of psychiatric disorder and hyperactivity was virtually a prerequisite for conduct disorder. Among older children, pervasive hyperactivity had greater comorbidity with other psychiatric disorder than situational hyperactivity and, furthermore, displayed the strongest links with conduct disorder.

Keywords: Hyperactivity, conduct disorder, prevalence, comorbidity

Introduction

Hyperactivity can refer to either a dimension or a category of psychopathology that is characterised by both restlessness and inattention (Taylor, 1986; Goodman & Stevenson, 1989). As a category it is central to the hyperkinetic syndrome of ICD-9 (WHO, 1978), its successor in ICD-10 (WHO, 1992), the DSM-III diagnosis of attention deficit disorder with hyperactivity (APA, 1980) and its successors in DSM-III-R, attention deficit hyperactivity disorder (APA, 1987) and in DSM-IV, attention-deficit/hyperactivity disorder (APA, 1994). However, inattention is not always an essential criterion for the latter diagnoses (Schachar, 1991; APA, 1994).

Although the prevalence of hyperactivity is a subject of considerable clinical and theoretical importance, it is no easy matter to elucidate this. Reasons for this difficulty include not only whether it is perceived as a symptom, a syndrome or

Accepted manuscript received 29 *June* 1994

* Fleming Nuffield Child Psychology and Psychiatry Unit, Newcastle upon Tyne.
† Northgate Trust Hospital, Morpeth, Northumberland.
‡ Royal Free Hospital School of Medicine and the Tavistock Clinic, Belsize Lane, London.
Requests for reprints to: Dr Paul McArdle, Fleming Nuffield Child Psychology and Psychiatry Unit, 1 Tankerville Terrace, Jesmond, Newcastle upon Tyne, NE2 3AE, U.K.

disorder but also because of the problem of allowing for comorbidity, bearing in mind the established link with conduct disorder in particular (Sandberg, Rutter & Taylor, 1978; August & Stewart, 1982; McGee, Williams & Silva, 1984; Shapiro & Garfinkel, 1986; Taylor *et al.*, 1986 a,b). Furthermore, conceptual and methodological differences between studies (Szatmari, Offord & Boyle, 1989a) involving differences in sample characteristics, in definition of symptoms, in the systems of classification used, in methods of collection and in sources of data and (where applicable), when using rating scales, the threshold or cut-off scores, also confound estimates of prevalence. Additionally [not surprisingly for a condition viewed as developmental in nature (Taylor, 1986; Cantwell, 1988)], prevalence is influenced by the age of the population examined (Szatmari *et al.*, 1989a). As a result, estimates of prevalence range widely.

For instance, when relying on survey questionnaires, Goodman and Stevenson (1989) observed almost one-quarter of 13-year-old children to display symptoms of hyperactivity. On the other hand, with both questionnaire data and a syndrome based on DSM-III diagnostic criteria, a rate of 6.9% emerged among 12–13-year-olds (Szatmari *et al.*, 1989a). However, in the Isle of Wight study (Rutter, Tizard & Whitmore, 1970) and in the more recent epidemiological study of Taylor, Sandberg, Thorley and Giles (1991) which incorporated the use of clinical judgement and where the focus was on disorder, less than 1% of 10- and 11-year-olds and between 1 and 2% of 6- and 7-year-old children, respectively, were diagnosed as suffering from a hyperkinetic disorder.

A further issue concerns whether the criteria include only pervasive hyperactivity, where it is present across situations [as in ICD-10 (WHO, 1992), and DSM-IV (APA, 1994)], or whether situational hyperactivity (present in one setting alone) is included. Studies focusing on situational hyperactivity report fairly high rates. For instance, Achenbach and Edelbrock (1981), on the basis of a parent questionnaire, report a rate for the symptom of over 30% for 6–9-year-olds, while Schachar, Rutter and Smith (1981) report a total prevalence for situational and pervasive hyperactivity combined, of 16.5% for 10- and 11-year-olds. However, prevalence rates in the latter study reduced to 2.2% when situational hyperactivity was excluded. Despite this, some important surveys such as that of McGee *et al.* (1984) did not examine the contribution of situationality to prevalence and, similarly, that of Szatmari *et al.* (1989a) examined only teacher reports in younger children.

Rapoport, Donnelly, Zametkin and Carrougher (1986) claimed that pervasive hyperactivity is equivalent to school-based situational hyperactivity in certain key respects. However, Goodman and Stevenson (1989) have argued that situational hyperactivity (whether home- or school-based) and pervasive hyperactivity represent the same basic condition but differing essentially in severity. This approach is recognised in DSM-III-R, which regards pervasive symptoms of hyperactivity as indicative of greater severity and contrasts with the approach of Taylor *et al.* (1991) and, indeed, of ICD 10 and now of DSM-IV, which have based the diagnosis of hyperactivity disorders on the criterion of pervasiveness.

The diagnostic systems of the World Health Organization (WHO 1978; 1992) and of the American Psychiatric Association (APA 1980; 1987; 1994) have consistently included categories that represent both childhood hyperactivity and antisocial

conduct. Both systems have been influenced by research and practice, so that evolving diagnostic guidelines and criteria have differed, not only between systems but also between subsequent versions of the same system (Schachar, 1991; Rutter, 1989; Robins, 1991). Nevertheless, the central concept of hyperactivity, as an enduring trait or category of inattentive, restless and uncontrolled behaviour, has remained substantially constant. Much the same is true for conduct disorder, in essence characterised by a 'repetitive and persistent pattern of dissocial, aggressive, or defiant conduct' (WHO, 1992).

Although they are classified separately, there is strong evidence that hyperactivity and conduct disorder overlap (Sandberg *et al.,* 1978) and the evidence is both clinical (August & Stewart, 1982; Satterfield, Satterfield & Schell, 1987; Gittelman, Mannuza, Shenker & Bonagura, 1985; Weiss, Hechtman & Perlman, 1979; Weiss, 1985) and epidemiological (Schachar *et al.,* 1981; Shapiro & Garfinkel, 1986; Reeves, Werry, Elkind & Zametkin, 1987; Esser, Schmidt & Woerner, 1990; Taylor *et al.,* 1991). Indeed, the strength of their association has led some to question whether it is appropriate to view the disorders as distinct (Shaffer & Greenhill, 1979; Rutter, 1982; Shapiro & Garfinkel, 1986; Werry, Reeves & Elkind, 1987; August & Garfinkel, 1989) and to offer the view that conduct disorder and hyperactivity should be conceptualised as different aspects of one behavioural syndrome (Shapiro & Garfinkel, 1986) or combined 'hyperkinetic conduct disorder' (Taylor *et al.,* 1986a), now a diagnostic category in ICD 10 (WHO, 1992).

On the other hand, there is also evidence that these disorders may, after all, be distinct: cluster analysis has produced separate clusters of cases of conduct disorder and hyperactivity (Taylor, *et al.,* 1986a), and factor analysis consistently demonstrates two dimensions of hyperactive and conduct problem behaviour (Hinshaw, 1987; Fergusson, Horwood & Lloyd, 1991). However, the majority of children displaying hyperactivity are also conduct disordered (Taylor *et al.,* 1986a) and the dimensions are highly correlated and thus only partially distinct (Hinshaw, 1987). Furthermore, data are commonly derived from questionnaire scores alone, which are imprecise measures of child behaviour (Fergusson & Horwood, 1989), or concern referred children and are not necessarily representative.

Hyperactivity may be a precursor of (and perhaps a vulnerability factor for) subsequent conduct disorder (Taylor, 1986; Taylor *et al.,* 1991). Some argue that, at an early stage of development, relative inattention and high levels of unfocused activity are normative (Taylor, 1986; Barkley, Karlsson, Pollard & Murphy, 1985). However, like other developmentally related behaviours, such as soiling, hyperactivity may become problematically deviant with age. In support of such a developmental view are the findings that hyperactivity tends to have an earlier onset than conduct disorder (Taylor *et al.,* 1986a), often precedes the latter (Esser *et al.,* 1990), has been linked to other developmental anomalies such as clumsiness, language delays and soft neurological signs (Taylor *et al.,* 1986a; Szatmari *et al.,* 1989; Taylor *et al.,* 1991) and, in many ways, is said to resemble the behaviour of younger children (Barkley *et al.,* 1985). However, although this view is appealing, crucial evidence may be based on studies that are partly reliant upon retrospective recall (Taylor *et al.,* 1986a), or are focused on hyperactivity but not on conduct disorder (Szatmari *et al.,* 1989b), or on longitudinal studies that have tended to include children

originally suffering mixed behaviour disorders, so that comorbidity on follow-up may be exaggerated (Gittelman *et al.*, 1985; Campbell, Ewing, Breaux & Szumowski, 1986). Thus, the influence of development and age on comorbidity remains uncertain.

So far, relatively few researchers have examined the issue of comorbidity and situationality (Schachar, 1991). Such studies have demonstrated a relationship between conduct problems and pervasive hyperactivity in particular (Sandberg *et al.*, 1978; Schachar *et al.*, 1981; Goodman & Stevenson, 1989).

Aims

A major data archive from previous research done in Newcastle has provided an opportunity to address some of the above-mentioned important issues, as follows. First, to study the prevalence of hyperactivity in an urban centre (Kolvin *et al.*, 1981) (a) at two different ages, (b) for situational and pervasive hyperactivity, (c) at three levels, namely (1) a symptom level, (2) at a level of statistical deviance (Szatmari *et al.*, 1989a), and (3) in a form likely to represent psychiatric disorder and clinical impairment, based on clinical judgement and (d) for boys and girls. Second, to explore the nature of the relationship between hyperactivity and conduct disorder (a) at two different ages, (b) in relation to situation-specific and pervasive hyperactivity, (c) at two levels of severity of conduct disorder and (d) in boys and girls.

Method

(A) *The populations under scrutiny*

These consisted of approximately 3,300 11- and 12-year-old senior school children (equal sex distribution) and 1,040 7- and 8-year-old children (52% males and 48% females) (Kolvin, Garside, Nicol, Leitch & Macmillan, 1977; Macmillan, Kolvin, Garside, Nicol & Leitch, 1980). Screening (see below) yielded 322 screen positive or 'maladjusted' senior school children (9.8% of the total population), 309 of whom had entered the original study (Kolvin *et al.*, 1981); these were considered to have a high probability of clinical disturbance. There was also a yield of 270 screen positive junior school children (26.0% of the total population) and 265 of these had also entered the original study; these were considered either disturbed or 'at risk' for disturbance.

Because of the organisation of data in the computer and because of the possibility of follow-up, it was decided that our analyses should include only those cases for whom full information was available on follow-up. At that juncture there was contact with 95% of the cases, but full data were not available for all of these. The net result was that at follow-up 14% of the original senior cases and 8% of the original juniors were not included. A small number of the original proformas (one senior and three junior proformas) could not be identified and on these it was not possible to gather data on hyperactivity; we suspect that they had been misfiled. Full data were, therefore, available on 263 senior and 241 junior children.

Missing data (and hence excluded subjects) were largely determined by incomplete parent scales. We have compared the original sample and missing cases in terms of sex and social class distribution and found the patterns very similar, and this applied for both junior and senior groups. These analyses suggest that the small percentage of missing rating scales is unlikely to have distorted the picture.

Data on a small sample of screen negative children who were labelled 'normal controls' were also analysed. The latter were randomly selected from the residual pool of children who had scored less

than three on the weighting system (see below), with the proviso that they were drawn from all of the six schools and that they reflected the sex ratio found in the group of screen positives.

(B) *Multicriterion screen*

The screen included, for all the children, the Rutter (B) teacher scales (Rutter, 1967) and sociometric indices (Macmillan *et al.*, 1978); for the older children, the neuroticism subscale of the Junior Eysenck Personality Inventory (Eysenck, 1965) and for the younger children, the Young Group Reading Test (Young, 1968), were used. Extreme scores on each measure were used as indicators of deviance.

For the senior children, in order to maximise sensitivity and to avoid excluding children with extreme scores on individual measures because of an insufficiently high summed score, weighting formulae were adopted that allowed children with markedly deviant teacher- or self-ratings to be selected on that basis alone (Macmillan *et al.*, 1980). With the younger children the system was less complex: identification by any one or more than one criterion was taken as indicating that the child might be at risk (Kolvin *et al.*, 1977). The original screening procedure for the older children had been aimed at identifying children who were actually maladjusted and that in the juniors, those at risk as well as maladjusted.

(C) *Clinical disorder*

All the above screen data, more detailed school-based measures and data from semistructured parent interviews on behaviour and temperament (Kolvin *et al.*, 1977), were examined blind by research psychiatrists who, on clinical grounds, rated the children's severity of disturbance on a four point scale. Clinical disturbance had been set at two levels—moderate and marked disturbance. We focused on *marked disturbance because it is likely to represent a high probability of true psychiatric disorder and impairment.* This was defined in the original research as "marked and prolonged abnormalities of behaviour, emotions, or relationships sufficient to give rise to handicap which might affect the family, community or child" (Kolvin *et al.*, 1981). Interrater reliability was calculated in a parallel study (Wrate *et al.*, 1985), and for the dimension of overall severity this was satisfactory with $r = 0.67$. Although the exercise was not independent of the screen data, the main sources of information were parent interviews on behaviour and temperament. As far as was possible, the psychiatrists were blind to the screen status of the children. Further, at the time of the original clinical rating, hyperactivity was not a focus of interest and hyperactivity data had not been abstracted from the Rutter questionnaires; as a consequence the psychiatrists were also blind to the presence of hyperactivity.

(D) *Conduct disorder*

Conduct disorder was indicated by the presence of symptoms such as tantrums, destructiveness, lying, stealing, truanting and fighting (Kolvin *et al.*, 1981) and broadly overlaps with category 312 of ICD-9. As specified above, all the behaviour data, more detailed school-based measures, also screen data but primarily data from semi-structured parent interviews (Kolvin *et al.*, 1977), were examined blind by research psychiatrists, who used their clinical judgement to rate the children for the presence of conduct disorder and also for severity of conduct disturbance on a four point scale. *For conduct disorder we focused on moderate and marked points on the scale as the equivalent of a clinical syndrome.* Interrater reliability for this dimension of conduct disturbance, calculated for 41 cases, was satisfactory with $r = 0.89$ (Wrate *et al.*, 1985).

(E) *Symptomatic 'Diagnosis' of a syndrome of hyperactivity*

It is possible to code the symptoms of hyperactivity using Rutter parent or teacher questionnaires. Parent questionnaires show satisfactory concurrent validity with respect to items such as poor concentration and restlessness (Fombonne, 1989) and, using hyperactivity scores, successfully distinguish between referred and nonreferred children (Achenbach & Edelbrock, 1981). In addition, teacher-rated instruments have demonstrated satisfactory sensitivity and specificity with regard to

direct observation by classroom raters blind to teacher ratings (Schachar, Sandberg & Rutter, 1986; Abikoff, Gittelman-Klein & Klein, 1987).

To maximise comparability, we have used a method for coding hyperactivity similar to that employed in other key studies (Schachar *et al.*, 1981; Goodman & Stevenson, 1989). Our 'diagnosis' of a syndrome of hyperactivity was based on the diagnostic algorithm employed in the reanalysis of Isle of Wight data performed by Schachar *et al.* (1981), which utilised information from the Rutter parent and teacher scales, and did not incorporate clinical judgement. By this approach (Schachar *et al.*, 1981) a score of 3 or more on certain symptoms (items) was obtained from both the Rutter scales then the child was designated pervasively hyperactive. If such a score was obtained on one scale alone, the child was classified as showing situational hyperactivity. The symptoms in question were (i) "very restless, often running about or jumping up and down" (ii) "squirmy, fidgety child" (iii) "cannot settle to anything for more than a few minutes"; these symptoms have consistently emerged as forming a distinct dimension on factor analysis of Rutter scales (Schachar *et al.*, 1981; McGee *et al.*, 1985 a,b; Goodman & Stevenson, 1989; Taylor *et al.*, 1991).

(F) *Categories*

The children were classified into categories of "no conduct disorder", "moderate conduct disorder" and "severe conduct disorder". They were then further classified according to the presence of hyperactivity that was situational (i.e. at home *or* at school) or pervasive (i.e. at home *and* at school).

(G) *Prevalence: estimates back to the original population*

As information was available about the proportion of the original populations that proved to be screen negative and screen positive it was possible to estimate the prevalence rates of syndromes or disorders. The prevalence of hyperactivity was estimated utilising available data on the subsamples and was calculated at three levels:– (1) symptomatic only, based on presence of relevant symptoms on the Rutter behaviour scales, (2) where hyperactivity is combined with being screen positive and (3) where hyperactivity is combined with the presence of clinical psychiatric disorder (reflecting both severity and handicap)—and for four categories, namely no hyperactivity, home-based hyperactivity, school-based and pervasive hyperactivity. The rates of conduct disorder and of comorbid conduct disorder and hyperactivity were estimated in the same way.

(H) *Statistics*

Odds ratios and chi-squared tests were calculated for observed data. However, to avoid distortions due to applying statistics to estimates and because we judge inspection, giving evidence of substantial discrepancies, to be sufficient, we have not used tests of statistical association on estimated data.

Findings

(A) *Prevalence of hyperactivity*

Table 1 gives the frequency of hyperactivity *symptoms* based on reports by parents, teachers or both, among screen negative and positive children of both ages. About one-third of 7- and 8-year-old (junior) screen negative children proved symptomatically hyperactive and over one-fifth exhibited home-based hyperactivity, but school-based and pervasive hyperactivity were less common. Among the screen positive or at risk 7- and 8-year-olds, a significantly larger proportion (almost three in four) proved symptomatically hyperactive. Hyperactivity subtypes were also distributed rather differently; while only one in eight was symptomatic exclusively at home, one in three was symptomatic at school and one in four was pervasively symptomatic.

Table 1. Percentages and absolute numbers of different forms of hyperactivity among samples of screen negative and screen positive junior and senior school children

	Juniors			Senior		
Screen status	Negative $N=53$ % (N)	Positive 241 % (N)	Odds ratio	Negative 63 % (N)	Positive 263 % (N)	Odds ratio
Hyperactivity						
Home	22.6 (12)	12.0 (29)	0.5	7.9 (5)	11.0 (29)	1.44
School	5.7 (3)	32.4 (78)*	8.3	11.1 (7)	34.6 (91)*	4.2
Pervasive	3.8 (2)	25.7 (62)*	8.9	3.2 (2)	22.4 (59)*	8.8
All hyperactivity	32.1 (17)	70.1 (169)*	5.0	22.2 (14)	68.1 (179)*	7.5

*$p < .001$. Chi-squared test with Yates correction where appropriate.

Comparing the screen negative juniors and seniors, the percentage with pervasive hyperactivity among the junior children was similar to that among the seniors; the percentage with school-based hyperactivity was half that of the seniors, but the percentage of juniors with home-based hyperactivity was almost three times as great as that of the seniors. In accordance with these findings, the odds of a screen positive senior child showing pervasive hyperactivity were similar to their junior counterparts (odds ratio = 8.8 and 8.9, respectively); the odds of showing school-based hyperactivity were half (odds ratio = 4.2 and 8.3, respectively) and the odds of showing home-based hyperactivity were almost three times those of the younger children (odds ratio = 1.44 and 0.5, respectively). Nevertheless, these differences must be viewed with caution as they are based on small absolute numbers in the subsamples. The patterns of hyperactivity in the screen positive (at risk and maladjusted) samples proved broadly similar at both ages.

It was possible, on the basis of the data available, to estimate the prevalence of hyperactivity among children of both ages, defined symptomatically, at the level of screen positive for deviance (Table 2a), and classified according to its association with psychiatric disorder (Table 2b).

Table 2 gives the total numbers of children of both ages who were selected or excluded by the screen, the proportion who were hyperactive in each group and an estimate of overall prevalence of hyperactivity at three different levels. First, *symptomatic* hyperactivity (Table 2a) is present in 41.9% of 7–8-year-olds and 26.7% of 11- and 12-year-olds. Second, the co-existence of *screen positivity* and *hyperactivity* (Table 2a) occurs in 18.2% of younger (189/1040) and 6.6% of older children (219/3300). Third (Table 2b), *psychiatric disorder with impairment* combined with hyperactivity occurs in 3.7% and 3.1%, respectively.

Table 3 displays the estimated prevalence rates of home- and school-based situational and pervasive hyperactivity in the two age groups and at different levels of caseness. At *the symptomatic level*, the distribution of hyperactivity subtypes estimated for the total population, differed across the age cohorts. In particular, the rate of home-based hyperactivity was much higher among the younger children, being more than twice the rate found among the older children; and this proved

Table 2. (A) Estimated prevalence of hyperactivity (a) as a symptom and with screen positivity and (b) according to its association with psychiatric disorder

Symptomatic HA	No. in total population (a)	% of sample with HA (b)	Est. total no. with HA (c = a × b)	Est. prevalence of HA (c/a)%
Juniors screen -ve	770	32.1	247	
Juniors screen +ve	270	70.1	189 (18.2%)	
Total	1040		436	41.9%
Seniors screen -ve	2978	22.2	661	
Seniors screen +ve	322	68.1	219 (6.6%)	
Total	3300		880	26.7%

(B)

	No. in total population	% of sample with HA plus disorder	Est. total no. with HA plus disorder	Est. prevalence of HA plus disorder %
Juniors screen -ve	770			
Juniors screen +ve	270	14.1	38	
Total	1040		38	3.7
Seniors screen -ve	2978	1.6	48	
Seniors screen +ve	322	17.1	55	
Total	3300		130	3.1

true also when all-home hyperactivity was taken into account (that is, when home-based activity is situational or part of a pervasive phenomenon). Similarly, pervasive hyperactivity was almost twice as frequent in the younger children, but the rates of school-based hyperactivity at both ages were similar. Thus among the juniors, home-based hyperactivity was the most common phenomenon whereas among the seniors it was school-based.

At *the second categorical level*—hyperactive and screen positive, irrespective of age—much of the home-based hyperactivity was screened out, not classified as being screen positive; however this was much less so with school-based and pervasive hyperactivity. Consequently, school-based hyperactivity emerged as the most prevalent form and home-based hyperactivity the least common and this remained true when all home and all school hyperactivity were considered. Thus, of the 436 junior children with symptomatic hyperactivity, defined on the basis of the Rutter scales, about 189 (43%) were found to be screen positive; and of the 189 about 17% ($N = 33$) were selected by home-based criteria, 46% ($N = 87$) by school-based and 37% ($N = 69$) by pervasive criteria. Despite differences in screening criteria, the pattern was broadly similar for the 11- and 12-year-olds, although at lower prevalence rates overall.

At *the third level*—of hyperactivity and psychiatric disorder—the overall prevalence reduced to between 3 and 4% for both junior and senior populations (Table 2b). For the juniors the subpatterns of hyperactivity remained similar with home-based

Table 3. Estimated total numbers and rates of home and school *only* situational hyperactivity; all home and all school hyperactivity; and pervasive hyperactivity: in males/females, at two ages and three levels of 'caseness'

	Home HA only	All home HA	School HA only	All school HA	Pervasive HA
Symptomatic	Total *N* (%) m *N* (%) f *N* (%)	Total *N* (%) m *N* (%) f *N* (%)	Total *N* (%) m *N* (%) f *N* (%)	Total *N* (%) m *N* (%) f *N* (%)	Total *N* (%) m *N* (%) f *N* (%)
Junior					
Est. nos. (prev.)	206(19.8)	305(29.3)	131(12.6)	230(22.1)	99(9.5)
m:f	119(22.0) 87(17.4)	175(32.4) 130(25.9)	104(19.3) 27(5.4)	160(29.7) 70(13.9)	56(10.4) 43(8.5)
	1.4:1	1.3:1	3.9:1	2.3:1	1.3:1
Senior					
Est. nos. (prev.)	272*(8.2)	436(13.2)	442(13.4)	606(18.4)	164(5.0)
m:f	204(12.4) 68(4.2)	342(20.8) 94(5.6)	318(19.2) 124(7.6)	456(27.6) 150(9.0)	138(8.4) 26(1.6)
	3:1	3.6:1	2.6:1	3.0:1	5.3:1
Screen positive					
Junior					
Est. nos. (prev.)	33(3.2)	102(9.8)	87(8.4)	156(15.0)	69(6.6)
m:f	18(3.3) 15(2.9)	59(11.0) 43(8.5)	60(11.2) 27(5.4)	101(18.7) 55(11.0)	41(7.5) 28(5.6)
	1.2:1	1.4:1	2.2:1	1.8:1	1.5:1
Senior					
Est. nos. (prev.)	36(1.1)	108(3.3)	111(3.4)	183(5.5)	72(2.2)
m:f	15(0.8) 21(1.2)	61(3.6) 47(2.8)	82(5.0) 29(1.8)	128(7.8) 55(3.4)	46(2.8) 26(1.6)
	0.6:1	1.3:1	2.8:1	2.3:1	1.8:1
Psychiatric disorder					
Junior					
Est. nos. (prev.)	5(0.5)	20(1.9)	18(1.7)	34(3.3)	15(1.4)
m:f	3(0.6) 2(0.4)	12(2.3) 8(1.7)	12(2.5) 5(0.8)	22(4.1) 11(2.3)	9(1.7) 6(1.2)
	1.5:1?	1.5:1	2.6:1	2:1	1.5:1?
Senior					
Est. nos. (prev.)	15(0.5)	87(2.6)	16(0.5)	88(2.7)	72(2.2)
m:f	6(0.4) 9(0.6)	72(4.4) 15(1.0)	6(0.4) 10(0.6)	72(4.4) 16(1.0)	66(4.0) 6(0.4)
	0.6:1?	4.8:1	0.6:1?	4.5:1	11:1

Junior population = 1040; Senior population = 3300.
? indicates sex ratios are based on small numbers.

the least common form (0.5%) (Table 3). However, for the seniors, the sub-patterns differed, with pervasive hyperactivity being the most common (2.2%) and school- and home-based hyperactivity being at equivalent levels (0.5%).

Further, among the *juniors*, 13.7% of the children with school-based (18 of 131) and 15.1% of those with pervasive hyperactivity (15 of 99) were found to have psychiatric disorder—this contrasts with home-based hyperactivity where substantially fewer, 2.4%, showed psychiatric disorder. However, among the *seniors*, pervasive hyperactivity was far the most likely to be associated with psychiatric disorder with 43.9% of the pervasively hyperactive showing additional psychiatric disorder (72 of 164); this contrasted with 3.6% with school-based (16 of 442) and 5.5% with home-based situational hyperactivity (15 of 272).

With few exceptions, there was a preponderance of males among hyperactive children. For younger children, and at each level, the highest male:female ratio was among those with school-based hyperactivity. Among older children, pervasive hyperactivity tended toward the highest male:female ratio (the screen positive level did not fit the pattern) and pervasive hyperactivity/disorder proved a largely male category. In three instances (all three in relation to seniors) there was a slight excess of females over males: these involved children showing home-based hyperactivity who were screen positive, or home-based hyperactivity plus psychiatric disorder, or school-based hyperactivity plus psychiatric disorder. However, when all-home or all-school, rather than situational, hyperactivity was considered, male predominance emerged.

(B) *Hyperactivity and conduct disorder*

(a) *Juniors*

(i) *Comorbidity in screen negative and screen positive samples.* Table 4 reveals the extent of comorbidity between hyperactivity and overall conduct disorder, according to screen status. One quarter of the screen negative and over one third of the screen positive *junior children* proved to have "pure" hyperactivity. None of the screen negative and only 3.3% of the screen positive juniors had pure conduct disorder. However, the percentage with combined hyperactivity and conduct

Table 4 Comorbidity: estimates of hyperactivity and conduct disorder in screen negative and screen positive junior and senior children

	Juniors		Seniors	
	screen -ve $N = 53$ % (N)	screen +ve $N = 241$ % (N)	screen -ve $N = 63$ % (N)	screen +ve $N = 263$ % (N)
No HA/CD	67.9 (36)	26.6 (64)*	76.2 (48)	27.7 (73)*
HA+ CD-	28.3 (15)	35.3 (85)	22.2 (14)	32.7 (86)
HA- CD+	0 (0)	3.3 (8)	1.6 (1)	4.2 (11)
HA+ CD+	3.8 (2)	34.9 (84)*	0 (0)	35.4 (93)*

Chi-squared test with Yates correction for continuity where appropriate: * $p < 0.001$.

Table 5. (a) Type of hyperactivity and severity of conduct disorder: estimated numbers and percentages in junior school cohort; $N = 1040$

	No HA *N* (%) m:f	Home HA *N* (%) m:f	School HA *N* (%) m:f	Pervsv HA *N* (%) m:f	Total *N* (%)
No CD	594(65.5) (98.5) 1.1:1	181(20.0) (87.4) 1.1:1	76(8.4) (58.0) 3.2:1	56(6.2) (56.6) 1.2:1	907 (87.2) 1.2:1
Moderate CD	9(7.8) (1.5) 2:1	24(20.7) (11.6) 9.5:1	47(40.5) (35.9) 4.9:1	36(31.6) (36.4) 1.4:1	116 (11.2) 3.1:1
Severe CD	0	2(11.8) (1.0) 2:0?	8(44.1) (6.1) 7:1?	7(41.2) (7.1) 2.5:1?	17 (1.6) 4.7:1
Total n m:f	603 1.1:1	207 1.4:1	131 3.9:1	99 1.3:1	1040

disorder among the screen positive juniors was almost 10 times that among the screen negative ($p < 0.001$); this constituted the main difference between the two screen groups. Finally, about two-thirds of the screen negative children had neither conduct disorder nor hyperactivity; this proved true in only one-quarter of the screen positive children.

(ii) *Is the presence of hyperactivity linked to the severity of conduct disorder?* By estimating rates of hyperactivity and conduct disorder in the total population we were able to explore the relationship between moderate and severe conduct disorder and hyperactivity in the original cohorts. Table 5(a) provides estimated rates of, and male:female ratios for, situational and pervasive hyperactivity and conduct disorder in the population of 1040 *junior school* children.

Of the juniors, 907 (87%) were without conduct disorder, and of these 34.5% proved hyperactive. Of the total sample, 6.2% and 8.4%, respectively, showed pervasive and school-based hyperactivity and 20.0% home-based hyperactivity, but no conduct disorder. Virtually all (92.2%) with moderate and all with severe conduct

Table 5. (b) Type of hyperactivity and severity of conduct disorder: estimated numbers and percentages in senior school cohort; $N = 3300$

	No HA *N* (%) m:f	Home HA *N* (%) m:f	School HA *N* (%) m:f	Pervsv HA *N* (%) m:f	Total *N* (%) m:f
No CD	2359(75.5) (97.4) 0.8:1	259(8.3) (94.9) 3.2:1	388(12.4) (87.8) 2.4:1	120(3.8) (72.5) 9.9:1	3126 (94.7) 1.1:1
Moderate CD	57(39.9) (2.4) 8.5:1	9(6.3) (3.3) 1.25:1	49(34.3) (11.0) 6:1	28(19.6) (16.8) 1.8:1	143 (4.3) 4.3:1
Severe CD	4(12.5) (0.2) 0.3:1?	5(15.6) (1.8) 1.5:1?	5(15.6) (1.1) 1.5:1?	18(56.3) (10.8) 2:1	32 (1.0) 1.9:1
Total	2420 0.6:1	273 3:1	442 2.6:1	167 5.5:1	3301*

*'Additional' case in estimated total population arises due to rounding up of decimal places.

Note: the percentages in the columns relate to hyperactivity; those in the rows relate to conduct disorders.

? Indicates sex ratios are based on small numbers.

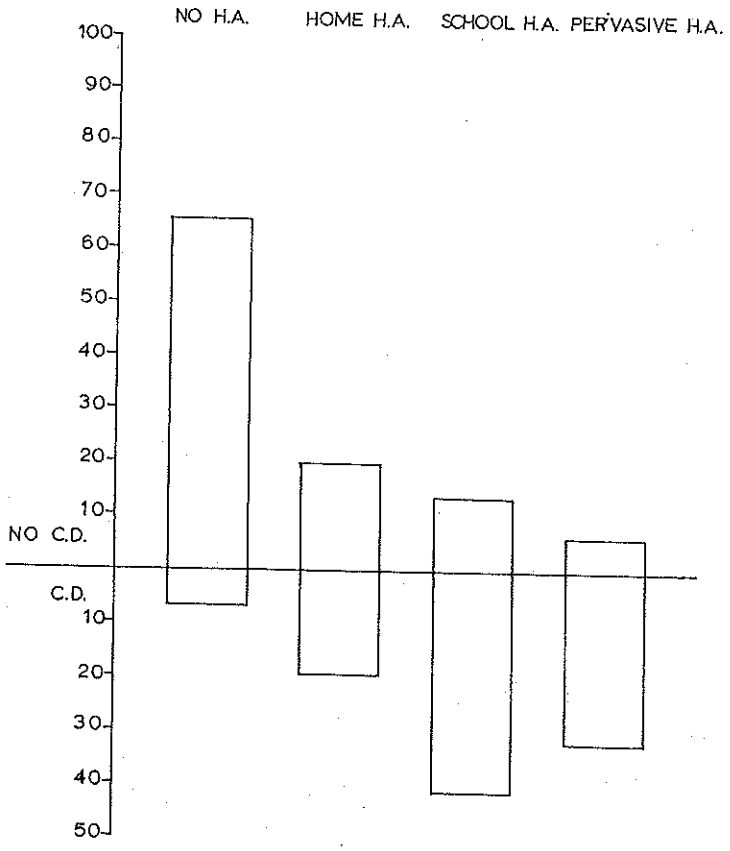

Fig. 1. Rates of hyperactivity among junior subjects with and without conduct disorder.

disorder were hyperactive. Further, conduct disorder occurred in only 1.5% of children without hyperactivity but no 7- or 8-year-old child had severe conduct disorder in the absence of hyperactivity. The data therefore indicate that hyperactivity is related to the severity of conduct disorder.

(iii) *What is the extent of situational and pervasive hyperactivity among subjects with conduct disorder in the total population?* This is shown best in Fig. 1: in the presence of conduct disorder, 6.8% show no hyperactivity, 20% show home hyperactivity, 41% show school hyperactivity and 32% pervasive hyperactivity. In the absence of conduct disorder, 65% of subjects show no hyperactivity, 20% home-based hyperactivity, 8% school-based hyperactivity and 6% pervasive hyperactivity. However, it is notable that there are similar rates of home-based hyperactivity among subjects with and without conduct disorder.

(iv) *What is the extent of conduct disorder among subjects with hyperactivity?* Table 5(a) reveals a base rate for moderate and severe conduct disorder, in the total junior population, of 12.8%. Of the hyperactive subjects, 28.4% overall were conduct disordered; of those with hyperactivity evident to parents only, 12.6% exhibited

conduct disorder, with severe conduct disorder affecting only 1.0%. This contrasted with the patterns for school-based and pervasive hyperactivity: of children with school-based hyperactivity, 42.0% were conduct disordered and 6.1% were severely conduct disordered; and of those with pervasive hyperactivity, 43.4% were conduct disordered and 7.1% severely so. The notable finding is that those hyperactive at home only are no more at risk for conduct disorder than the general population.

(v) *Do the male–female ratios differ according to the type of hyperactivity?* At this age, the highest male:female ratio occurred among children with school-based hyperactivity (ranging from over 3:1 to 7:1); and it was lowest among those without hyperactivity or conduct disorder. Among those with conduct disorder the highest male:female ratio was among those with the most severe conduct disorder (almost 5:1 overall). If the total school-based and home-based cases of hyperactivity (irrespective of whether pervasive or not) are considered, then the male:female ratios are, for school-based hyperactivity 2.3:1, and for home-based 1.4:1. It would seem that the lower ratio of males to females in the pervasive group occurs because the data are "diluted" by home-based cases.

(b) *Seniors*

(i) *Comorbidity in screen negative and screen positive senior children.* As among the juniors (Table 4), the majority of screen negative *seniors* (76.2%) but a minority of those that were screen positive (27.7%) were without hyperactivity or conduct disorder ($p < 0.001$). Trends were evident for higher rates of "pure" hyperactivity (32.7% vs 22.2%) and "pure" conduct disorder (4.2% vs 1.6%) among the screen positive compared with the screen negative seniors, Further, over one third of the screen positive (35.4%) but none of the screen negative seniors proved to have combined hyperactivity and conduct disorder ($p < 0.001$).

(ii) *Is the presence of hyperactivity linked to the severity of conduct disorder?* Table 5(b) shows the estimated numbers of children with situational and pervasive hyperactivity and conduct disorder among the total population of 3300 *senior* children. Of the subjects without conduct disorder, 24.6% were hyperactive. Of the children with conduct disorder, 65.1% were hyperactive overall, but of those with severe conduct disorder the rate rose to 87.5%. In the latter group 12.5% of the senior children were without hyperactivity, 15.6% had home or school hyperactivity, but 56.3% showed pervasive hyperactivity. Hence, as among the juniors, the rate of hyperactivity is linked to the severity of conduct disorder, but at this age and among those with severe conduct disorder, to pervasive hyperactivity in particular.

(iii) *What is the extent of situational and pervasive hyperactivity among subjects with conduct disorder in the total population?* This is shown best in Fig. 2 (also Table 5b). This shows that among those without conduct disorder, approximately 75% are also without hyperactivity, 12.4% have school-based hyperactivity and only 3.8% pervasive hyperactivity. In the presence of conduct disorder, 35% are without hyperactivity, 30.9% show school based hyperactivity and 26.3% pervasive hyperactivity. However, as among junior subjects, the rate of home-based hyperactivity, at approximately 8%, did not differ irrespective of the presence or absence of conduct disorder.

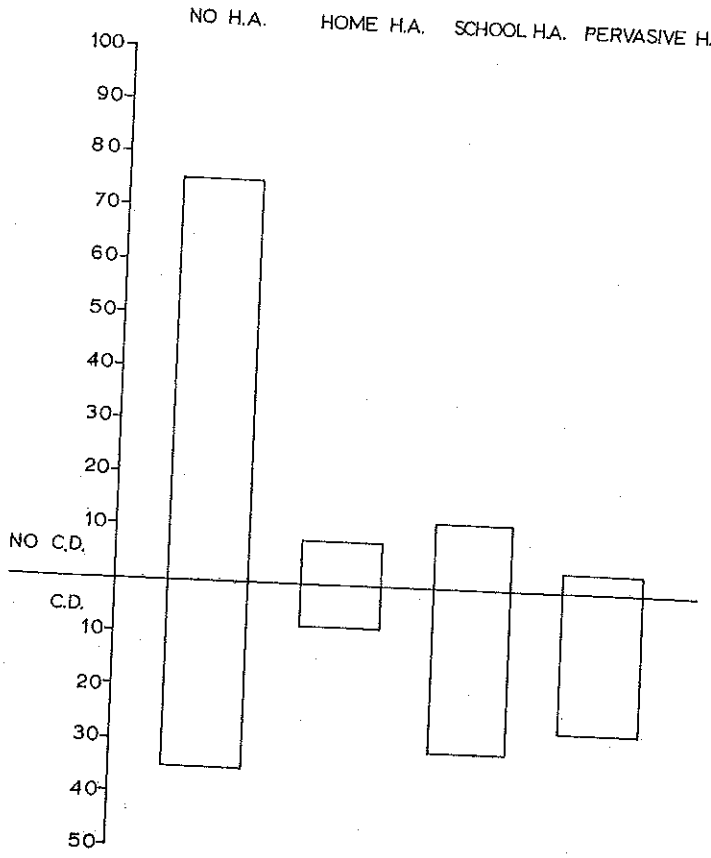

Fig. 2. Rates of hyperactivity among senior subjects with and without conduct disorder.

(iv) *What is the extent of conduct disorder among subjects with hyperactivity in the total population?* Of the hyperactive older children (Table 5b), 12.9% were conduct disordered: of those with home-based hyperactivity, 5.1% were conduct disordered; of the school-based hyperactive seniors 12.2%, and of the pervasively hyperactive 27.5% were conduct disordered. Severe conduct disorder was present in 10.8% of those with pervasive hyperactivity, and in 1.8% and 1.1% of those with home-based and school-based hyperactivity, respectively.

(v) *Do the male–female ratios differ according to the type of hyperactivity?* The highest *senior* school child male–female ratio was among the pervasively hyperactive (5.5:1), with home-based and school-based not far behind; there was a slight female predominance in the nonhyperactive. If the total school-based and home-based cases of hyperactivity (irrespective of whether pervasive or not) are considered, then the male–female ratios are, for school-based 2.8:1, and for home-based 2.2:1. It would seem that the ratio of males to females in the pervasive group, at this age, is higher than either situational group alone, irrespective of how the latter gender ratios are calculated.

Discussion

(1) *Prevalence of hyperactivity*

An extensive database on urban 7–8-year-olds and 11–12-year-olds has allowed an examination of the prevalence of hyperactivity at three levels: at the level of hyperactivity symptoms, at the level of a syndrome of screen positivity/hyperactivity and at the level of hyperactivity combined with psychiatric disorder.

(a) *Estimated prevalence of symptomatic hyperactivity.* At a symptomatic level, hyperactivity proved common in our two populations. Nevertheless, when urban–rural differences are taken into account (Quinton, 1988), the rate of 41.9% among our urban 7- and 8-year-olds is not excessive when compared with the approximately 37% reported for 8–9-year-olds from a mixed urban, suburban and rural area in the U.S. (Achenbach & Edelbrock, 1981). Similarly, the rate of 26.7% found among our 11- and 12-year-olds is not excessive when compared with the 16.3% prevalence in a methodologically similar study of 10- and 11-year-olds but which had a more rural base (Schachar *et al.*, 1981); it parallels the 24.5% rate reported among the 13-year-old inner city children by Goodman and Stevenson (1989).

(b) *Estimated prevalence of screen positivity combined with hyperactivity.* Such high rates of hyperactivity symptoms raise the question of how such measures of hyperactivity relate to other indices of disturbance. The prevalence of hyperactivity in conjunction with screen positivity was about 6.6% in our older population. This corresponds to the rate of 6.9% for a statistically, rather than clinically, identified attention deficit disorder with hyperactivity (ADDH) syndrome (Boyle *et al.*, 1987) among 12–13-year-olds in Ontario (Szatmari *et al.*, 1989a). Our rate for hyperactivity coexisting with screen positivity among our younger population was 18.3%; this is twice as high as the 8.6% found for 8–9-year-old children in Ontario and may reflect the nature of our screen for younger children which was designed to identify the children "at risk" rather than maladjusted children—the former is a wider concept and tends to be more inclusive than the concept of "maladjustment" in the older children.

(c) *Estimated prevalence of hyperactivity related to clinical disorder.* Based on the clinicians' judgements of disturbance, a prevalence of 3–4% was found for hyperactivity combined with disorder for both younger and older children. However, as we chose only marked deviance as indicating psychiatric disorder, this may be a conservative figure representing a likely minimum prevalence of cases of hyperactivity associated with evidence of clinical impairment. Nevertheless, it coincides with the prevalence (3%) of a syndrome of "generalized hyperkinesis" among 7-year-olds, defined on the basis of parental interview and clinical examination (Gillberg, Carlstrom & Rasmussen, 1983) and with that of referred ADDH (2.8%) in urban New Zealand 11-year-olds (Anderson, Williams, McGee & Silva, 1987). It is higher than the rate of 1.4% reported by Lambert, Sandoval and Sassone (1978) in a survey of referred hyperactive elementary school children; however, unlike the present study reported here, their population was substantially middle class and included rural families. It is also somewhat higher than the 1.7% reported for

clinically diagnosed hyperkinetic disorder among 7-year-old boys in London by Taylor *et al.* (1991) but those authors had applied persistence and pervasiveness as essential diagnostic criteria.

The rate of symptomatic hyperactivity among older children was about 60% of that in younger children. An age gradient was also evident for hyperactivity with screen positivity. Other population-based studies, which have included parent-based data, have reported a reduction in hyperactivity with age, whether assessed on the basis of symptoms (Achenbach & Edelbrock, 1981), or of an ADDH-equivalent syndrome based on questionnaire data (Szatmari *et al.*, 1989a). However, the developmental reduction in the prevalence of hyperactivity essentially disappeared in the current study when we focused on combinations of hyperactivity and the clinicians' rating of marked psychiatric disturbance as the criterion. This suggests that, in younger children, only a small proportion of those presenting with hyperactivity as a symptom will prove to have a true psychiatric disorder. This is supportive of ICD 10 guidelines (WHO, 1992) which indicate that, among young children, only high levels of disturbance should lead to the diagnosis of a hyperkinetic disorder.

Further, linking hyperactivity with clinical disorder markedly reduced the rates of symptomatic hyperactivity or hyperactivity combined with being screen positive, in both age groups; this suggests that much of symptomatic hyperactivity, irrespective of age, reflects behavioural features that do not necessarily represent true disorder. The latter finding is consistent with the view of Goodman and Stevenson (1989). It also parallels the conclusion by Weissman, Warner and Fendrich (1990) concerning the application of psychosocial impairment criteria to children's psychiatric diagnosis: in their survey, when impairment criteria were applied, the rates of most psychiatric disorders in children were markedly reduced. Further, there is evidence that syndromes without the presence of handicap or impairment are less sensitive predictors of treatment outcome (Weissman, Klerman & Paykel, 1974). We contend, in common with Weissman and colleagues, that long-term follow-up studies are essential in order to determine clinical outcome for those children who meet diagnostic criteria for different types of hyperactivity, either as a symptom or a syndrome, but who are not judged to show clinical evidence of impairment or handicap.

(d) *Prevalence of pervasive hyperactivity.* Some argue that pervasive hyperactivity represents a valid syndrome in its own right by virtue of its distinctive associations with antisocial behaviour (Goodman & Stevenson, 1989), poor prognosis (Schachar *et al.*, 1981) and particularly with cognitive and developmental vulnerability (Taylor *et al.*, 1986a; Boudreault *et al.*, 1988). For pervasive hyperactivity we found a rate in older children of 5.0%, which is similar to the 4.6% reported, using comparable methodology, by Goodman and Stevenson (1989) among 13-year-olds in inner London, although higher than the 2.2% among 10–11-year-olds on the largely rural Isle of Wight. For younger children the rate of 9.5% accords with that of 9.0% among 7-year-olds in inner London, reported by Taylor *et al.* (1991) and the 7.4% reported for mixed urban and rural 7-year-olds in New Zealand (McGee *et al.*, 1984).

Taylor *et al.* (1991) reported that approximately one in five pervasively hyperactive 7-year-olds suffered clinical hyperkinetic disorder, and this broadly accords with our finding of one-in-six of junior school children suffering pervasive hyperactivity combined with psychiatric disorder. However, in our study, almost one in two of pervasively hyperactive senior school children were judged clinically disordered. Thus it may be that the clinical significance of the symptom of pervasive hyperactivity is greater among older children.

(e) *Prevalence and situation specificity.* Relatively high prevalence rates have been reported for school-based symptomatic hyperactivity: 14.3% by Trites, Dugas, Lynch & Ferguson (1979) for 5–12-year-olds, 9.2% by August and Garfinkel (1989) for 5–14-year-olds and 12% by Holborrow, Berry & Elkins (1984) also for elementary school children, and this accords with the overall rate of approximately 13% for each of our populations. The lower rate of Shen Yu-cun, Wang Yu-feng & Yang Xiao-ling (1985), 4.8%, for Chinese urban 7-year-olds is an exception; in that study, urban rates of hyperactivity were lower than rural rates, perhaps reflecting the operation of rather different cultural influences in a nonWestern society.

We found that similar proportions (i.e about one-in-seven) of *younger* children with school-based and pervasive hyperactivity demonstrated associated psychiatric disorder but very much lower proportions (about one-in-40) of children with home-based hyperactivity. In contrast, among the *senior* children, there was a clear gradient from a relatively weak link between home-based hyperactivity and clinical disorder (about one-in-18), and a similarly weak link with school-based hyperactivity (about one-in-28) to a strong relationship with pervasive hyperactivity (just over one-in-two).

August and Garfinkel (1989) reported school-based hyperactivity symptom rates of approximately 10.0% at 7–8 years and also at 11–12; Shen *et al.* (1985) reported corresponding rates of 4.8% and 4.2%. In our urban population we report rates for home-based symptomatic hyperactivity of 19.8% at 7–8-years and 8.2% at 11–12-years of age, for pervasive hyperactivity of 9.5% at 7–8 and 5.0% at 11–12-years; for school-based symptomatic hyperactivity of 12.6% at 7–8 and 13.4% at 11–12 years and rates for all home and all school hyperactivity of 29.3 and 13.2% and of 22.1 and 18.5%, respectively. Thus we infer that there is only marginal developmental reduction in school-based hyperactivity. The Ontario group report that, with home-based hyperactivity, a marked developmental decline, of approximately 30%, is apparent for hyperactivity symptoms from 4–11 years to 12–16 years (Szatmari *et al.*, 1989a); this decline is equally impressive in our study, from 7–8 to 11–12 years. It seems that the apparently substantial developmental reduction in prevalence of total symptomatic hyperactivity is mainly due to the decline in home-based hyperactivity with age. However, this may also be a factor of the perception of parents and caretakers. Parents are likely to be exposed to the behaviour of more dependent smaller children to a greater extent than that of more independent older children and, unlike teachers, may lack a knowledge of behavioural norms (Rapoport *et al.*, 1986).

(g) *Gender differences in prevalence of hyperactivity.* There was a clear predominance of boys among the pervasively hyperactive, especially among older children and

at the most severe level of disturbance and this is consistent with earlier reports (e.g. Schachar *et al.*, 1981); Trites *et al.*, 1979; Achenbach & Edelbrock, 1981; Shekim *et al.*, 1985; Lambert *et al.*, 1978). However, hyperactivity is not an exclusively male prerogative: junior school girls with hyperactivity constitute over two-in-five of the home-based and pervasive and over one-in-five of the school-based hyperactive children; the rates for seniors are one-in-four, one-in-six and, just over one-in-four, respectively.

(2) *Hyperactivity and conduct disorder*

(a) *Rates of hyperactivity compared to rates of conduct disorder.* British studies of disruptive behaviour disorders suggest that, in referred populations, conduct disorder (Thorley, 1986; Prendergast *et al.*, 1988) and particularly mixed hyperactivity and conduct disorder (Taylor *et al.*, 1986a) are more frequently recognised than hyperactivity alone. Here we show that in our population-based study of two different age groups, this ratio is reversed, with "pure" hyperactivity the more common syndrome within the community. Thus, in the juniors the estimated number of children with hyperactivity but no conduct disorder is 313 (30.1%) and that of conduct disorder alone or with hyperactivity is 133 (12.8%); in the seniors the numbers are 768 (23.3%) and 175 (5.3%), respectively. Although this contrasts with the report of McGee *et al.* (1984) of equivalence between rates of "pure" hyperactivity and "pure" conduct disorder, their data was derived solely from Rutter parent and teacher questionnaires. It is consistent with the more comprehensive questionnaire-based data of Taylor *et al.* (1991) and with community studies reliant upon interview rather than questionnaire data as the basis for diagnosis (Esser *et al.*, 1990; Anderson *et al.*, 1987).

(b) *Comorbidity: hyperactivity and conduct disorder.* Subjects who were identified as being 'at risk' or 'maladjusted' by school screen exercises were no more likely to be rated as having 'pure' hyperactivity or conduct disorder than those not so identified. However, screen positive children were significantly more likely to suffer hyperactivity and conduct disorder comorbidity than their screen negative counterparts. As the psychiatric raters were blind to the presence of hyperactivity and so blind also to the presence of comorbidity, this is a striking finding. It is consistent with evidence from other workers that the combined disorder represents greater deviance than either hyperactivity or conduct disorder alone (McGee *et al.*, 1984, Stewart & Behar, 1983; Taylor *et al.*, 1991; Soussignan *et al.*, 1992).

Despite the reported link between conduct and hyperactivity symptoms in clinic samples (Taylor, Schachar, Thorley & Weiselberg, 1986b; Sandberg *et al.*, 1978), and the overlap in clinic samples between hyperactivity and conduct disorder as syndromes (Taylor *et al.*, 1986a), only a small proportion of subjects with hyperactivity symptoms in our community samples was found to have a conduct disorder. This remains true even when the data are analysed according to the type of hyperactivity or even according to 'severity', as represented by pervasive hyperactivity. In other words, the extent of comorbidity of hyperactivity and antisocial behaviour evident in clinic samples appears to be less impressive when the community or random populations of children are reviewed.

However, although most hyperactive children in the community are not conduct disordered, virtually all younger conduct disordered children show symptoms of hyperactivity—so much so, that hyperactivity appears to be a prerequisite for severe conduct disorder at 7 or 8 years. However, by 11 and 12 years the picture has changed and a substantial number, albeit a minority, of conduct-disordered children, even with severe conduct disorder, show no symptoms of hyperactivity. This suggests that a proportion of the conduct disorder that emerges in secondary school children may differ in nature from that which manifests in younger children and that there may be different paths to conduct disorder in older children (Robins, 1991; Moffitt, 1990).

(c) *Hyperactivity as a risk factor for conduct disorder.* Some findings from longitudinal studies have led to the assertion that hyperactivity may be a risk factor for subsequent conduct disorder (Satterfield, Hoppe & Schell, 1982; Gittelman *et al.*, 1985; Mannuzza, Gittelman-Klein, Horowitz-Konig & Giampino, 1989; Mannuzza *et al.*, 1991). Our two cross-sectional samples can contribute to this debate as they provide indirect information about longitudinal links. Thus, a crucial finding is that whereas 28.4% of the junior school children with hyperactivity were conduct disordered, the rate of conduct disorder among the senior school children with hyperactivity was less than half that (12.9%). Further, in the younger cohort, home-based hyperactivity was not associated with a substantial increase of conduct disorder over that in the nonhyperactivity group and this is also true for the seniors. However, whichever way the data are analysed, the comorbid links are greater in the younger cohort. This suggests that the extent of the link with conduct disorder appears, in fact, to decline with age and, further, that some forms of hyperactivity, home-based hyperactivity especially, may have few current or longitudinal implications. There are hints in the literature to support this view. For instance, other workers report that, in the absence of conduct disorder, relatively few differences emerge between hyperactive adolescents and controls save for the defining symptoms themselves, said not to be associated with substantial impairment at this age (Mannuzza *et al.*, 1988; 1989).

(d) *The significance of pervasive hyperactivity.* Goodman and Stevenson (1989), studying 13-year-olds, argue that "hyperactive behaviour can usefully be thought of as a quantitative trait" and that only pervasive hyperactivity "makes a major qualitative difference to the clinical picture". However, correlations between hyperactivity scores from different situations (e.g. home and school) are higher for 6–11-year-olds than for adolescents (Achenbach, McConaughy & Howell, 1987). Furthermore, when school-based and pervasive hyperactivity were compared in a clinic sample (mean age 8.5 years), few differences emerged between the two groups (Rapoport *et al.*, 1986). Our current research demonstrates that the relative male predominance and link with conduct disorder said to be characteristic of pervasive rather than situational hyperactivity emerge only among older children. Thus, it is possible that among younger children any distinction between pervasive and school-based hyperactivity may be less important than that among their older counterparts.

This latter observation may be of relevance to diagnostic classification. On the grounds of clinical (Sandberg *et al.*, 1978; Taylor, 1986) and community research (Schachar *et al.*, 1981; Boudreault *et al.*, 1988; Goodman & Stevenson, 1989), it has been argued that pervasive hyperactivity forms the basis of a meaningful clinical syndrome. This view has been incorporated into the ICD 10 diagnosis of hyperkinetic disorder (WHO, 1992) as well as the DSM-IV diagnosis of attention-deficit/hyperactivity disorder (APA, 1994), where one of the criteria is that symptoms must be present in at least two situations. However, the evidence may not be conclusive. Findings in clinical studies are notoriously unrepresentative of the picture in the general population. Further, population-based studies may represent only one age group—that of Schachar *et al.* (1981) and Goodman and Stevenson (1989) were based on older children alone. In addition, Schachar *et al.* (1981) and Boudreault *et al.* (1988) combined home- and school-based hyperactivity together and therefore, could not examine their specific contribution, and the more recent epidemiological study of Taylor *et al.* (1991) did not focus on school-based hyperactivity. Our data suggest that in younger children especially, there is a possibility that excessive reliance on pervasiveness of symptoms as a key diagnostic criterion may lead to exclusion of a group of children with significant hyperactivity reported by schools alone.

(e) *Methodological issues.* First, in the current study, the clinicians had not originally sought to make a diagnosis of hyperactivity as a predominant disorder—rather, all cases were 'force' classified as conduct, neurotic or mixed disorders (Rutter *et al.*, 1970). This approach did not affect the defining of hyperactivity at a symptomatic level, at an "at risk" level or at a maladjustment level of caseness. However, from a review of the present research data, there is a possibility that some cases of "pure" hyperactivity, severe and handicapping enough to be considered a clinical disorder (but without comorbid conduct or neurotic disorder), might have been missed. This is likely to be a minor problem in a clinical study where only a minority of hyperactive children have "pure" disorders (Taylor *et al.*, 1986a). However, in an epidemiological study, where "pure" disorders may be more common (Bird, Gould & Staghezza, 1993) there remains a theoretical possibility of underestimating prevalence—but the evidence from other epidemiological research suggests that a serious underestimate of prevalence of "pure hyperactivity", at the level of a clinical disorder, rather than at a symptomatic level, appears unlikely (Taylor *et al.*, 1991).

Second, clinical diagnoses were based largely on data from parent interviews. With the possibility of poor agreement between informants concerning child behaviour (Achenbach *et al.*, 1987), there could have been an underestimate of the association of psychiatric disorder and school-based hyperactivity, and a potential bias in the direction of increased disorder among children with home-based hyperactivity. Consequently, the finding of comparatively higher rates of hyperactivity associated with psychiatric disorder among children with school-based rather than home-based hyperactivity assumes greater significance.

Finally, we define hyperactivity on the basis of items from a rating scale and conduct disorder on the basis largely of parental interviews. Clearly these are not

similar methods of determining membership of diagnostic groups. However, they meet the needs of the aims of the study, which were to focus upon the exploration of relationships between conduct disorder and hyperactivity in terms of symptoms and syndromes.

Conclusions

Given comparable methodology and definitions, the prevalence of hyperactivity is broadly equivalent across different Western societies and we confirm that it is predominantly, though not exclusively, a male phenomenon.

By extrapolation from our cross-sectional samples, symptomatic hyperactivity has only a limited relationship with indices of psychiatric disorder. This was most notable among the juniors. The link was somewhat stronger among the seniors, and particularly in those seniors with pervasive hyperactivity. Furthermore, pervasive hyperactivity was associated with a higher rate of the most severe conduct disorder in older children. These findings suggest that, at least until late childhood, hyperactivity—and especially pervasive hyperactivity—grows in significance with age. Among younger children, school-based and pervasive hyperactivity seem to be of broadly similar clinical significance. Hence, at least for older children, our data are consistent with the principles of ICD 10 (WHO, 1992) and of DSM-IV (APA 1994)—these require pervasiveness of symptoms as an essential diagnostic criterion for both hyperkinetic and attention-deficit/hyperactivity disorders. However, the data also indicate that the diagnostic criteria outlined in DSM III(R) (APA, 1987), which emphasised the importance of school-based hyperactivity on its own, may constitute a useful and meaningful concept in younger children and the new criteria may be unhelpfully rigorous.

Home-reported situational hyperactivity was much more common among younger children than among older children. This is particularly the case when hyperactivity is associated with being screen positive or when associated with a clinical psychiatric disorder. Thus it is argued that home-based hyperactivity symptoms on their own are unlikely to present a basis for a persistent or clinically significant syndrome or disorder. Hyperactivity presenting only at home may represent a normal developmental phenomenon in many subjects and should be given a psychiatric diagnosis only with caution.

Our data confirm earlier findings that there is an important link between hyperactivity and conduct disorder. They also support the view that comorbid hyperactivity and conduct disorder are of greater clinical significance than either "pure" syndrome alone. Furthermore, the data indicate that even severe conduct disorder may occur without comorbid hyperactivity, but that this happens only among older children. The above findings and arguments suggest that there are different aetiological paths to conduct disorder at different ages.

Taken together, these findings emphasise the influence of age on the complex pattern of interrelationships between different forms of hyperactivity and psychiatric disorder, and between hyperactivity and conduct disorder. This study further indicates the importance and utility of a developmental perspective in research into child psychopathology.

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