Can Autism be Detected at 18 Months?
The Needle, the Haystack, and the CHAT

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Autism is currently detected only at about three years of age. This study aimed to establish if detection of autism was possible at 18 months of age. We screened 41 18-month-old toddlers who were at high genetic risk for developing autism, and 50 randomly selected 18-month-olds, using a new instrument, the CHAT, administered by GPs or health visitors. More than 80% of the randomly selected 18-month-old toddlers passed on all items, and none failed on more than one of pretend play, protodeclarative pointing, joint-attention, social interest, and social play. Four children in the high-risk group failed on two or more of these five key types of behaviour. At follow-up at 30 months of age, the 87 children who had passed four or more of these key types of behaviour at 18 months of age had continued to develop normally. The four toddlers who had failed on two or more of these key types of behaviour at 18 months received a diagnosis of autism by 30 months. *British Journal of Psychiatry* (1992), 161, 839–843

Autism is widely regarded as the most severe of childhood psychiatric disorders, yet detection of autism is unacceptably late. Thus, even specialist clinicians are rarely referred a child with suspected autism much before three years old (specialist centres are beginning to have referrals of two-year-olds, but this is still exceptional), despite the consensus among researchers that the disorder almost always has prenatal onset (Volkmar *et al*, 1985).

This relatively late age of detection is not surprising, since (a) primary health practitioners are not specifically trained to detect autism early, (b) nothing in the current routine developmental screening would alert a general practitioner (GP) or health visitor to a possible case of autism since in most countries they only screen motor, intellectual, and perceptual development, all of which may appear normal in autism (Frith & Baron-Cohen, 1987), (c) the disorder is quite rare, and (d) most sets of criteria for autism (American Psychiatric Association, 1987; World Health Organization, 1987) emphasise abnormalities in social and communicative development, both of which are difficult to assess in the pre-school period.

To date, most researchers have recognised the importance of early detection but have not attempted this, simply because the odds of finding autism at such a young age were not dissimilar to those of finding the proverbial needle in a haystack: only

4–8 per 10 000 infants develop autism (Gillberg *et al*, 1991). Given its rarity, it appears uneconomical to attempt early detection in a random sample.

A basic tenet of the present study is that the early detection of autism is both possible and economic. It is possible because findings from experimental psychology have shown us what to look for in toddlers if we want to detect autism early. Firstly, *pretend play* (in which objects are used as if they have other properties or identities and which is normally present by 12–15 months) is absent or abnormal in autism (Wing & Gould, 1979; Baron-Cohen, 1987). This deficit seems to be highly specific – there is not a general absence of play *per se*. For example, children with autism do show functional play (using toys as they were intended to be used) and sensorimotor play (exploring the physical properties of objects only, with no regard to their function, e.g. banging, waving, sucking, throwing, etc.) (Baron-Cohen, 1987).

Secondly, *joint-attention* behaviour (normally present by 9–14 months old) is also absent or rare in autism (Sigman *et al*, 1986). Again, this is a strikingly specific deficit. For example, while the joint-attention behaviour of protodeclarative pointing is absent or rare in autism (Baron-Cohen, 1989), pointing for 'non-social' purposes is present. Thus, they do show protoimperative pointing (Baron-Cohen, 1989), and pointing for naming (Goodhart & Baron-Cohen, 1992). (Joint-attention behaviour includes pointing, showing, and gaze monitoring, and is defined as attempts to monitor or direct the attention of another person to an object or event: protodeclarative pointing is the use of the index finger to indicate to another person an object of interest, as an end in itself; protoimperative pointing is the use of the index finger simply to attempt to obtain an object; pointing for naming is to pick out an object within an array while naming it, and this can be non-social.) Other deficits in joint-attention in autism include a relative lack of showing objects to others, and of gaze monitoring – directing one's gaze where someone else is looking (Sigman *et al*, 1986).

Since both pretend play and joint-attention behaviour, especially protodeclarative pointing, are universal development achievements (Butterworth, 1991; Leslie, 1991), normally present in simple forms by 15

months, their absence at the routine 18-month screening could be clear, specific indicators of autism or related disorders. Yet neither of these two psychological markers are currently checked.

But what about the economics of early detection? Screening even 10 000 randomly selected children would find few children with autism. Our alternative was to screen 18-month-old children who were at high risk for autism – younger siblings of children with diagnosed autism, 2–3% of whom on genetic grounds would also develop autism (Folstein & Rutter, 1987). We reasoned that if we could demonstrate the value of a screening instrument on a high-risk sample, then it would be safer to use such an instrument on a random population later.

Method

We tested two groups of subjects. Firstly, 50 randomly selected 18-month-olds (group 1) attending a London health centre for their routine 18-month check-up were tested, in order to collect normative data. The mean age of this group was 18.3 months (range 17–20 months, s.d. 1.04 months). They comprised 28 boys and 22 girls. Secondly, we tested 41 younger siblings of children with autism (group 2), identified with the help of the National Autistic Society (UK) and the Statewide Diagnostic Autism Register, kept at the Child Neuropsychiatric Clinic in Gothenburg. Group 2 was our high-risk group. The older siblings of this group all had a diagnosis of autism that met accepted criteria (Rutter, 1978; American Psychiatric Association, 1987). The mean age of subjects in group 2 was 19.3 months (range 17–21 months, s.d. 1.6 months). The difference in age between groups 1 and 2 was not significant ($t = 1.78$, d.f. $= 89$, $P > 0.05$).

Both groups were tested using our newly developed instrument, the Checklist for Autism in Toddlers (the CHAT). Subjects were tested by their GP or health visitor. GP cooperation for group 2 was obtained by explaining to them that the CHAT would only take about 15 minutes to complete, that it could be fitted into the routine 18-month check-up, that there was only one child among their patients who needed to be tested in this way, and that this would aid research. In the case of GP refusal ($n = 10$ in group 2), subjects were tested by a parent on Section A only (see below).

Subjects in both groups were followed up 12 months later (at age 30 months), with a letter to the parent (in the case of group 2) or the GP (in the case of group 1), asking if the child had developed any psychiatric problems.

The CHAT was initially constructed by including several questions in each of six areas of development reported in the literature to be abnormal in autism: social play, social interest, pretend play, joint-attention, protodeclarative pointing, and imitation. In addition, we also included several items in each of four areas of development reported to be normal in autism: functional play, protoimperative pointing, motor development, and rough and tumble play. This made a total of 10 areas of development. This rather long version of the CHAT was only given to group 1. It had

two sections: section A comprised questions for the parent, while section B comprised attempts to elicit some of these types of behaviour by the clinician.

In an effort to ensure the CHAT was both easy and quick to use by busy clinicians, and only included questions that normal 18-month-olds easily passed, the CHAT was then shortened. Firstly, those items that were failed by more than 20% of group 1 were dropped (20% was chosen as an arbitrary index that this behaviour was not reliably present in normal 18-month-olds). This resulted in dropping imitation. Secondly, within each of the nine remaining areas of development, the question that was passed by the largest number of children in group 1 was kept, but the other questions were dropped. These two modifications produced the short CHAT (see Appendix).

Section A of the resulting check-list therefore assessed each of nine areas of development, with one question for each: rough and tumble play; social interest; motor development; social play; pretend play; protoimperative pointing; proto-declarative pointing; functional play; joint-attention. The order of questions was designed to avoid a yes or a no bias, by interspersing the predicted areas of abnormality with the predicted areas of normality in children with autism.

Section B was included for the clinician to check the child's actual behaviour against the parental report given in section A. Thus, item Biii checked for pretend play and corresponded to question A5. Item Biv checked for protodeclarative pointing and corresponded to question A7. Items Bi and Bii recorded actual social interaction, but were not intended to correspond to particular questions in section A, and Bv was a check for mental handicap.

Predictions

Following Folstein & Rutter (1987), we predicted we should find approximately 3% of group 2 would develop autism. Since group 2 contained only 41 subjects (this being the total number of 18-month-olds who were siblings of already diagnosed children with autism that we could locate in the whole of the UK and Sweden), this meant we could expect only 1.2 cases of autism. The question was, would the CHAT identify these one or two cases at 18 months? We predicted that these cases should fail questions A2, 4, 5, 7, and 9, but pass A1, 3, 6, and 8. We knew that more than 80% of children in group 1 were able to pass all items in the CHAT, as the instrument had been constructed on this basis.

Results

Table 1 shows the percentage of subjects in each group passing (i.e. recording a 'yes') on each item in section A. Groups 1 and 2 did not differ statistically on any question. While a small percentage of the toddlers in group 1 still lacked protodeclarative pointing (8%), social interest (6%) joint-attention (6%), and pretend play (14%), as measured by section A (7, 2, 9, and 5, respectively), none lacked more than one of these four types of behaviour. The fifth behaviour of interest, social play (A4), was present in all of group 1. This pattern was also true of the toddlers in group 2, with the exception of four subjects (9.75% of

Table 1
Percentage of each group 'passing' each item on the CHAT

	Group 1 (n = 50)	Group 2 (n = 41)
Section A questions		
1	90	92.7
2	94	97.5
3	100	95.0
4	100	95.1
5	86	82.9
6	98	87.8
7	92	87.8
8	100	100
9	94	92.7
Section B items[1]		
i	100	96.8
ii	98	90.3
iii	82	74.2
iv	88	80.6

1. n = 31 for group 2, as in ten instances only Section A of the CHAT was given by parents.

group 2) who lacked two or more of these five key types of behaviour. Questions A3 and A8 demonstrated that none of the groups showed gross motor or intellectual delay, and nor were parents prone to a 'no' bias.

Validation of the CHAT: follow-up data

At follow-up at 2.5 years old, none of group 1 were reported to have developed any psychiatric problems, and certainly there were no cases of autism. In group 2, 37 out of 41 were reported to be free of psychiatric problems, but four had been diagnosed (between 24 and 30 months old) as having autism, by two independent psychiatrists, using DSM-III-R criteria (American Psychiatric Association, 1987). These subjects were the only ones in group 2 to have lacked two or more of the five key types of behaviour. Two of these cases were in the British sample, and two were in the Swedish sample. This shows that the CHAT correctly predicted at 18 months old which children were developing normally versus which children were developing autism.

Reliability of the CHAT

Items Biii and Biv were included as a test of whether parents might be either under- or overestimating their child's ability, as they had reported it to the clinician on questions A5 and A7. In group 1 (who were all tested by a clinician), each of the two section A questions was passed by 92% of the children passing the corresponding section B item, as can be seen in Table 1. That is, most children who passed an item in section A were also scored as showing the relevant behaviour in section B. The four children (out of 50) who passed a question in section A but who did not show the relevant behaviour in section B were all accounted for by the clinician's notes. In three of these cases the clinician noted this was because of the child's shyness, and the other child's native language was not English. The opposite

pattern (failing an item in section A but showing the relevant behaviour in section B) never occurred.

The final aspect of reliability that was tested concerned the ten subjects in group 2 who were assessed by their parents, because of GP refusal. The predictive accuracy from their assessment was just as reliable as that from the GP assessment.

Discussion

This first study using the CHAT revealed that key psychological predictors of autism at 30 months are showing two or more of the following at 18 months: (a) lack of pretend play, (b) lack of protodeclarative pointing, (c) lack of social interest, (d) lack of social play, and (e) lack of joint-attention. The CHAT detected all four cases of autism in a total sample of 91 18-month-olds. Partly this must reflect that we chose the right measurements and the right high-risk group, although in part we were 'lucky', in that statistically a sample of only 41 high-risk children could have contained no cases of incipient autism (Folstein & Rutter, 1987). This predictive success provides a preliminary test of the validity of the CHAT. We therefore recommend that if any child lacks any combination of these key types of behaviour on examination at 18 months, it makes good clinical sense to refer him/her for a specialist assessment for autism.

We are currently extending this research into an epidemiological study of 20 000 randomly selected 18-month-olds in the South East Thames Region of England, as a necessary next step towards further validation of this instrument. This will help establish the rate of false negatives, such as cases of mental handicap. We expect that most children with general and severe mental handicap will fail questions A3 and A8, and thus not be confused with early cases of autism. In addition, we recommend adding a further item to the CHAT (see Appendix item Bv) to help differentiate severe mental handicap without autism from autism itself. This item is already widely used in routine check-ups. Whether children with other kinds of disorders (e.g. Asperger's syndrome, language disorder, etc.) show a different pattern of failure on the CHAT will be an important question to answer.

Finally, it is of considerable theoretical interest that three of the items that predicted which children would receive a diagnosis of autism are those that have been postulated to stand in a precursor relationship to the impaired 'theory of mind' found later in autism: pretend play, protodeclarative pointing, and joint-attention (Baron-Cohen, 1991; Leslie, 1991). Our epidemiological study, being prospective, will allow a stronger test of this precursor relationship. It is hoped that research with the CHAT will lead to improvements in the early diagnosis of autism.

Appendix: The CHAT

To be used by GPs or health visitors during the 18-month developmental check-up.

Child's name
Date of birth
Age
Child's address
Phone number

Section A. Ask parent:

1. Does your child enjoy being swung, bounced on your knee, etc?   Yes   No
2. Does your child take an interest in other children?   Yes   No
3. Does your child like climbing on things, such as up stairs?   Yes   No
4. Does your child enjoy playing peek-a-boo/hide-and-seek?   Yes   No
5. Does your child ever pretend, for example, to make a cup of tea using a toy cup and teapot, or pretend other things?   Yes   No
6. Does your child ever use his/her index finger to point, to ask for something?   Yes   No
7. Does your child ever use his/her index finger to point, to indicate interest in something?   Yes   No
8. Can your child play properly with small toys (e.g. cars or bricks) without just mouthing, fiddling, or dropping them?   Yes   No
9. Does your child ever bring objects over to you (parent), to show you something?   Yes   No

Section B. GP's or health visitor's observation:

i.   During the appointment, has the child made eye contact with you?   Yes   No
ii. Get child's attention, then point across the room at an interesting object and say "Oh look! There's a [name a toy]!" Watch child's face.
     Does the child look across to see what you are pointing at?   Yes[1]   No
iii. Get the child's attention, then give child a miniature toy cup and teapot and say "Can you make a cup of tea?"
     Does the child pretend to pour out tea, drink it, etc?   Yes[2]   No
iv. Say to the child "Where's the light?", or "Show me the light".
     Does the child point with his/her index finger at the light?   Yes[3]   No
v.   Can the child build a tower of bricks? (If so, how many?) (Number of bricks ....   )   Yes   No

1. To record yes on this item, ensure the child has not simply looked at your hand, but has actually looked at the object you are pointing at.
2. If you can elicit an example of pretending in some other game, score a yes on this item.
3. Repeat this with "Where's the teddy?" or some other unreachable object, if child does not understand the word "light". To record yes on this item, the child must have looked up at your face around the time of pointing.

Acknowledgements

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An Empirical Study of Delirium Subtypes

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Using a structured instrument, 325 elderly patients admitted to a general hospital for an acute medical problem were evaluated daily in order to detect symptoms of delirium. Patients were scored for 'hyperactive' or 'hypoactive' symptoms, and then the 125 patients with DSM-III delirium were rated as 'hyperactive type' (15%), 'hypoactive type' (19%), 'mixed type' (52%), or 'neither' (14%). There were no statistically significant differences between the groups with respect to age, sex, place of residence, or presence of dementia. These definitions of subtypes should be studied further.

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Delirium has been recognised and described by doctors for over 2000 years. Lipowski (1990) points out that even early Greek and Roman writers distinguished two types of what we now think of as delirium. 'Phrenitis' was regarded as an acute disorder, usually associated with fever, featuring cognitive and behavioural disturbances as well as disruption of sleep. It was typically marked by restless and excited behaviour, in contrast to its opposite condition, 'lethargus', which was characterised by listlessness, sleepiness, inertia, memory loss, and dulling of the senses.

Lipowski (1983) suggested that delirium be the term used to characterise both hyperactive and hypoactive states, rather than distinguishing 'delirium' from 'acute confusion'. More recent literature cited by Lipowski (1990) distinguishes three subtypes of delirium - the hyperactive-hyperalert, the hypoactive-hypoalert, and the mixed - but points out that only one, unpublished, study presented data on the frequency of the respective subtypes, which found 55% of a small sample to be 'active'. Lipowski suggested that clinical impressions of the frequency and characteristics of subtypes need to be validated by systematic clinical research, and that is the purpose of this study.

Such empirical validation is particularly important since the diagnostic criteria which define the syndrome of delirium have been explicitly defined (American Psychiatric Association, 1980), revised (American Psychiatric Association, 1987), and are being revised again (Frances *et al*, 1989), to be consistent with the tenth edition of the *International Classification of Diseases* of the World Health Organization (1992). None of these sets of criteria currently incorporates the subtypes above. In this paper, we provide empirical data concerning the occurrence of different subtypes of delirium, and examine the characteristics of each.

Method

Two groups of patients over the age of 65 from a defined community (East Boston) and from a long-term care facility (Hebrew Rehabilitation Center for the Aged, or HRCA) who were admitted to Beth Israel Hospital for medical or surgical care over 18 months were studied. Patients admitted directly to an intensive-care unit were excluded. The participation rate was 79.5% of all eligible patients. In all, 325 study participants were evaluated within 48 hours of hospital admission and monitored daily throughout their hospital stay for symptoms in each domain of DSM-III delirium (i.e. clouding of consciousness, disorientation/ memory impairment, perceptual disturbance, speech disturbance, psychomotor behaviour, sleep/wake disturbance, and fluctuating behaviour).

Since the study involved daily assessments of a large number of patients over their entire hospital stay, it was impractical to have a clinician conduct all the assessments. An instrument (the Delirium Symptom Interview, or DSI) was developed by an interdisciplinary group which described the behaviours and responses associated with a particular symptom in explicit, operational terms, so that a research