Predictors of psychotic symptoms among young people with special educational needs

Andrew C. Stanfield*, Andrew G. McKechanie*, Stephen M. Lawrie, Eve C. Johnstone and David G.C. Owens

Background

Psychotic symptoms and psychotic disorders occur at increased rates in adults with intellectual disability, including borderline intellectual functioning, compared with the general population. Little is known about the development of such symptoms in this population.

Aims

To examine whether clinical factors predictive of psychotic disorder in a familial study of schizophrenia also apply to those with intellectual disability.

Method

Adolescents with special educational needs (SEN) were assessed with the Structured Interview for Schizotypy (SIS) and Childhood Behavioural Checklist (CBCL). These scores were used to prospectively divide participants based on their anticipated risk for psychotic disorder. A subsample were reassessed three times over 6 years, using the Positive and Negative Syndrome Scale (PANSS).

Results

The SEN group were more symptomatic than controls throughout (Cohen's d range for PANSS subscale scores: 0.54–1.4, all $P < 0.007$). Over 6 years of follow-up, those above the SIS and CBCL cut-off values at baseline were more likely than those below to display morbid positive psychotic symptoms (odds ratio, 3.5; 95% CI 1.3–9.0) and develop psychotic disorder (odds ratio, 11.4; 95% CI 2.6–50.1). Baseline SIS and CBCL cut-off values predicted psychotic disorder with sensitivity of 0.67, specificity of 0.85, positive predictive value of 0.26 and negative predictive value of 0.97.

Conclusions

Adolescents with SEN have increased psychotic and non-psychotic symptoms. The personality and behavioural features associated with later psychotic disorder in this group are similar to those in people with familial loading. Relatively simple screening measures may help identify those in this vulnerable group who do and do not require monitoring for psychotic symptoms.

Declaration of interest

None.

Keywords

Schizophrenia; psychosis; intellectual disability; special education; high risk.

Copyright and usage

Background

Individuals with intellectual disability are known to have higher rates of psychopathology than the general population.[1,2] In particular, it is well established that they show a three- to five-fold increase in the prevalence of schizophrenia.[3–6] This increase in risk for psychosis has also recently been extended to those with borderline intellectual functioning (i.e. IQ between 70 and 85), who have been reported to have over twice the risk of developing a probable psychosis compared with those of higher IQ.[7] Despite these findings, there is a relative paucity of research on the early development of psychotic symptoms in the intellectually impaired, with studies more commonly focusing on groups at increased risk because of familial reasons[8] or the presence of prodromal symptoms.[9]

The Edinburgh Study of Comorbidity

The Edinburgh Study of Comorbidity (ESC) was initially set up in 2005 to longitudinally examine a group of young people at enhanced risk for later schizophrenia because of intellectual impairment.[10] The ESC was stimulated by earlier work on the Edinburgh High Risk Study (EHRS) of people at familial risk of developing schizophrenia;[8] essentially the aim was to examine the extent to which the findings of the EHRS were replicated in an investigation where the heavy familial loading was not present. To this end, the cohort recruited for the ESC was not derived from health services, but instead was acquired from education services, on the basis that they were receiving special educational support for presumed intellectual impairment.

Within the ESC cohort, we have previously demonstrated that, at baseline, high levels of schizotypal traits were associated with clinical, neuropsychological and brain structural features that are consistent with findings from the EHRS.[10–12] We have also reported that those with the highest levels of schizotypal traits and adolescent behaviour difficulties were most likely to develop psychotic symptoms over the first 2 years of follow-up,[10] and that these individuals showed increased levels of medial temporal lobe volume loss over this time.[13] More recently, we extended these brain structural findings to 6 years of follow-up, into early adulthood, where we found that those with high levels of psychotic symptoms continue to show medial temporal lobe grey matter loss over this time,[14] and that the presence of negative symptoms is also associated with longitudinal grey matter tissue loss in other brain regions.[15]

Aims and hypotheses

The current paper concerns the clinical findings derived from the 6-year follow-up study of these young people with special educational needs (SEN). Specifically, we had two primary aims: (a) to determine the level of psychiatric symptoms in this cohort through adolescence and early adulthood; and (b) to examine the predictors of the development of psychotic symptoms, and of psychotic disorder. With regard to our first aim and based on previous work examining psychopathology in adults with borderline and mild intellectual disabilities,[1,7] we hypothesised that those receiving educational assistance would have higher rates of psychopathology than controls at all three time points. For the second aim, in the light of our previous findings from the early follow-up of this cohort[10] and from the

---

* These authors contributed equally to the paper.

EHRS,[8] we hypothesised that later psychotic symptoms, and indeed psychotic disorder, would be predicted by the combined presence of high levels of baseline schizotypal features and behavioural difficulties, as well as other known risk factors for psychosis, such as obstetric complications, substance misuse and family history.

Method

Participant recruitment and baseline assessment

Ethical approval for the study was granted by the Multicentre Research Ethics Committee for Scotland. Full details of recruitment are available elsewhere[10] and are summarised in Fig. 1. Briefly, relevant schools and colleges throughout mainland Scotland were contacted and asked to identify young people, aged 13–22 years, receiving educational assistance for presumed intellectual impairment and with an estimated IQ of between 50 and 80 (as IQ is not routinely measured in the Scottish educational system). After exclusions, 394 individuals with SEN were recruited to undergo further investigation.

At their initial assessment these participants were assessed with the Structured Interview for Schizotypy (SIS)[16] and the Childhood Behavioural Checklist (CBCL).[17] Cut-off values on these instruments were found to predict the later development of schizophrenia
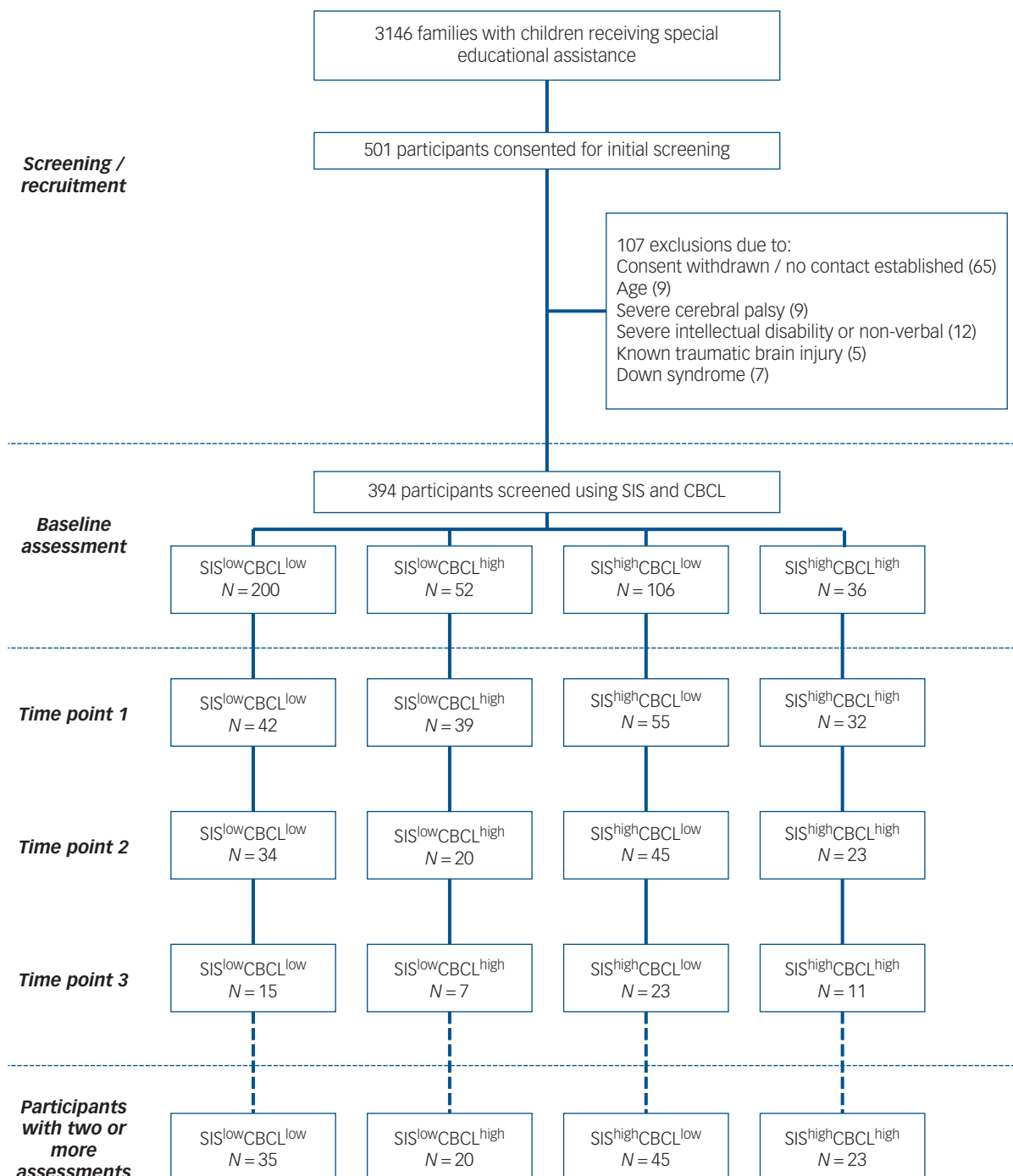

Fig. 1 Study flow diagram. CBCL, Childhood Behavioural Checklist; SIS, Structured Interview for Schizotypy.

in the EHRS of individuals at enhanced familial risk of schizophrenia,[8] and therefore these were used to derive cut-off values for the ESC to create four cells of individuals: those with high scores on both the SIS and CBCL (SIS^{high}CBCL^{high}), those with low scores on both the SIS and CBCL (SIS^{low}CBCL^{low}), and those with high on one and low on the other (SIS^{high}CBCL^{low} and SIS^{low}CBCL^{high}). These SIS/CBCL groupings were then sampled with the intention of conducting detailed assessments on approximately equal numbers of individuals from each group. This left a final population of 168 individuals for study. It is important to note that this sampling deliberately led to a relative enrichment of individuals scoring high on these scales (see Fig. 1).

In addition, two comparison groups comprising typically developing siblings (also in the 13–22 years age group) and age-matched young people with no history of psychiatric disorder or special educational requirement recruited through youth organisations in the areas from which the sample participants came. Basic demographic data, reported diagnoses (if any) and family history of psychiatric or neurodevelopmental disorders were also obtained at this time. Family history was considered in four categories: psychotic illness, non-psychotic psychiatric illness, epilepsy and intellectual disability, and no family history.

Assessments

Approximately 6 months following this baseline assessment, participants were then examined with the semi-structured Clinical Interview Schedule (CIS)[18] and the Positive and Negative Syndrome Scale (PANSS).[19] These assessments of psychopathology were conducted by clinicians blinded to group membership of participants. Interrater reliabilities were conducted for the CIS and were greater than 0.76.[10] IQ was formally measured at this time with either the Wechsler Adult Intelligence Scale, 3rd edition or the Wechsler Intelligence Scale for Children, 3rd edition as appropriate.[20,21] In addition, participants also underwent a structural magnetic resonance imaging scan and neuropsychological assessments of executive function and memory, although these are not considered further in the current paper. All of these assessments were conducted by staff who had not been involved in the initial assessments with the SIS and CBCL and who were therefore blind to their ratings on these instruments.

The CIS, PANSS, magnetic resonance imaging and neuropsychological assessments were repeated 1–2 years later and again 6 years later in all participants who consented to be followed up, although on the last occasion, no attempt was made to reassess the sibling controls. Information on substance misuse was collected only for those who returned after 6 years.

Participants and their mothers were also asked to give consent for the examination of their obstetric and neonatal histories from routinely collected healthcare data held by the Information and Statistics Division of the National Health Service in Scotland. Full details of the data extracted and the linkage process are given elsewhere.[22] For the present study, data on gestational age at birth, weight at birth, occipitofrontal circumference and Apgar scores were examined.

Statistical analyses

As the present study concerns the possible predictors of psychotic symptoms, only participants who had provided data for interview on at least two of the three assessment points were included. The related controls were not included as they were not assessed at the final time point.

To examine the psychopathology in all participants, PANSS subscale scores at each successive time point were compared between controls and the SEN group, initially as a whole and then divided by SIS/CBCL grouping. As the PANSS scores were not normally distributed, Kruskal–Wallis tests and Mann–Whitney U-tests were used for these analyses.

The next step aimed to establish whether factors found to predict psychosis in the familial EHRS were also associated with the development of psychotic symptoms in the current cohort. The identification of psychotic symptoms can be more difficult to make with confidence in those with intellectual disability;[23] this is particularly the case for negative symptoms such as poverty of speech or flattening of affect, but also for certain positive symptoms such as conceptual disorganisation. With this in mind, a conservative approach was adopted, only considering participants as having psychotic symptoms if they showed clear evidence of either delusions or hallucinations (which, according to PANSS criteria, relates to a score of 3 or more in relevant items) at one or more time points throughout the study. This is consistent with our previous approach in this cohort.[14] Using these criteria, participants were therefore divided into two groups: psychotic symptoms present and psychotic symptoms absent. The relationship between psychotic symptom status and SIS/CBCL grouping was then examined by χ^2-tests and an odds ratio was calculated comparing those who scored above the cut-off value on both instruments versus the remainder of the population. Next, the relationship between symptom status and the other potential predictors of interest (IQ, family history, obstetric complications and substance misuse) were examined by comparing the groups, using t-tests, χ^2-tests or Mann–Whitney U-tests as appropriate to the distribution of the data.

Although the above analyses examine the relationship between psychotic symptoms and potential predictors, one of the primary intentions of the study was to consider whether the SIS/CBCL groupings would be helpful in predicting the development of a psychotic disorder, not just symptoms. To examine this, a final analysis was conducted where the SEN group was dichotomised into those with a likely psychotic disorder, based on scoring 4 or more on the delusions or hallucinations items of the PANSS, and those without. A χ^2-test was then used to determine the relationship between SIS/CBCL grouping and future diagnostic status; sensitivity and specificity, as well as positive and negative predictive values, were also calculated for the SIS/CBCL groupings.

<div align="center">Results</div>

Participant characteristics and psychopathology

The characteristics of the cohort at each time point are shown in Table 1. Of the 168 participants assessed at time point 1, 122 returned for time point 2 and 56 returned for time point 3. The reasons for the attrition between time point 2 and 3 related primarily to the recontact process required for the 6-year follow-up, which occurred via participants' general practitioners.[14] To summarise, of those seen at the second time point, 3 participants did not give permission for future contact, 15 participants were uncontactable, 23 participants no longer wished to be involved and 26 participants did not wish or were not able to return for full face-to-face assessments. In addition, one participant attended for time point 3 who did not attend for time point 2. There were no significant differences in baseline SIS/CBCL group membership between those who attended for all three time points and those who only attended at time points 1 and 2.

There were no significant differences in age between the groups at any time point (all $P > 0.10$); however, gender differed significantly between the SEN group and the controls at time points 1 and 2 (both $P = 0.04$), but not at time point 3 ($P = 1.0$).

The SEN group scored more highly than the controls on all subscales of the PANSS at each time point throughout the study

Table 1 Cohort and control participant characteristics

	Time 1		Time 2		Time 3	
	SEN	Controls	SEN	Controls	SEN	Controls
n	123	28	122	28	56	10
Gender (M:F)	79:44	12:16	78:44	12:16	39:17	7:3
Age	15.8 (1.7)	16.4 (1.8)	17.1 (1.6)	17.7 (1.8)	22.2 (2.0)	22.5 (2.2)
IQ at entry	74.4 (17.5)	107.5 (17.3)	74.5 (17.6)	107.5 (17.3)	77.6 (16.5)	111.1 (16.6)
PANSS P	8 (7–21)	7 (7–10)	8 (7–16)	7 (7–8)	7 (7–19)	7 (7–7)
PANSS N	11 (7–31)	7 (7–14)	13 (7–26)	7 (7–13)	11 (7–29)	7 (7–7)
PANSS G	20 (16–44)	17 (16–23)	19 (16–39)	16 (16–21)	19 (16–49)	16 (16–21)

Age and IQ given as mean (s.d.); PANSS scores given as median (range). M:F, male:female; PANSS, Positive and Negative Syndrome Scale; PANSS G, PANSS general subscale score; PANSS N, PANSS negative subscale score; PANSS P, PANSS positive subscale score; SEN, special educational needs.

(see Table 1, Cohen's d effect sizes ranging from 0.54 to 1.4; all $P < 0.007$). This was the case regardless of whether the SEN group had an IQ <70 or not (all $P < 0.03$). Within the SEN group, those with an IQ <70 tended to score more highly on negative symptoms than those with an IQ >70, but this was only significant at time points 2 and 3 (time point 1: $Z = -1.54$, $P = 0.12$; time point 2: $Z = -3.40$, $P = 0.001$; time point 3: $Z = -2.69$, $P = 0.007$). For positive and general symptoms there were no significant differences within the SEN group at any time point between those with an IQ <70 compared with those with higher IQ (all $P > 0.44$). Notably, ten participants in the study had IQs ≥100; no significant differences were found between these ten and the other participants in their SIS, CBCL or PANSS scores at any time point (all $P > 0.10$).

When the SEN group were divided into the SIS/CBCL groupings, the Kruskal–Wallis test showed significant differences for positive, negative and general subscale scores on the PANSS at all time points. Follow-up Mann–Whitney U-tests revealed that the SEN participants had higher levels of negative symptoms and general psychopathology than the controls at all time points, regardless of their SIS/CBCL group allocation (all $P < 0.02$). Positive symptoms were also higher in the SEN groups with SIS scores above the cut-off value (i.e. SIS^{high}CBCL^{high} and SIS^{high}CBCL^{low} groups) at all time points; whereas the two groups that scored below the cut-off value on the SIS (i.e. the SIS^{low}CBCL^{high} and SIS^{low}CBCL^{low} groups) did not show significantly greater positive symptoms than the controls at time point 1 and time point 3 (see Supplementary Figure 1 available at https://doi.org/10.1192/bjp.2018.296).

Detailed inspection of the individual PANSS symptoms showed that across the three time points the relative morbidity of the SEN group in terms of positive symptoms is primarily related to hallucinations and delusions; in terms of negative symptoms it relates to concrete thinking, flattening of affect, poor rapport and poverty of speech; and in terms of general symptoms relates to high levels of anxiety, depression, somatic concern, unusual thought content and preoccupation (see Supplementary Figures 2–4).

Factors associated with the development of positive psychotic symptoms

The characteristics of the SEN groups determined by the presence or absence of positive psychotic symptoms are shown in Table 2. There were no differences between the groups with regard to age, gender or IQ (all $P > 0.1$). The presence of positive psychotic symptoms was significantly associated with baseline SIS/CBCL grouping ($\chi^2 = 7.94$, $P = 0.047$); with the SIS^{high}CBCL^{high} group showing enhanced risk compared with the remainder of the population (odds ratio, 3.48; 95% CI 1.34–9.02).

Family history data were available on 106 participants in the SEN group. Of these, 15 individuals (14.2%) had a family history of a psychotic illness, 52 individuals (49.1%) had a family history of non-psychotic psychiatric disorder, 24 individuals (22.6%) had a family history of intellectual disability and 9 individuals (8.5%) had a family history of epilepsy. χ^2-tests showed that there were no significant relationships between any of the above family histories and the presence of positive psychotic symptoms (all $P > 0.08$).

Obstetric data were available on 91 participants in the SEN group. No significant associations were found between the presence of positive psychotic symptoms and birth weight ($t = -0.88$, $P = 0.38$), gestational age ($t = -0.99$, $P = 0.32$), occipitofrontal circumference ($t = -0.83$, $P = 0.41$), Apgar score at 1 minute ($Z = -0.80$, $P = 0.43$) or Apgar score at 5 minutes ($Z = -1.04$, $P = 0.30$).

Data on illicit drug use were available for 54 of the 56 SEN participants who attended the third follow-up. Of these, only nine participants had ever used illicit drugs on more than three occasions. There was no relationship between illicit drug use and the presence of psychotic symptoms (Fisher's exact test, $P = 1.0$).

The development of psychotic disorder in the cohort

Nine participants scored 4 or more on either the delusions or hallucinations subscales of the PANSS. In seven of them, the symptoms were persistent and convincing and provide strong clinical justification for a diagnosis of definite or probable schizophrenia. In the remaining two, the diagnosis is less clear as the account given was limited; however, they did report persistent auditory hallucinations over a sustained period. The distribution of these individuals with respect to the baseline SIS/CBCL groups is shown in Table 3. The Fisher's exact test demonstrated significant differences between the groups ($P = 0.003$), with six of the nine participants being in the SIS^{high}CBCL^{high} group at baseline; the SIS^{high}CBCL^{high} group showed significantly increased risk compared with the remainder of the population (odds ratio, 11.4; 95% CI 2.6–50.1).

In terms of the 6-year prediction of psychotic disorder among individuals with SEN, using both the SIS and CBCL cut-off values

Table 2 Characteristics of participants with SEN divided by the presence or absence of positive psychotic symptoms

	Positive symptoms absent	Positive symptoms present
Age (time 1)	15.6 (1.4)	16.1 (2.0)
Gender (M:F)	47:26	32:18
IQ	72.5 (17.0)	77.2 (18.2)
SIS/CBCL grouping		
SIS^{low}CBCL^{low}	24 (68.6%)	11 (31.4%)
SIS^{low}CBCL^{high}	14 (70%)	6 (30%)
SIS^{high}CBCL^{low}	27 (60.0%)	18 (40.0%)
SIS^{high}CBCL^{high}	8 (34.8%)	15 (65.2%)

Positive symptoms absent: individuals who never scored >2 on PANSS delusions or hallucinations subscales. Positive symptoms present: individuals who scored ≥3 on PANSS delusions or hallucinations subscales at one or more time points throughout the study. Age and IQ are given as mean (s.d.). CBCL, Childhood Behavioural Checklist; M:F, male:female; PANSS, Positive and Negative Syndrome Scale; SEN, special educational needs; SIS, Structured Interview for Schizotypy.

Table 3 Distribution of psychotic participants among the baseline SIS/CBCL groupings

	No psychotic disorder	Psychotic disorder
$SIS^{low}CBCL^{low}$	35 (100%)	0
$SIS^{low}CBCL^{high}$	19 (95%)	1 (5.0%)
$SIS^{high}CBCL^{low}$	43 (95.6%)	2 (4.4%)
$SIS^{high}CBCL^{high}$	17 (73.9%)	6 (26.1%)

No psychotic disorder: individuals who never scored >3 on PANSS delusions or hallucinations subscales. Psychotic disorder: individuals who scored ≥4 on PANSS delusions or hallucinations subscales at one or more time points throughout the study. CBCL, Childhood Behavioural Checklist; PANSS, Positive and Negative Syndrome Scale; SIS, Structured Interview for Schizotypy.

provides the following values: sensitivity of 0.67, specificity of 0.85, positive predictive value of 0.26 and negative predictive value of 0.97.

Discussion

In this non-clinical sample of young people who received special educational support, we found that the presence of schizotypal cognitions and behavioural difficulties in mid-adolescence was associated with the development of psychotic symptoms, and likely schizophrenia, over the following 6 years. These findings are in keeping with our original hypothesis, and are consistent with our previous study of individuals at risk of schizophrenia for familial reasons.[8]

Our findings suggest that the personality and behavioural features associated with the development of psychosis are the same regardless of whether the vulnerability state to psychosis is familial or intellectual in nature. However, there are overlaps between the genetic risk factors for psychosis and cognitive impairment.[24] An alternative explanation of the concordance between the current study and the previous familial study is therefore that intellectual impairment in the current sample results from genetic factors overlapping those in our familial sample. If that is the case then intellectual impairment may not be an independent vulnerability state to psychosis, and instead the participants intellectual impairments could be regarded as resulting from a genetically determined schizophrenic process where the full symptoms of the disorder are yet to become manifest.

It is evident from Table 3 that although most people who score above the SIS and CBCL cut-off values do not become unwell, a significant minority (26%) do develop a later psychotic disorder. This is around five to ten times higher than the reported rates in people with intellectual disability as whole.[3–6] Although this prevalence is high, the positive predictive value that we report is relatively low (0.26), highlighting that if these tests were applied widely, three out of four individuals would screen positive but would not go on to develop a psychotic disorder. Despite the fact that such screening could be potentially useful to clinicians, the risk of harm to participants and their families must be considered and any screening carefully explained. Perhaps of greater utility is the potential of these tests to exclude the risk of later psychotic disorder in this vulnerable population, and this is reflected in the high negative predictive value that we report (0.97). It is particularly notable that no one in the $SIS^{low}CBCL^{low}$ group was found to develop psychotic disorder across 6 years of study, suggesting a very low risk in this group.

We did not find any association between the presence of psychotic symptoms in those with SEN and the other potential predictors that we examined: obstetric factors, family history or substance misuse. These findings were not expected given their previously identified associations with psychosis. It is important to note that

in the current study, rates of adverse obstetric factors were increased compared with general population rates,[22] which is consistent with the established association between obstetric complications and intellectual disability.[25] This may explain why we did not observe the relatively specific association between obstetric complications and schizophrenia that has previously been reported in the general population. It is possible that family history and substance misuse do not affect the likelihood of developing psychotic symptoms in this population; however, the group sizes for each were relatively small, which may have affected our ability to detect any differences that were present.

Beyond our initial question, we also identified that individuals receiving special educational support also showed persistently elevated levels of non-psychotic symptoms compared with controls, across adolescence and into early adulthood. It is important to note that this population was recruited through educational services and very few of them had sought medical attention for these symptoms. Although the absolute differences in PANSS scores were relatively small, the effect of having morbid psychopathology in adolescents is high.[26,27] We have previously shown that functional outcome in this cohort is highly variable and is related to intellectual ability and behavioural difficulties;[28] we did not, however, consider ongoing psychopathology in that report. The findings presented here suggest that this matter merits further attention, as much of the general psychopathology was accounted for by anxiety- and mood-related symptoms, and effective treatments for these symptoms are well established. The identification and treatment of these symptoms would at least relieve distress, and may help to lift those whose functional outcome is limited to the very much better levels of some of their peers so that they might reach their full potential.

There are a number of potential issues as regards this study that merit further consideration. The defining characteristic of the sample was their receipt of special educational assistance because of presumed intellectual impairment, but within the sample there was a wide range of educational difficulties reported by families. Unfortunately we did not have access to school records to confirm the exact nature of these reported difficulties, therefore we were unable to examine whether specific difficulties are associated with later mental ill health. We do not have detailed symptom-level data for those who did not return for the final follow-up and it is possible that this may have biased our results. However, there were no significant differences in baseline SIS/CBCL group membership between those who attended all three time points and those who only attended the first two, therefore it is unlikely that this drop-off selectively affected our findings. It is also important to note that the group under study here was deliberately sampled to be weighted toward those scoring highly on the SIS and CBCL (see Fig. 1). As such, the exact rates of psychopathology for the group as a whole cannot be generalised to the wider population of people receiving educational assistance. However, even the group of participants who scored below the cut-off values on both the SIS and the CBCL showed higher levels of psychopathology compared with controls (Supplementary Figure 1), indicating that our broad finding of increased psychopathology in this group is likely to hold for the wider population. Finally, although the clinicians rating psychopathology were technically blinded as to whether or not a participant was in receipt of educational assistance, in many cases this may have become apparent to them during the conduct of the clinical interview, which could have influenced our findings for the SEN group as a whole; however, it is worth highlighting that they would have remained unaware of SIS/CBCL group membership.

Implications

Overall, these findings suggest that the personality and behavioural features associated with the development of psychosis in those with intellectual impairments are similar in nature to those observed in people who are vulnerable to psychosis as a result of their familial genetic loading. They also raise the possibility of using relatively simple screening measures to identify those at greatest risk of future psychosis, and highlight the need to be vigilant for the presence of potentially treatable psychopathology, both of a psychotic and non-psychotic nature, in this vulnerable group.

Andrew C. Stanfield, MB, ChB, PhD, MRCPsych (iD), Senior Clinical Research Fellow, Patrick Wild Centre, University of Edinburgh; and Division of Psychiatry, University of Edinburgh, UK; **Andrew G. McKechanie**, MB, ChB, MRCPsych, Clinical Research Fellow, Patrick Wild Centre, University of Edinburgh; and Division of Psychiatry, University of Edinburgh, UK; **Stephen M. Lawrie**, MD (Hons), FRCPsych (iD), Professor of Psychiatry, Patrick Wild Centre, University of Edinburgh; and Division of Psychiatry, University of Edinburgh, UK; **Eve C. Johnstone**, MD, FRCPsych, Emeritus Professor of Psychiatry, Patrick Wild Centre, University of Edinburgh; and Division of Psychiatry, University of Edinburgh, UK; **David G.C. Owens**, MD (Hons), FRCPsych, Professor of Psychiatry, Division of Psychiatry, University of Edinburgh, UK

Correspondence: Dr Andrew C. Stanfield, Patrick Wild Centre, Kennedy Tower, Royal Edinburgh Hospital, Tipperlinn Road, Edinburgh, EH10 5HF, UK. Email: andrew.stanfield@ed.ac.uk

First received 2 Jul 2018, final revision 19 Nov 2018, accepted 28 Nov 2018

Supplementary material

Supplementary material is available online at https://doi.org/10.1192/bjp.2018.296.

Funding

Acknowledgements

References

1 Cooper SA, Smiley E, Morrison J, Williamson A, Allan L. Mental ill-health in adults with intellectual disabilities: prevalence and associated factors. *Br J Psychiatry* 2007; **190**: 27–35.

2 Emerson E, Hatton C. Mental health of children and adolescents with intellectual disabilities in Britain. *Br J Psychiatry* 2007; **191**: 493–9.

3 Cooper SA, Smiley E, Morrison J, Allan L, Williamson A, Finlayson J, et al. Psychosis and adults with intellectual disabilities. Prevalence, incidence, and related factors. *Soc Psychiatry Psychiatr Epidemiol* 2007; **42**(7): 530–6.

4 Deb S, Thomas M, Bright C. Mental disorder in adults with intellectual disability. 2: the rate of behaviour disorders among a community-based population aged between 16 and 64 years. *J Intellect Disabil Res* 2001; **45**(Pt 6): 506–14.

5 Turner TH. Schizophrenia and mental handicap: an historical review, with implications for further research. *Psychol Med* 1989; **19**(2): 301–14.

6 Morgan VA, Leonard H, Bourke J, Jablensky A. Intellectual disability co-occurring with schizophrenia and other psychiatric illness: population-based study. *Br J Psychiatry* 2008; **193**(5): 364–72.

7 Hassiotis A, Noor M, Bebbington P, Afia A, Wieland J, Qassem T. Borderline intellectual functioning and psychosis: Adult Psychiatric Morbidity Survey evidence. *Br J Psychiatry* 2017; **211**(1): 50–1.

8 Johnstone EC, Ebmeier KP, Miller P, Owens DG, Lawrie SM. Predicting schizophrenia: findings from the Edinburgh High-Risk Study. *Br J Psychiatry* 2005; **186**: 18–25.

9 Yung AR, Nelson B. The ultra-high risk concept-a review. *Can J Psychiatry* 2013; **58**(1): 5–12.

10 Johnstone EC, Owens DG, Hoare P, Gaur S, Spencer MD, Harris J, et al. Schizotypal cognitions as a predictor of psychopathology in adolescents with mild intellectual impairment. *Br J Psychiatry* 2007; **191**: 484–92.

11 Spencer MD, Moorhead TW, McIntosh AM, Stanfield AC, Muir WJ, Hoare P, et al. Grey matter correlates of early psychotic symptoms in adolescents at enhanced risk of psychosis: a voxel-based study. *Neuroimage* 2007; **35**(3): 1181–91.

12 Stanfield AC, Moorhead TW, Harris JM, Owens DG, Lawrie SM, Johnstone EC. Increased right prefrontal cortical folding in adolescents at risk of schizophrenia for cognitive reasons. *Biol Psychiatry* 2008; **63**(1): 80–5.

13 Moorhead TW, Stanfield A, Spencer M, Hall J, McIntosh A, Owens DC, et al. Progressive temporal lobe grey matter loss in adolescents with schizotypal traits and mild intellectual impairment. *Psychiatry Res* 2009; **174**(2): 105–9.

14 Moorhead TW, Stanfield AC, McKechanie AG, Dauvermann MR, Johnstone EC, Lawrie SM, et al. Longitudinal gray matter change in young people who are at enhanced risk of schizophrenia due to intellectual impairment. *Biol Psychiatry* 2013; **73**(10): 985–92.

15 McKechanie AG, Moorhead TW, Stanfield AC, Whalley HC, Johnstone EC, Lawrie SM, et al. Negative symptoms and longitudinal grey matter tissue loss in adolescents at risk of psychosis: preliminary findings from a 6-year follow-up study. *Br J Psychiatry* 2016; **208**(6): 565–70.

16 Kendler KS, Lieberman JA, Walsh D. The Structured Interview for Schizotypy (SIS): a preliminary report. *Schizophr Bull* 1989; **15**(4): 559–71.

17 Achenbach TL. *Integrative Guide for the 1991 CBCL/4-18, YSR, and TRF Profiles*. University of Vermont Department of Psychiatry, 1991.

18 Goldberg DP, Cooper B, Eastwood MR, Kedward HB, Shepherd M. A standardized psychiatric interview for use in community surveys. *Br J Prev Soc Med* 1970; **24**(1): 18–23.

19 Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophr Bull* 1987; **13**(2): 261–76.

20 Wechsler D. *Wechsler Adult Intelligence Scale* (3rd edn). Psychological Corporation, 1992.

21 Wechsler D. *Wechsler Intelligence Scale for Children* (3rd edn). Psychological Corporation, 1999.

22 Sussmann JE, McIntosh AM, Lawrie SM, Johnstone EC. Obstetric complications and mild to moderate intellectual disability. *Br J Psychiatry* 2009; **194**(3): 224–8.

23 Deb S, Matthews T, Holt G, Bouras N. *Practice Guidelines for the Assessment and Diagnosis of Mental Health Problems in Adults with Intellectual Disability*. Pavilion, 2001.

24 Hubbard L, Tansey KE, Rai D, Jones P, Ripke S, Chambert KD, et al. Evidence of Common Genetic Overlap Between Schizophrenia and Cognition. *Schizophr Bull* 2016; **42**(3): 832–42.

25 Eaton WW, Mortensen PB, Thomsen PH, Frydenberg M. Obstetric complications and risk for severe psychopathology in childhood. *J Autism Dev Disord* 2001; **31**(3): 279–85.

26 Thapar A, Collishaw S, Pine DS, Thapar AK. Depression in adolescence. *Lancet* 2012; **379**(9820): 1056–67.

27 Essau CA, Lewinsohn PM, Olaya B, Seeley JR. Anxiety disorders in adolescents and psychosocial outcomes at age 30. *J Affect Disord* 2014; **163**: 125–32.

28 McGeown HR, Johnstone EC, McKirdy J, Owens DC, Stanfield AC. Determinants of adult functional outcome in adolescents receiving special educational assistance. *J Intellect Disabil Res* 2012; **57**(8): 766–33.

EXTRA CONTENT ONLINE

427