British Journal of Psychiatry (1994), **165**, 340–346

The Nithsdale Schizophrenia Surveys
XII. 'Neurodevelopmental' Schizophrenia: a Search for Clinical Correlates and Putative Aetiological Factors

R. G. McCREADIE, M. A. CONNOLLY, D. J. WILLIAMSON, R. W. B. ATHAWES and D. TILAK-SINGH

Background. The aim was to examine in a population of schizophrenic patients the clinical correlates of 'neurodevelopmental' schizophrenia and their relationship to putative aetiological factors.
Method. Premorbid social adjustment, premorbid schizoid and schizotypal personality traits, and the obstetric history of 40 schizophrenic patients and their 102 sibs were assessed through interviews with their mothers. Patients' premorbid level of intelligence was assessed by the National Adult Reading Test and current symptoms by the Positive and Negative Syndrome Scale and the Subjective Deficit Syndrome Scale.
Results. Patients had more schizoid and schizotypal traits than their sibs. They showed a deterioration in social adjustment between childhood and adolescence; sibs' social adjustment improved. There were statistically significant associations between current negative schizophrenic symptoms, premorbid deterioration in social adjustment, and schizoid and schizotypal personality traits, and between an early age of onset of illness and the same premorbid assessments. There was no evidence that patients with a family history of severe mental illness leading to hospitalisation, or a history of definite obstetric complications, had poorer premorbid functioning or more severe current symptoms.
Conclusions. We have confirmed clinical correlates of 'neurodevelopmental' schizophrenia but found no association between these and obstetric complications or a family history of severe mental disorder.

The concept of 'neurodevelopmental schizophrenia' has gained ground in recent years (Murray & O'Callaghan, 1991). It is suggested that this form of the illness can be distinguished from other forms. Patients show evidence of developmental abnormalities and abnormal personality or social impairment in childhood. They develop the illness in adolescence or early adult life, exhibit negative symptoms, and show morphological brain changes and cognitive impairment. The illness will have a poor outcome. Males are more likely to be affected. The abnormality is present (although not necessarily recognisable) at birth. The cause may be a genetic defect or early developmental insult in foetal or neonatal life.

The present study has examined in a population of schizophrenic patients the clinical correlates of the neurodevelopmental form of the illness, namely poor premorbid social adjustment, abnormal premorbid personality, negative symptoms, lower premorbid IQ and early age of onset. The influence of gender has also been assessed. In addition the role of obstetric complications and family history of psychiatric illness has been examined by investigating the association of these historical factors with the clinical features described.

Method

The identification of the schizophrenic population has been described elsewhere (McCreadie, 1982). Briefly, repeat censuses in Nithsdale, an historically ancient and geographically discrete part of Dumfries and Galloway Region in southwest Scotland, have identified all known schizophrenic patients – in-patients, day-patients, out-patients, patients supervised by community psychiatric nurses, and patients known only to their family doctor. A repeat census on 1 October 1991 identified 174 patients, 92 (53%) male, 82 (47%) female. All had ICD–9 diagnoses of schizophrenia (World Health Organization, 1978). Of the 174 patients, 55 (32%) had living mothers. It was on these patients that the present study focused. The following information was obtained.

Firstly, one psychiatrist (MAC), with patients' consent, interviewed mothers in their homes. Such interviews took place throughout Scotland. The psychiatrist was in the majority of instances blind as to who was the patient and who were his/her sibs. Mothers were asked not to reveal until the end of the interview the identity of the patient. Through a semi-structured interview, information was obtained about her

children's premorbid personality and social adjustment. The former was assessed through the Scale for Assessment of Premorbid Schizoid and Schizotypal Traits (PSST; Foerster *et al*, 1991). This seven item scale examines behaviour between the ages of 5 and 16 years, and covers areas such as sociability, demonstrative affect and sensitivity, with a higher score indicating greater impairment. Social adjustment was assessed by the Premorbid Social Adjustment Scale (PSA; Foerster *et al*, 1991). This five part scale covers such areas as peer relationships, school adaptation, and hobbies and interests, and was used to assess two periods, namely ages 5 to 11 years (PSA1) and 12 to 16 years (PSA2). A higher score indicates poorer adjustment. The psychiatrist was blind to the results of the other interview with mothers and to further assessments.

Secondly, the patient's current mental state was assessed by a second psychiatrist (DJW) using the Positive and Negative Syndrome Scale (PANSS; Kay *et al*, 1987). The patient's subjective assessment of the presence of psychiatric symptoms was obtained by a third psychiatrist (DTS) using the Subjective Deficit Syndrome Scale (SDSS) (Jaeger *et al*, 1990). This was carried out on the same day as the PANSS assessment. Both psychiatrists were blind to each others' results and to other assessments.

Thirdly, the patient's premorbid level of intellectual functioning was assessed by a fourth psychiatrist (RWBA) using the National Adult Reading Test (NART) (Nelson, 1982) for which he was specifically trained. He was blind to all other assessments.

Fourthly, the obstetric history of patients and their sibs was obtained from patients' mothers. This information had been collected in all but nine patients for a previous study (McCreadie *et al*, 1992). The mothers of the remaining patients were interviewed in their homes by a psychiatrist (DTS) who was blind to the other assessments apart from the SDSS. Again, mothers were asked not to reveal until the end of the interview the identity of the patient. Obstetric histories were obtained using a semi-structured interview (McCreadie *et al*, 1992) and each patient given a score using the Obstetric Complications Scale (Lewis *et al*, 1989). A person was categorised as having one or more definite complications, one or more equivocal complications, or no complications.

Fifthly, where mothers had not already given information to the interviewers in the previous study (McCreadie *et al*, 1992) they were asked by the same psychiatrist (DTS) about any admissions to psychiatric care of herself, her children, her children's father(s), and her grandchildren. Case records were then obtained where a schizophrenic patient's sibs, parents or children had been admitted to a psychiatric hospital. References identifying the individual were deleted, and a case record diagnosis made by another psychiatrist (DJW) using DSM–III–R criteria (American Psychiatric Association, 1987). To increase blindness, a number of case records of patients unrelated to the Nithsdale schizophrenic cohort were also included.

Finally, the age of onset of illness was determined by age of first admission to a psychiatric facility.

Results

Of the 55 patients interviewed, two refused access to their mothers, two mothers refused to be seen, and two mothers, one of whom had two schizophrenic sons, were too ill with dementia to be interviewed. Thus information about premorbid functioning was obtained from the mothers of 48 patients and their 102 sibs. Thirty-one (65%) were male, mean age 38 years (s.d. 10), and 17 (35%) were female, mean age 37 years (s.d. 12). All patients had an ICD–9 diagnosis of schizophrenia (World Health Organization, 1978); 20 (65%) men and 16 (94%) women also fulfilled DSM–III–R criteria for schizophrenia. Current mental state assessments were carried out on 45 of the 48 patients, and premorbid IQ measured in 43 of the 48 patients. Two patients and their sibs were excluded from the analysis of premorbid personality and social adjustment, as the age of onset of illness fell within the age range covered by the PSA2 and PSST. Thus there are slightly different values for *n* in the various results. At the time of assessment only five (10%) were in-patients.

Premorbid ratings

The mean scores on PSA1, PSA2 and PSST for male and female patients and sibs are shown in Table 1. Also shown is premorbid change in social adjustment, obtained by subtracting the PSA1 from the PSA2 score. It can be seen that patients score significantly higher than sibs on all scales, indicating poorer premorbid social adjustment and more pronounced premorbid schizoid and schizotypal traits. These significant differences were maintained when males and females were considered separately (except for PSA1 scores in females). PSA2 scores were higher than PSA1 scores in patients; PSA2 scores were lower than PSA1 scores in sibs. This difference between patients and sibs in change scores was statistically significant. This suggests a deterioration in social adjustment between childhood and adolescence in patients, and an improvement in sibs. There

Table 1
Mean (s.d.) scores in assessments of premorbid functioning

Scale	Patients			Sibs		
	All ($n=46$)	Males ($n=31$)	Females ($n=15$)	All ($n=100$)	Males ($n=48$)	Females ($n=52$)
PSA1	***12.3 (3.9)	12.4 (4.2)***	11.9 (3.2)****	10.1 (2.8)	10.0 (2.2)	10.2 (3)
PSA2	****13.0 (4.3)	13.3 (4.8)****	12.6 (3.1)**	9.7 (2.9)	9.8 (2.6)	9.6 (3)
Premorbid change	**+0.8 (2.8)	+0.8 (2.7)*	+0.7 (3.1)*	−0.4 (1.3)	−0.2 (1.7)	−0.5 (1.6)
PSST	****2.2 (2.2)	2.2 (2.4)**	2.3 (1.7)****	0.8 (1.3)	1.0 (1.3)	0.6 (1.2)

Left hand asterisks relate to comparisons between all patients and all sibs; right hand asterisks relate to comparisons between males and females.
Comparisons made using *t*-tests: *$P<0.05$, **$P<0.01$, ***$P<0.001$, ****$P<0.0001$.

were no statistically significant differences between male and female patients or between male and female sibs on any of the three ratings.

Current mental state

The PANSS assesses separately positive schizophrenic symptoms, negative schizophrenic symptoms and general psychopathology. The SDSS has 19 items which include subjective difficulties in the fields of perception, arousal, cognition and affect. Table 2 shows mean PANSS and total SDSS scores. In both scales a higher score indicates a greater severity of symptoms. There were no significant between-gender differences in scores on any of the scales. The relationship between SDSS total scores and PANSS scores was examined by Pearson correlation coefficients. There was a significant positive correlation between SDSS total scores and PANSS positive scores ($r=+0.41$, $P<0.002$) and general psychopathology ($r=+0.61$, $P<0.002$) but not between SDSS total scores and PANSS negative scores ($r=+0.16$). Five items in the SDSS correspond closely to five in the PANSS; they are nervousness/anxiety (anxiety in the PANSS), mood disorder (depression), irritability (hostility), concentration (poor attention) and loss of emotion/indifference (blunted affect). Mean scores and correlations are shown in Table 3. There were significant correlations between SDSS items 'nervousness' and 'mood disorder' and the corresponding PANSS items, but not between the other three SDSS items and those in the PANSS.

Table 2
Mean (s.d.) scores on PANSS and SDSS assessment

PANSS assessments	Scores		
	All	Males	Females
Positive schizophrenic symptoms	12.7 (4.9)	12.4 (4.3)	13.2 (6.0)
Negative schizophrenic symptoms	16.3 (7.6)	15.8 (7.4)	17.4 (8.0)
General psychopathology	28.8 (7.4)	28.8 (7.0)	29.0 (8.1)
SDSS assessments	27.1 (16.1)	24.0 (15.8)	32.2 (15.9)

Current mental state and premorbid functioning

Table 4 shows the correlations between mental state and premorbid functioning scores for all patients, and for males and females separately. It can be seen that the principal association is between PANSS negative and general psychopathology scores and PSA2, PSST, and deterioration scores; that is, the more abnormal the premorbid personality, or the poorer the premorbid social adjustment, the more severe were current symptoms. There were statistically significant correlations for both male and female patients. Correlations between PANSS positive symptoms, SDSS scores and measures of premorbid functioning were weak and did not reach statistical significance.

The PANSS scale for negative schizophrenic symptoms is made up of seven items. Correlations between the items and measures of premorbid functioning are shown in Table 5. Difficulty in abstract thinking was most highly correlated with premorbid measures, and social withdrawal the least.

Premorbid intelligence and functioning

The mean premorbid IQ was 104 (s.d. 11) for all patients, 103 (s.d. 12) for males, and 105 (s.d. 8) for females. There was a weak and negative correlation between IQ and PSA2 ($r=-0.29$, $P<0.07$) which became stronger when

https://doi.org/10.1192/bjp.165.3.340 Published online by Cambridge University Press

Table 3
Mean scores and correlations between items in SDSS and PANSS

SDSS		PANSS		Pearson's 'r'
Items	Mean score (s.d.)	Item	Mean score (s.d.)	
Nervousness/anxiety	2.0 (1.3)	Anxiety	1.9 (1.0)	+0.34*
Mood disorder	1.5 (1.4)	Depression	2.5 (1.6)	+0.53**
Irritability	1.2 (1.2)	Hostility	1.3 (0.8)	−0.15
Concentration	1.6 (1.4)	Poor attention	1.2 (0.6)	−0.16
Loss of emotion/indifference	1.4 (1.7)	Blunted affect	3.4 (1.9)	+0.18

*$P<0.02$, **$P<0.0001$.

Table 4
Pearson's correlations between premorbid functioning and current symptoms

Premorbid functioning		PANSS assessments						SDSS score	
		Positive symptoms		Negative symptoms		General psychopathology			
		r	*P*	*r*	*P*	*r*	*P*	*r*	*P*
PSA1	All	0.04	NS	0.27	NS	0.16	NS	−0.14	NS
	Male	0.12	NS	0.34	NS	0.16	NS	−0.26	NS
	Female	−0.08	NS	0.14	NS	0.15	NS	0.10	NS
PSA2	All	0.16	NS	0.52	0.0004	0.41	0.006	−0.05	NS
	Male	0.20	NS	0.51	0.006	0.38	0.05	−0.07	NS
	Female	0.09	NS	0.61	0.02	0.55	0.03	0.01	NS
Premorbid deterioration	All	0.20	NS	0.46	0.002	0.44	0.003	0.11	NS
	Male	0.22	NS	0.47	0.01	0.49	0.009	0.26	NS
	Female	0.18	NS	0.46	NS	0.38	NS	−0.09	NS
PSST	All	0.06	NS	0.38	0.01	0.31	0.04	0.06	NS
	Male	0.12	NS	0.47	0.01	0.26	NS	0.05	NS
	Female	−0.08	NS	0.14	NS	0.43	NS	0.05	NS

Table 5
Pearson's correlations between individual negative symptoms and premorbid functioning

Negative schizophrenic symptoms	Premorbid assessments							
	PSA1		PSA2		Premorbid deterioration		PSST	
	r	*P*	*r*	*P*	*r*	*P*	*r*	*P*
Blunted affect	0.17	NS	0.39	0.009	0.39	0.01	0.31	0.04
Emotional withdrawal	0.18	NS	0.42	0.005	0.42	0.005	0.35	0.02
Poor rapport	0.31	0.05	0.51	0.0005	0.40	0.008	0.39	0.009
Passive/apathetic social withdrawal	0.04	NS	0.24	NS	0.31	0.04	0.25	NS
Difficulty in abstract thinking	0.25	NS	0.49	0.0009	0.44	0.003	0.45	0.002
Lack of spontaneity & flow of conversation	0.27	NS	0.36	0.02	0.21	NS	0.11	NS
Stereotyped thinking	0.28	NS	0.47	0.002	0.36	0.02	0.17	NS

only males were considered ($r=-0.37$, $P<0.07$). There were no other significant correlations between IQ and premorbid functioning, nor were there any significant correlations between IQ and PANSS or SDSS scores.

Age of onset of illness

The mean age of onset of illness was 23.8 years (s.d. 5.9) in males, 24.4 years (s.d. 7.5) in females, a non-significant difference. The relationship between

https://doi.org/10.1192/bjp.165.3.340 Published online by Cambridge University Press

age of onset of illness and premorbid functioning was examined in two ways. Firstly, there was a significant negative correlation between age of onset and PSA2 scores ($r = -0.38$, $P < 0.01$), PSST scores ($r = -0.42$, $P < 0.05$) and premorbid deterioration ($r = -0.30$, $P < 0.05$), but not PSA1 scores. When males and females were considered separately, statistically significant correlations were found for males on PSST scores only ($r = -0.38$, $P < 0.05$) and for females on PSA 2 scores ($r = -0.64$, $P < 0.01$) and PSST scores ($r = -0.59$, $P < 0.03$). Secondly, scores of patients with illness onset before 25 years of age were compared with those patients with a later illness onset. PSA2 and PSST scores were higher in the former group (PSA2: $t = 2.41$, $P < 0.02$; PSST: $t = 2.23$, $P < 0.03$). When results were separated by gender, statistical significance was found only with females (PSA2: $t = 2.54$, $P < 0.03$; PSST: $t = 2.62$, $P < 0.02$). Premorbid IQs tended to be lower in patients whose illness began before age 25 (mean IQ 102 v. 108: $t = 1.92$, $P < 0.06$); this difference achieved statistical significance when males were considered separately (mean IQ 99 v. 110: $t = 2.56$, $P < 0.02$). There was no correlation between PANSS and SDSS scores and age of onset of illness.

Obstetric and family history

Seventeen of 48 patients (35%) had a history of at least one definite obstetric complication. These patients did not differ from those with no definite complication on PSA1, PSA2, PSST, PANSS and SDSS scores. Females with a definite obstetric complication had a significantly higher IQ, as assessed by the NART, than females without a complication (mean IQ 110 v. 98: $t = 3.82$, $P < 0.002$). Also, more females with an age of onset of illness before 25 years had a history of at least one definite obstetric complication when compared with those whose illness began after 25 years (9 of 14 v. 0 of 5; Fisher's exact test, $P < 0.03$). Seventeen of 48 patients (35%) had a first degree relative who fulfilled DSM-III-R criteria for schizophrenia, delusional disorder, major depression or bipolar disorder. Such patients compared with those with no family history did not differ significantly on PSA1, PSA2, PSST, PANSS, SDSS or NART IQ scores.

Patients with a family history or an obstetric complication did not differ from those with neither a family history nor an obstetric complication on any of the above measures.

Discussion

Some discussion is necessary on the methods used. A principal difference between this and other studies of schizophrenic patients' childhood is that the present study has not confined itself to in-patients; it has examined a population of schizophrenic patients, the majority of whom (90%) were not in-patients at the time of review. It is likely, therefore, that the patients studied include those with a better prognosis (McCreadie & Phillips, 1988).

A second important difference between patients in this and other studies was that there was no significant difference between males and females in the age of onset of illness. One of the few consistent findings in schizophrenia research is that the age of onset in males is younger than in females (Lewis, 1992). The likeliest explanation in Nithsdale is that only patients who had living mothers were included, thus biasing against patients whose illness began later in life and whose mothers were more likely to have died. It is noteworthy that the study included 31 males, but only 17 females.

Childhood personality, social adjustment and obstetric history were assessed retrospectively by mothers. Information obtained may not have been accurate. Mothers may be more likely to recall abnormalities in the birth and development of ill adult offspring than in unaffected sibs. However, a recent study (O'Callaghan *et al*, 1990) found that mothers' recall of their children's birth (children who later developed schizophrenia) correlated highly with birth records made at the time. Also, when the PSA and PSST were used in two groups of severely ill patients, namely affectively ill and schizophrenic patients (Foerster *et al*, 1991), mothers of the former described them differently from the latter. Possible interviewer bias in the present study was reduced in two principal ways. Firstly, the interviewers of mothers were blind in most instances until the interview had ended as to who were patients and who were sibs. Secondly, different aspects of the patient were assessed by different psychiatrists, blind to each others' ratings.

We found considerable differences in childhood personality and social adjustment between patients and their sibs. The patients had more schizoid and schizotypal personality traits, and showed poorer adjustment in both childhood and adolescence. A noteworthy finding was that between childhood and adolescence, sibs' social adjustment improved while schizophrenic patients deteriorated. Similar findings for normal controls (Cannon-Spoor *et al*, 1982) and schizophrenic patients (Mukherjee *et al*, 1991; Kelley *et al*, 1992) have been reported previously. The normal pattern, in which with increasing maturity children usually become more confident socially, widen their circle of friends and increase their interests, did not appear to happen with the schizophrenic patients.

In the previous study (Foerster *et al*, 1991) which examined schizophrenic patients using the same scales, mean PSA1 and PSA2 scores were similar to those found in the present study, but PSST scores were much higher – means of 9.61 and 7.17 for males and females respectively, compared with 2.16 and 2.41 in the Nithsdale cohort. Foerster *et al* noted a marked skew in PSST scores, with 61% scoring less than 2. It may be that our cohort contained few individuals with markedly disordered premorbid personalities.

In our search for clinical correlates of neurodevelopmental schizophrenia, we examined the association between childhood personality and adjustment, premorbid level of intelligence, age of onset of illness, and current symptoms. Our findings that premorbid deterioration in social adjustment, premorbid schizoid and schizotypal personality traits, and current negative schizophrenic symptoms all correlate with each other support previous work (e.g. Buchanan *et al*, 1990; Mukherjee *et al*, 1991; Kelley *et al*, 1992). The negative symptom that had the highest correlation with premorbid measures was difficulty in abstract thinking, the symptom with the lowest correlation was social withdrawal; the former is probably a 'primary' negative symptom, the latter may well be 'secondary' to positive symptoms (Carpenter *et al*, 1988).

An earlier age of onset of illness was associated with premorbid deterioration in social adjustment and schizoid and schizotypal traits, but not with current symptoms.

These clinical associations can be explained in two ways. The poor functioning in childhood and adolescence may be an early manifestation of the illness itself, or a characteristic that promotes the development of the illness and its symptoms.

The mean NART scores were similar to that obtained in the Camberwell Collaborative Psychosis Study (Jones *et al*, 1993). Lower premorbid intelligence was only weakly related to poorer premorbid social adjustment and earlier age of onset of illness; the correlations were higher for males than for females. Intelligence in schizophrenia has been comprehensively reviewed (Aylward *et al*, 1984); IQs positively correlate with age of onset of illness.

We found no significant between-gender differences in premorbid personality, social adjustment, and current symptoms. The neurodevelopmental hypothesis suggests that males have a more severe form of the illness (Castle & Murray, 1991). However, as discussed above, the females in the present study are not representative of all those living in Nithsdale. They have a similar age of onset of illness to the males, and are likely to have more in common with male schizophrenic patients than with other female patients whose illness begins later in life.

Putative aetiological factors in neurodevelopmental schizophrenia include a genetic defect and an early environmental insult in foetal life; the latter might show itself primarily or secondarily through an obstetric complication. In the present study, however, neither a history in a first degree relative of severe mental illness leading to in-patient admission (which might suggest genetic factors are especially important in that person's illness) nor a history of obstetric complications was associated with premorbid deterioration in social adjustment, schizoid or schizotypal personality traits, or current symptoms. Therefore we have been unable to demonstrate that the clinical correlates of neurodevelopmental schizophrenia which we found are associated with these putative aetiological factors.

We have no good explanation for our findings that female patients with a history of a definite obstetric complication had a higher premorbid IQ and a lower age of onset of illness than those with no complication. Perhaps these are chance findings.

An interesting by-product of the study was the comparison of objective and subjective mental state assessments. Given the opportunity, schizophrenic patients report many subjective complaints. More than 80% reported feelings of nervousness and fewer than 23% of patients reported none of the 19 symptoms assessed by the SDSS. When compared with objective ratings made through the PANSS, the highest correlation was between SDSS total scores and general psychopathology. However, the correlation was only +0.61 suggesting that the PANSS items in this sub-scale account for only a small proportion of the variance of SDSS scores. There was almost no correlation between SDSS total scores and PANSS negative symptom scores; that is, patients see their own deficits very differently from that rated by observers. This was confirmed when individual items were examined; although 65% of patients complained of difficulty in concentration and 44% of loss of emotion, there was no correlation between subjective and objective assessment of these symptoms. A lack of correlation between subjective symptoms assessed by the SDSS and negative symptoms assessed by the SANS (Andreason, 1983) has also been reported (Jaeger *et al*, 1990).

Conclusions

We have found, in a population of schizophrenic patients, significant associations between premorbid abnormalities of personality and social adjustment, age of onset of illness, current symptoms and, in males,

premorbid intelligence. However, we have found no associations between these clinical correlates and obstetric complications or a family history of severe mental disorder.

Acknowledgements

We thank patients and their mothers for their cooperation, and Mrs T. Buisson and Miss C. Drummond for secretarial assistance.

References

AMERICAN PSYCHIATRIC ASSOCIATION (1987) *Diagnostic and Statistical Manual of Mental Disorders* (3rd edn, revised) (DSM-III-R). Washington, DC: APA.

ANDREASON, N. C. (1983) *Scale for the Assessment of Negative Symptoms (SANS).* Iowa City: University of Iowa.

AYLWARD, E., WALKER, R. & BETTES, B. (1984) Intelligence in schizophrenia: meta-analysis of the research. *Schizophrenia Bulletin*, **10**, 430–459.

BUCHANAN, R. W., KIRKPATRICK, B., HEINRICHS, D. W., *et al* (1990) Clinical correlates of the deficit syndrome of schizophrenia. *American Journal of Psychiatry*, **147**, 209–294.

CANNON-SPOOR, H. E., POTKIN, S. G. & WYATT, R. J. (1982) Measurement of premorbid adjustment in chronic schizophrenia. *Schizophrenia Bulletin*, **8**, 470–484.

CARPENTER, W. T., HEINRICHS, D. W. & WAGMAN, A. M. I. (1988) Deficit and non-deficit forms of schizophrenia: the concept. *American Journal of Psychiatry*, **145**, 578–583.

CASTLE, D. J. & MURRAY, R. M. (1991) The neurodevelopmental basis of sex differences in schizophrenia. *Psychological Medicine*, **21**, 565–575.

FOERSTER, A., LEWIS, S., OWEN, M., *et al* (1991) Premorbid adjustment and personality in psychosis. Effects of sex and diagnosis. *British Journal of Psychiatry*, **158**, 171–176.

JAEGER, J., BITTER, I., CZOBOR, P., *et al* (1990) The measurement of subjective experience in schizophrenia: the Subjective Deficit Syndrome Scale. *Comprehensive Psychiatry*, **31**, 216–226.

JONES, P. B., BEBBINGTON, P., FOERSTER, A., *et al* (1993) Premorbid social underachievement in schizophrenia. Results from the Camberwell Collaborative Psychosis Study. *British Journal of Psychiatry*, **162**, 72–79.

KAY, S. R., FISZBEIN, A. & OPLER, L. A. (1987) The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin*, **13**, 261–276.

KELLEY, M. E., GILBERTSON, M., MOUTON, A., *et al* (1992) Deterioration in premorbid functioning in schizophrenia: a developmental model of negative symptoms in drug-free patients; *American Journal of Psychiatry*, **149**, 1543–1548.

LEWIS, S. (1992) Sex and schizophrenia: vive la difference. *British Journal of Psychiatry*, **161**, 445–450.

LEWIS, S. W., OWEN, M. J. & MURRAY, R. M. (1989) Obstetric complications and schizophrenia: methodology and mechanisms. In *Schizophrenia: Scientific Progress* (eds S. C. Schulz & C. A. Tamminga). New York: Oxford University Press.

MCCREADIE, R. G. (1982) The Nithsdale Schizophrenia Survey: I. Psychiatric and social handicaps. *British Journal of Psychiatry*, **140**, 582–586.

——— & PHILLIPS, K. (1988) The Nithsdale Schizophrenia Survey: VII. Does relatives high emotion predict relapse? *British Journal of Psychiatry*, **152**, 477–481.

———, HALL, D. J., BERRY, I. J., *et al* (1992) The Nithsdale Schizophrenia Survey: X. Obstetric complications, family history and abnormal movements. *British Journal of Psychiatry*, **161**, 799–805.

MUKHERJEE, S., REDDY, R. & SCHNUR, D. B. (1991) A developmental model of negative syndromes in schizophrenia. In *Negative Schizophrenic Symptoms: Pathophysiology and Clinical Implications* (eds J. Greden & R. Tandon). Washington, DC: American Psychiatric Press.

MURRAY, R. M. & O'CALLAGHAN, E. (1991) Neurodevelopmental schizophrenia. *Schizophrenia Monitor*, **1**, 1–3.

NELSON, H. E. (1982) *National Adult Reading Test. Test Manual.* Windsor, Berks: NFER-Nelson.

O'CALLAGHAN, E. O., LARKIN, C. & WADDINGTON, J. L. (1990) Obstetric complications in schizophrenia and the validity of maternal recall. *Psychological Medicine*, **20**, 89–94.

WORLD HEALTH ORGANIZATION (1978) *Mental Disorders: Glossary and Guide to their Classification in Accordance with the Ninth Revision of the International Classification of Diseases.* Geneva: WHO.

Robin G. McCreadie, DSc, FRCPsych; **Moira A. Connolly**, MB, MRCPsych; **Douglas J. Williamson**, MB, MRCPsych, MRCPsych; **Richard W. B. Athawes**, MB, MRCPsych; **Deepa Tilak-Singh**, MB, Crichton Royal Hospital

Correspondence: Dr R. G. McCreadie, Crichton Royal Hospital, Dumfries, DG1 4TG

(First received June 1993, final revision September 1993, accepted October 1993)