Soc Psychiatry Psychiatr Epidemiol (1993) 28: 1–4

Social Psychiatry and
Psychiatric Epidemiology

Does social deprivation during gestation and early life predispose to later schizophrenia?

D. J. Castle, K. Scott, S. Wessely, and R. M. Murray

Genetics Section, Institute of Psychiatry and Department of Psychological Medicine, Kings College Hospital, London, UK

Accepted: October 26, 1992

Summary. We employed a case-control study design to investigate whether schizophrenic patients differed from non-psychotic psychiatric patients in terms of place of birth and paternal occupation. "Cases" were first-contact schizophrenic patients ascertained from the Camberwell Cumulative Psychiatric Case Register. "Controls" were the next (non-psychotic) patient on the Register matched for age and sex. In comparison with controls, cases were more likely to have: (1) been born in the deprived inner-city Camberwell catchment area (odds ratio 2.3), and (2) had fathers who had "manual" as opposed to "non-manual" occupations (odds ratio 2.1). The results were compatible with the notion that socio-economic deprivation during gestation and early life predisposes to later schizophrenia.

Many studies have reported an excess of schizophrenic individuals in lower socio-economic groups (e.g. Redlich et al. 1954; Hollingshead and Redlich 1953; Goldberg and Morrison 1963; Silverton and Mednick 1984). Goldberg and Morrison (1963), in a widely cited study, have claimed that although schizophrenics are more likely than controls to be categorised as social class V, their fathers show the same social class distribution as the general population. Such data have led to a general conclusion that schizophrenics "drift" down the social stratum as a result of their illness or its prodomes. A similar interpretation has also been applied to the finding (e.g. Faris and Dunham 1939; Hare 1956) of high rates of schizophrenia in deprived inner-city areas.

More recently, however, there has been a renewal of interest in an alternative to the "drift" hypothesis, namely that early environmental influences per se are of aetiological importance in schizophrenia. It is now widely accepted that at least some schizophrenics have an illness consequent upon some subtle damage to the developing brain; such damage might be genetically or environmentally mediated (Jones and Murray 1991). The "environmental" factors that have attracted most attention have been obstetric complications (Lewis and Murray 1987), head injury (Wilcox and Nasrallah 1987), and prenatal exposure to viral infection (Murray et al. 1992a). All these factors are more likely to be encountered in deprived, overcrowded inner-city areas. Thus, Kety (1980) wrote:

> "To the extent that perinatal injuries, malnutrition and infection may play roles in the environmental aetiologies of schizophrenia, their impact would be exaggerated in the lower classes in large cities."

To explore these issues further, we conducted a case-control study of operationally defined schizophrenics vs non-psychotic psychiatric patients, ascertained through a register of all first-contact psychiatric patients from a poor inner-city area of London. In particular, we wished to test the hypothesis that, compared with other psychiatric patients, schizophrenics would have been preferentially born into low social class families living in the inner city.

Methods

The selection of cases has been described elsewhere (Castle et al. 1991). In brief, they comprised all first-contact cases of schizophrenia and related conditions entered in the Camberwell Cumulative Psychiatric Case Register between 1965 and 1984. Psychiatric records were obtained for 90% of the cases, and detailed demographic data recorded by D.J.C. and S.W., who also completed a standardised diagnostic checklist [the Operational Criteria Checklist (OCCPI; McGuffin et al. 1991)] on each individual. The OCCPI, with its computer program OPCRIT, generates a wide range of diagnoses for schizophrenia; for the purposes of this study, Research Diagnostic Criteria (RDC; Spitzer et al. 1978) for schizophrenia and related disorders were used. Each control was the next patient on the Register after a case, matched for age (to within 5 years) and sex, who did not have a psychotic illness; controls were thus also matched for time-period (Wessely et al. 1991).

The current analyses were confined to those patients born in England and Wales, as the Office of Population Censuses and Surveys (OPCS) has birth records only on

such individuals. This restriction also served to preclude bias arising from the inclusion of immigrant groups, who are known to be at high risk for schizophrenia (Castle et al. 1991; Wessely et al. 1991). Where a control patient was found to have been born outside the UK, the next appropriate control on the Register was chosen instead. Two measures relating to early environment were used as indicators of the socio-economic status of the household, viz. (1) place of birth; Camberwell (a deprived area in inner London) vs elsewhere in England and Wales, and (2) paternal occupation at birth.

Data on place of birth and paternal occupation were obtained directly from the medical records. In the absence of such data, birth certificates were obtained from the OPCS; birth certificates routinely record place of birth and paternal occupation. Allocation of fathers to employment categories was made according to the Registrar-General's Classification of Occupations. The allocations were performed "blind" to case-control status by K. S. For this study, comparisons were made between "non-manual" (categories I, II and IIIa) and "manual" (categories IIIb, IV, and V) employment. Roughly half of the paternal occupation data were collected from the medical records for both patients and controls, and the rest, from birth records; thus, there was no systematic bias between cases and controls in the recording of paternal occupation *at birth* of the child. As a check on the medical records, birth certificates were drawn on 20 random patients on whom data had been recorded from the medical records. Despite a few minor dissimilarities (e.g. exact description of job), no errors were found in allocation of place of birth, i.e. being born in Camberwell vs elsewhere, or in fathers being recorded as being in "manual" or in "non-manual" employment.

Two types of analysis were performed. Firstly, odds ratios and 95% confidence limits were calculated for each of the variables of interest. The study was matched, so that only those case-control pairs discordant for the variable of interest contributed to the odds ratio; concordant pairs did not contribute further (Schesselman 1982). Secondly, we employed conditional logistic regression to assess whether there was an association between paternal occupation and inner-city birth and, if so, whether adjusting for inner-city birth had an effect on the odds ratios for paternal occupation. Conditional logistic regression was also used to assess any confounding effect of ethnic Afro-Caribbeans born in England and Wales. These analyses were performed using the computer program EGRET.

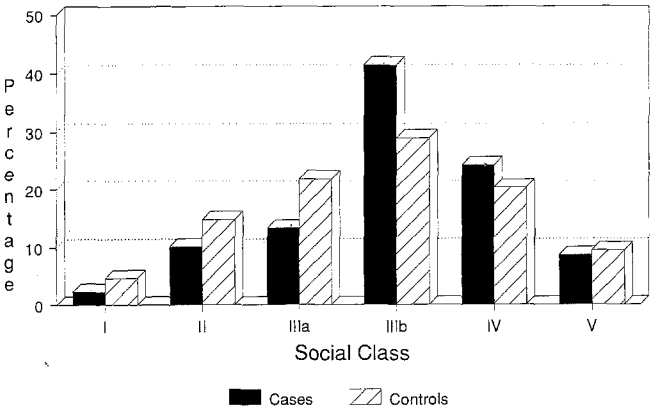

Fig. 1. Paternal social class distribution for 128 matched case-control pairs

Table 1. Odds ratios (95% confidence intervals) for discordant matched pairs

Matched pair	Numbers of discordant matched pairs	Odds ratio	95% confidence intervals
(1) Paternal social class:			
Father of case "manual", father of control "non-manual"	38	2.1	1.2–3.7
Father of case "non-manual", father of control "manual"	18		
(2) Place of birth (Camberwell):			
Case born Camberwell, control born elsewhere	42	2.3	1.3–4.1
Control born Camberwell, case born elsewhere	18		
(3) Place of birth (inner London):			
Case born inner London, control born elsewhere	35	2.1	1.2–3.7
Control born inner London, case born elsewhere	19		

Results

Data on paternal occupation at birth were available for 128 matched case-control pairs. The distribution is shown in Fig. 1. The fact that the majority of fathers in both groups were in non-manual employment was consistent with the inner-city status of Camberwell. The major discrepancy between the distributions for cases and controls was a relative paucity of fathers of cases in class IIIa (non-manual), and an excess in class IIIb (manual).

Regarding place of birth, data were available for 155 case-control pairs on being born in Camberwell vs elsewhere (for a further 6 pairs it was known that patients/controls were born in inner London or elsewhere, but unclear whether they were born in Camberwell). Table 1 shows the discordant pairs, odds ratios and 95% confidence intervals for: (1) paternal occupation, (2) being born in Camberwell vs elsewhere, and (3) being born in inner London or elsewhere. It can be seen that the schizophrenic patients were more likely than controls to have had a father in "manual" employment at the time of their birth. They were also more likely to have been born in inner London; the odds ratio was even higher when comparison was made between those born inside or outside Camberwell.

The conditional logistic regression analyses were performed on those 117 case-control pairs for whom both place of birth and paternal occupation data were avail-

able. For these pairs, the odds ratio for paternal occupation was much the same as for the original 126 pairs (odds ratio 2.0; 95% confidence intervals 1.1–3.7). Controlling for being Camberwell born reduced the odds ratio to 1.7 (95% confidence intervals 0.9–3.2).

Being of Afro-Caribbean ethnicity was a risk factor for schizophrenia (odds ratio 16.0; 95% confidence intervals 2.1–120.7). Controlling for ethnicity reduced the odds ratio for both paternal occupation (odds ratio 1.6; 95% confidence intervals 0.9–2.8) and being born in Camberwell (odds ratio 2.1; 95% confidence intervals 1.1–3.9).

Discussion

Methodological considerations

This study has the advantage of being catchment-area-based, thus reflecting all first contacts with the psychiatric services of a defined area over 20 years. The demography of the area has changed considerably over this period, with a gradual reduction in the size of the population. According to census figures, there has also been a slight increase in the proportion of individuals in social classes IV and V; however, as cases and controls were matched for time-period, any bias arising from these changes should affect both cases and controls equally.

We have shown elsewhere (Castle et al. 1991; Wessely et al. 1991) that the incidence of schizophrenia in Camberwell increased over the 2 decades from 1965, and that this increase was, in part at least, due to an influx into the area of individuals of Afro-Caribbean extraction; such individuals showed rates of schizophrenia 4–6 times that of the Caucasian population. As the current study was confined to schizophrenic patients born in England and Wales, the results were not confounded by foreign immigrants. However, the British-born children of Afro-Caribbean immigrants, who are also at increased risk of schizophrenia, were included. Because their parents migrated almost exclusively to cities, these second-generation Afro-Caribbeans were particularly likely to have been born in inner London. Being black in the UK is associated with a wide range of social adversity, including unemployment, inadequate housing, and low social class (Townsend et al. 1988). Thus, it is possible that the British-born Afro-Caribbeans were confounders in our study. The results of the logistic regression confirmed that being a second-generation Afro-Caribbean had a powerful effect on the risk of schizophrenia. However, controlling for ethnicity did not alter the trends for being born in Camberwell, or for having a manual-class father.

It might be argued that a general population control group might have been better than the controls we chose, as non-psychotic psychiatric patients could conceivably be particularly likely to show geographical mobility or have fathers in the higher social classes. There have been suggestions of social-class bias in referral for neurotic disorders (e.g. Barker et al. 1990). In our sample, there was a trend towards higher socio-economic status in controls than in patients, but this was not statistically significant. Furthermore, our controls had the advantage of having been ascertained in exactly the same manner as the patients. Also, we did not confine ourselves to a single category of non-psychotic patients, thus avoiding bias from any one group of such patients who might show a particular trend with respect to geographical mobility or parental socio-economic class.

Interpretation

Our results suggest that individuals who develop schizophrenia are more likely than non-psychotic controls to have been *born* into socially deprived households. Here, social deprivation was indicated by lower socio-economic status of fathers, as well as the fact that inner-London boroughs (and Camberwell in particular) rate highly on measures of deprivation based on factors such as housing tenure and socio-economic status (see Balarajan et al. 1992).

The inner-city birth effect that we found is consonant with a number of other studies. In Norway, Astrup and Odegaard (1961) found higher rates of schizophrenia amongst those born in cities, and, while migrants generally showed lower rates, migrants from cities had higher rates that those from rural areas. Machon et al. (1983), in a high-risk sample, found that an excess of individuals who later manifested schizophrenia had been born in urban areas. More recently, in England and Wales, Takei et al. (1992) found schizophrenics to be significantly more likely than other psychiatric patients to have been born in cities, while Lewis et al. (1992), using Swedish data, found that schizophrenics were particularly likely to have been brought up in urban centres. Dauncey et al. (1991) reported that schizophrenics were especially likely to live in socio-economically deprived areas in Nottingham, and that this pattern had been present from early in life.

Many studies have examined the social class of schizophrenics, but few have investigated the socio-economic grouping of their fathers. The best known, though not the best study (Goldberg and Morrison 1963), reported that fathers of schizophrenics had the same occupational distribution as the general population. However, the studies of Hollingshead and Redlich suggested that the fathers of schizophrenics were themselves from lower socio-economic backgrounds, while Turner and Wagenfeld (1967) reported fathers of schizophrenics to be over-represented in the lower socio-economic groups. In reviewing these studies, Kohn (1975) concluded that

> "The weight of evidence lies against the drift hypothesis providing a sufficient explanation of the class-schizophrenia relationship. In all probability, lower class families produce a disproportionate number of schizophrenics."

Our study supports this conclusion, and challenges the conventional wisdom that the excess of schizophrenics in deprived areas and the maldistribution of these individuals with regard to social class is due entirely or predominantly to "drift". Individuals who later manifest schizophrenia are disproportionately likely to have suffered the disadvantages of social deprivation in utero and in early life. One explanation could be that their fathers have some genetic "loading" for schizophrenia, insufficient to

manifest the illness, but sufficient to make them less "competitive" in socio-economic terms. An alternative, which we favour, is that some environmental factor of aetiological importance in schizophrenia is more likely to affect those born into households (a) of lower socio-economic status and (b) in the inner city.

There is now a great deal of evidence that at least some schizophrenics have an illness consequent upon neurodevelopmental deviance, cerebral insult being sustained very early in life but manifesting symptoms only as the brain matures (Weinberger 1987; Murray et al. 1992b). Possible environmental causes of such brain insult include obstetric complications, low birth weight, and maternal viral infections. Regarding the latter, three studies (Machon et al. 1983; O'Callaghan et al. 1992; Takei et al. 1992) have shown that city-born, as opposed to rural-born, schizophrenics are particularly likely to have been born in the winter months, when respiratory viral infections are especially prevalent. We conclude that research should now be directed to establish whether it is overcrowding within households and within cities, with consequent greater exposure to viral infection during pregnancy, that mediates the increased risk of schizophrenia in those born into working-class households in the inner city.

Acknowledgements. The following individuals provided helpful comments on earlier drafts of this paper: Dr. Glyn Lewis, Dr. Anthony David and Prof. Anthony Mann. Financial support of a Guinness Research Trust grant through SANE (Schizophrenia A National Emergency) is also gratefully acknowledged.

References

Astrup C, Odegaard O (1961) Internal migration and mental illness in Norway. Psychiatr 34: 116–130

Balarajan R, Yuen P, Machin D (1992) Deprivation and general practitioner workload. BMJ 304: 529–534

Barker C, Pistrang N, Shapiro DA, Shaw I (1990) Coping and help-seeking in the UK adult population. Br J Clin Psychol 29: 271–285

Castle D, Wessely S, Der G, Murray RM (1991) The incidence of operationally defined schizophrenia in Camberwell, 1965–1984. Br J Psychiatry 159: 790–794

Dauncey K, Giggs J, Baker K, Harrison G (1991) Schizophrenia in Nottingham: the contribution of the breeder-drifter hypothesis. Paper presented at Royal College of Psychiatrists Annual Meeting, Brighton, UK, July 1991

Faris REL, Dunham HW (1939) Mental disorders in urban areas. Chicago University Press, Chicago

Goldberg EM, Morrison SL (1963) Schizophrenia and social class. Br J Psychiatry 109: 785–802

Hare EH (1956) Mental illness and social conditions in Bristol. J Ment Sci 102: 349–357

Hollingshead AB, Redlich FC (1954) Schizophrenia and social structure. Am J Psychiatry 110: 695–701

Jones PB, Murray RM (1991) The genetics of schizophrenia is the genetics of neurodevelopment. Br J Psychiatry 158: 615–623

Kety SS (1980) The syndrome of schizophrenia. Br J Psychiatry 136: 421–436

Kohn ML (1975) Social class and schizophrenia: a critical review and reformulation. In: Cancro R (ed) Annual review of the schizophrenic syndrome. Brunner/Mazel, New York, pp 311–340

Lewis SW, Murray RM (1987) Obstetric complications, neurodevelopmental deviance, and schizophrenia. J Psychiatr Res 21: 413–421

Lewis G, David A, Andreasson S, Allebeck P (1992) Schizophrenia and city life. Lancet 34: 137–140

McGuffin P, Farmer AE, Harvey I (1991) A polydiagnostic application of operational criteria in studies of psychotic illness: development and reliability of the OPCRIT system. Arch Gen Psychiatry 48: 645–650

Machon RA, Mednick SF, Schulsinger F (1983) The interaction of seasonality, place of birth, genetic risk and subsequent schizophrenia in a high-risk sample. Br J Psychiatry 143: 383–388

Murray RM, Jones PB, O'Callaghan E, Takei N, Sham P (1992a) Genes, viruses and neurodevelopment. J Psychiatr Res (in press)

Murray RM, O'Callaghan E, Castle DJ, Lewis SW (1992b) A neurodevelopmental approach to the classification of schizophrenia. Schizophr Bull 18: 319–332

O'Callaghan E, Colgan K, Cotter D, Larkin C, Walsh D, Waddington JL (1992) Evidence for confinement of winter birth excess to those born in cities. Schizophr Res 6: 102

Redlich FC, Hollingshead AB, Roberts BH, Robinson HA, Freedman LZ, Myers JK (1953) Social structure and psychiatric disorders. Am J Psychiatry 109: 729–734

Schesselman J (1982) Case-control studies: design, conduct, analysis. Oxford University Press, New York

Silverton L, Mednick S (1984) Class drift and schizophrenia. Acta Psychiatr Scand 70: 304–309

Spitzer RL, Endicott J, Robins E (1978) Research diagnostic criteria: rationale and reliability. Arch Gen Psychiatry 35: 773–782

Takei N, O'Callaghan E, Sham P, Glover G, Murray RM (1992) Winter birth excess in schizophrenia: its relationship to place of birth. Schizophr Res 6: 102

Townsend P, Phillimore P, Beattie A (eds) (1988) Health and deprivation: inequality and the North. Croom Helm, London

Turner RJ, Wagenfeld MO (1967) Occupational mobility and schizophrenia: an assessment of the social causation and social selection hypothesis. Am Sociol Rev 32: 104–113

Weinberger DR (1987) Implications of normal brain development for the pathogenesis of schizophrenia. Arch Gen Psychiatry 44: 660–669

Wessely S, Castle D, Der G, Murray RM (1991) Schizophrenia and Afro-Caribbeans: a case-control study. Br J Psychiatry 159: 795–801

Wilcox JA, Nasrallah HA (1987) Childhood head trauma and psychosis. Psychiatry Res 21: 303–307

Dr. D. J. Castle
Genetics Section
Institute of Psychiatry
De Crespigny Park
London SE5 8AF
UK