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The criminal careers of incident cases of schizophrenia

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SYNOPSIS We present a population-based, longitudinal study of all incident cases ($N = 538$) of schizophrenia in the London Borough of Camberwell between 1964 and 1984. Cases were selected from the Camberwell Cumulative Psychiatric Case Register. Case-notes were obtained, and further classified using a computerized operational check list for rating psychotic illness. Cases are not restricted to hospital discharges, as in previous studies, and account is taken of time at liberty to offend. In order to test the hypothesis that schizophrenia makes an independent contribution to criminality over other mental disorders, controls were chosen to be representative of non-schizophrenic mental disorders matched for age, sex and period.

The rate of conviction is increased in women with schizophrenia compared to other mental disorders for most offence categories (rate ratio = 3·3). In men overall rates do not differ (rate ratio = 1·03), although there is an interaction between gender, schizophrenia and ethnicity, with young black men with schizophrenia being most at risk. The rate ratio for violent offences in men with schizophrenia is 3·8, confirming recent studies from Sweden. Subjects with schizophrenia were more likely to acquire any criminal record than those with other mental disorders. The rate of lifetime conviction was greater in those with schizophrenia than either a sample of working-class boys from the same area followed by Farrington & West, or National data.

The risk of first conviction is increased by schizophrenia, unemployment, ethnic group, substance abuse and low social class, and decreased by being employed, married, female and older age of onset. Adjustment using survival analysis showed that schizophrenia made a small independent contribution to the risk of acquiring a criminal record (hazard ratio = 1·4), but gender, substance abuse, ethnicity and age of onset were more substantial. Previous criminality was the strongest independent association of post-illness conviction, with schizophrenia only a trend. Although subjects with schizophrenia were more likely to acquire a criminal record, criminal careers began later and were shorter than those of the controls. The risk of criminality increased throughout the study period, but suggestions of a specific increase in those with schizophrenia as a result of changes in community care were not confirmed. These results confirm that women with schizophrenia are at increased risk of acquiring a criminal record, but the effect in men is for violent convictions only. The strongest associations of criminal conviction remain those recognized in non-schizophrenic subjects.

INTRODUCTION

The relationship between criminal behaviour and schizophrenia has long been a subject of interest and controversy. During the 1960s and 1970s a series of papers were published suggesting that patients discharged from public mental hospitals in the United States had higher rates of offending than various control subjects. However, problems of selection bias, inadequate control of confounders, inappropriate controls and brief follow-up led to considerable criticisms of this work (Rabkin, 1979; Cohen, 1980). In an important review Monahan & Steadman (1983) concluded 'There is no consistent evidence that the true prevalence rate of criminal behaviour among former mental patients exceeds the true

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prevalence rate of criminal behaviour among the general population matched for demographic factors and prior criminal history'. They also suggested that the 'same factors that relate to the rehospitalisation of civil mental patients also relate to the rehospitalisation of mentally disordered offenders'. Their conclusion was that mental illness plays a little part in the aetiology of criminality in the mentally ill.

In recent years this consensus has been reappraised, not least by Monahan (1988, 1992) himself, and others (Wessely & Taylor, 1991). This revision has been prompted by a series of studies that again cast doubt upon the previous consensus of the lack of association between crime and serious mental illness. These have included surveys showing high rates of serious mental illness in those remanded in custody (Taylor & Gunn, 1984), high rates of unrecorded violent behaviour by the mentally ill prior to hospital admission (MacMillan & Johnson, 1987; McNeil *et al.* 1988) and during hospital admission (McNeil *et al.* 1988). A relationship between the presence of clinical features of psychosis, such as delusions, and criminal behaviour by those with schizophrenia has also been shown (Taylor, 1985; Taylor *et al.* 1994). However, although such studies raised doubts about the conventional wisdom, methodological limitations, in particular selection bias, prevented generalization of these and similar results.

It was not until the publication of a series of papers notable for their methodological rigour that the previous view as to the absence of an association between criminal behaviour and schizophrenia could be seriously challenged. These studies, which consist of two United States surveys (Swanson *et al.* 1990; Link *et al.* 1992) and two Swedish cohort studies (Lindqvist & Allebeck, 1990*a*; Hodgins, 1992), reported an association between severe mental illness and criminal behaviour. The cross-sectional surveys found an association between self-reported violent behaviour and either a diagnosis of schizophrenia (Swanson *et al.* 1990), or current psychotic symptoms (Link *et al.* 1992). Link and colleagues (1992) also found an association with criminal convictions. Both cohort studies found that the risk of acquiring a criminal record for violent offending was increased in both men and women with schizophrenia, while women with schizophrenia had an increased risk of all offences (Lindqvist & Allebeck, 1990*a*; Hodgins, 1992).

These studies represent a substantial advance over previous work, largely because of their improved methodology, but some problems still remain. The most powerful design for determining the relationship between crime and schizophrenia is that of a cohort study, which enables the analysis of 'criminal careers' (Mulvey *et al.* 1986; Wessely & Taylor, 1991; Taylor, 1994). This has been adopted by two Swedish studies (Lindqvist & Allebeck, 1990*a*; Hodgins, 1992). However, cases were identified only at hospital discharge, hence neither study is truly population based. No account was taken of time at risk of offending, since many subjects with schizophrenia spend considerable amounts of time in prison or hospital, where they are unlikely to acquire convictions. Subjects who died during the study periods were excluded; this represents an important source of bias. Hodgins (1992) was able to make some adjustment for important confounders, such as social class and substance abuse, but, despite the large sampling frame, was limited by the small number of subjects with 'major mental disorder'. On the other hand, the true population-based studies (Swanson *et al.* 1990; Link *et al.* 1992) were surveys, and thus the assessment of criminal behaviour was made retrospectively. Subjects were not incident cases, and there was thus an over-representation of cases with long duration and poor prognosis. All the studies used 'normal' controls, and therefore, were not able to test the hypothesis of a specific risk of acquiring a criminal conviction in schizophrenia compared to other mental disorders.

METHOD

Design of the study

The hypothesis to be tested is that schizophrenia is associated with both an increased risk of acquiring any criminal conviction and also an increase in the rate of convictions, compared to other mental disorders. The present study is a cohort study based on incident cases of schizophrenia identified from a community psychiatric case register in a defined catchment area. Controls are selected from the same register, and thus are representative of subjects with mental disorders other than schizophrenia presenting

in the same area at the same time. Rates of criminal convictions are calculated based on the amount of time at liberty to acquire a conviction.

In an ideal study of schizophrenia and crime all cases of illness would be recruited at the same age, from the same area, and at the same time period. However, new cases of schizophrenia are not common, and few areas have a register system allowing detection of incident cases. In order to acquire sufficient numbers of cases for meaningful analysis, given that most subjects will not acquire any criminal conviction, it was necessary to recruit new cases of schizophrenia over a 20-year period.

The sample

The cases for this study were collected for a recent study of the epidemiology of schizophrenia in the London Borough of Camberwell (Castle *et al.* 1991). Cases were obtained from the Camberwell Cumulative Psychiatric Case Register (Wing & Hailey, 1972), which provides a comprehensive list of all persons from the area of Camberwell who had their first contact with the psychiatric services between 1965 and 1984, including admissions, domiciliary visits, outpatients and emergency contacts. Cases were all Register first contact patients between 1965 and 1984 who received an ICD-9 diagnosis (WHO, 1978) of 'schizophrenic psychosis' (equivalent ICD codes 295.0–295.9), including 'schizoaffective type' (ICD 295.7); 'paraphrenia' (ICD 297.2) or 'other non-organic psychosis' (ICD 298.1–298.9). This broad sample was chosen to minimize the possibility of missing a substantial number of those with schizophrenia who had been inappropriately labelled, and to allow for variation in diagnostic habits. All those who had previous contact with Camberwell services before 1965, or contact elsewhere, were excluded.

Camberwell is an inner city of London Borough. It has a predominantly working-class composition. During the period of study it has been subject to certain demographic changes, including an overall decrease in size (from 171000 in 1964 to 118000 in 1984). The proportion of Social Class IV and V increased, albeit slightly, during the study period (27·3% in 1971 to 28·6% in 1981). Compared to National data, the 1981 census data show that Camberwell has an overall excess of Social Classes IIIa, IV and V, and is above average in terms of Jarman indices (South East London Commissioning Agency (SELCA) 1992). Measures such as stillbirth, perinatal mortality and infant death rates are all higher than National averages (SELCA, 1992). In over half of the electoral wards unemployment is above 10%.

One particular feature of Camberwell is its ethnic minority population. At the 1981 Census, of the 24 electoral districts, in only four districts were less than 10% of the population born outside of the UK and Eire. In six the percentage was above 20%. In particular, the black population of the Borough has grown steadily. The 1961 Census showed that 2·5% of the local population were born in the West Indies; this rose to 6·6% in 1981. We have estimated that in 1981 11·5% of the local population was of Afro-Caribbean ethnicity (Castle *et al.* 1991; Wessely *et al.* 1991).

Choice of controls

Cases were recruited over a 20-year period, the period during which the Camberwell Case register was in operation. Cases were thus of varying age, and were followed up for different lengths of time to the end of the study (i.e. 1990). Criminal behaviour is influenced by both age and time period, so it is essential to choose controls in which the confounding elements of age and period (and thus different length of follow-up), and place, are eliminated.

Comparability of place was ensured by choosing controls from the same Camberwell Case Register. Comparability of age, gender and period was ensured by recruiting as a control the next person on the register to a case, matched for sex and age (to within 5 years), and who received any ICD-9 diagnosis other than ICD-9 schizophrenia. Thus, the control cohort experienced the same changes of age and period as the study cohort (see Wessely *et al.* 1991). Controls differed from cases only by the absence of psychosis. Four controls that fulfilled criteria for schizophrenia were replaced by new controls. The final sample was 538 cases and 538 controls.

Information obtained

Once the names of possible cases were identified, further information was acquired from the more detailed clinical case records. The case records of each subject were obtained from the appropriate hospital or clinic, and all medical,

Table 1. *Diagnostic breakdown of cases: DSM-III-R criteria*

Diagnosis	Frequency (%) Males	Females
No diagnosis	15 (5·4)	5 (1·9)
Major depression	4 (1·4)	7 (2·7)
Bipolar disorder	0 (0)	1 (0·4)
Major affective disorder with psychosis	19 (6·8)	39 (15·1)
Atypical psychosis	49 (17·6)	49 (18·9)
Schizophreniform	24 (8·6)	27 (10·4)
Schizophrenia	114 (40·9)	90 (34·7)
Delusional disorder	32 (11·5)	18 (6·9)
Missing	22 (7·9)	23 (8·9)
Total	279	259

Table 2. *Diagnostic breakdown: controls*

Diagnosis (ICD-9)	Number (frequency) Male *N*	(%)	Female *N*	(%)
Depressive disorders	94	(34)	135	(52)
Anxiety, phobic and obsessive compulsive disorders	34	(12)	22	(9)
Alcohol	29	(10)	7	(3)
Drugs	18	(6)	0	(0)
Personality disorders	41	(15)	14	(5)
Forensic	8	(3)	0	(0)
Dementias	6	(2)	28	(11)
Other organic disorders	12	(4)	11	(4)
Eating disorder	0	(0)	4	(2)
Somatoform	3	(1)	5	(2)
Hypomania	1	(0·5)	3	(1)
Mental impairment	2	(1)	0	(0)
Others	21	(8)	22	(8)
No diagnosis made	10	(4)	8	(3)
Total	279		259	

nursing, social work and occupational therapy records were scrutinized, as well as all correspondence. The majority of the patients were seen by the services associated with the Maudsley, Bethlem Royal and King's College Hospitals, where the quality of record taking is high, and case summaries follow a semi-structured pattern (Institute of Psychiatry Training Committee, 1973).

Diagnostic and other information was obtained using a standardized approach. The Operational Criteria Checklist for Psychotic Illness (OCCPI, McGuffin *et al.* 1991) was completed for all cases. This check list is a simple and reliable method of determining operational definitions of psychotic illnesses. The rating period was either the first episode of illness, or the first year of that episode. The diagnostic breakdown of the cases using DSM-III-R (APA, 1987) is given in Table 1, while the Register (ICD-9) diagnoses of controls are in Table 2. A kappa of 0·74 was obtained for DSM-III-R diagnoses (Castle *et al.* 1991). As the controls were chosen as a random sample of all subjects with non-psychotic illnesses known to the mental health services, diagnoses such as depression and dementia were commoner in the women, while alcohol and personality disorder was more frequent among the male controls.

Throughout this study data will be presented using both the broad ICD-9 clinical diagnoses and the operational DSM-III-R criteria. Data are also available for DSM-III and Research Diagnostic Criteria (RDC), but are not presented for reasons of brevity. However, carrying out the same range of analyses as described below using both these criteria made little difference to the pattern of results obtained.

Data on drug and alcohol abuse were obtained from case records. A previous study of Maudsley case records showed them to be an accurate source of quantitative, if not qualitative, data on alcohol abuse (Farrell & David, 1988). Where no charts were available, or the quality of the case notes was not sufficient to be rated, the data are listed as missing, unless the register diagnosis was of drug or alcohol abuse. Only hazardous use was rated as positive – thus entries such as 'occasional' use of cannabis, or 'social' drinking, were rated as negative. Data were also obtained on employment status at first contact, marital status, age at first contact and age at illness onset.

Data on ethnicity and country of birth of patient and their parents were obtained principally from the case notes, supplemented by other sources when necessary. Full details, including reliability checks, are contained elsewhere (Wessely *et al.* 1991). No misclassifications were found. Age of onset was recorded as 'the earliest age at which medical advice was sought for psychiatric reasons or at which symptoms began to cause subjective distress or impair functioning' (as in OCCPI). Inter-rater reliability (performed by 5 year bands) was excellent (kappa = 0·93). For poor pre-morbid work adjustment it was 0·65, and for poor pre-morbid social adjustment it was 0·60 (see Castle *et al.*

1993*a*). A variable representing overall poor pre-morbid adjustment was also created, and scored as positive if both pre-morbid social and work adjustment were rated as impaired.

As far as possible social class was coded by father's social class. This was obtained directly from medical records when available. In the absence of such data, birth certificates were obtained from the Office of Population Censuses and Surveys (OPCS), since birth certificates routinely record paternal occupation. Paternal occupation could not be determined in 44% of cases and 50% of controls (usually because the subject was born in Scotland, Northern Ireland or outside the United Kingdom). For these social class of the subject at time of presentation was used. In 9% of cases and 15% of controls there were no social class data, either because the data were missing, or the coding on the register was of a student, unemployed or housewife, and thus could not be classified. Full details, including reliability checks, are contained elsewhere (Castle *et al.* 1993*b*).

Allocation of fathers to employment categories was made according to the Registrar General's Classification of Occupations (HMSO, 1970).

Time at risk

Time at risk for conviction (or 'time spent incapacitated', Mulvey *et al.* 1986) was calculated for each subject, in order to obtain true conviction rates. Although subjects can still acquire criminal records while in prison or hospital, this risk is certainly considerably reduced. Since 1964, the start of this study, the minimum age for criminal responsibility has been 10. Subjects could not be at risk of acquiring a conviction before that age, and therefore do not contribute person years until age 10. Adjustment was made for the following:

1 immigration to the United Kingdom (if over 10);
2 time in prison;
3 time in hospital;
4 emigration from the United Kingdom;
5 death.

Details of all subjects for whom the case-notes did not indicate a date of death, or who were not in contact with the local mental health services at the termination of the study (1 January 1990), were sent to the OPCS. Dates were obtained of all 'exit events' – death, emigration or entering a long-stay hospital (defined as a stay of longer than 2 years). Criminal record data routinely include details of prison sentences. Some of the more recent records do not record date of release. Therefore, this was calculated from the length of the sentence assuming maximum remission.

Time in hospital was obtained from local hospital case records, supplemented by the computerized or non-computerized administrative records maintained at all the local hospitals. Recourse was also made to the Camberwell Case Register, which records hospital admissions. This method ensured that virtually all admissions of cases and controls to catchment area hospitals were established.

The possibility of admissions to hospitals outside this area was also considered. It is impractical to contact every mental hospital in the country. However, frequently when a subject is admitted to another hospital, and the medical officer is aware of a previous admission elsewhere, a request is made for relevant information. Fortunately, receipt of such requests are routinely filed in the case-notes. Whenever such a request was encountered, the requesting hospital was contacted for further information. It was not always possible to obtain summaries, but there were no difficulties in obtaining dates of admission. A check was also made on the Special Hospital Case Register for any cases admitted to one of the four special hospitals (maximum security hospitals) for England and Wales. Four admissions were noted, all already identified. Finally, for subjects no longer in contact, or whose case-notes had been destroyed, general practitioners were traced via OPCS and asked for simple information including dates of admission.

Source of criminal record data

Details of convictions for the entire sample up to 1990 were obtained from the Criminal Records Office. It is estimated that the Criminal Records Office has records of 90% of all convictions on subjects in the United Kingdom, the principal source of error being the distance of the relevant court from London (Steer, 1973). As nearly all the subjects obtained their conviction in Greater London, it is reasonable to assume that the records of conviction are almost complete, but

case records were also checked, and a small number of self-reported convictions not found in the official records were added. Another change was to record separate offences only if committed on different days. As Farrington (1990*a*) has pointed out, an analysis based only on offences would over estimate the number of separate offending events, since one event can lead to several convictions. For example, a burglar arrested for a single event could face charges of 'going equipped' as well as burglary. Further details of the reliability of criminal record data and case records are reported elsewhere (Wessely & Castle, 1992).

Offence categories were divided as follows:

1 theft;
2 criminal damage;
3 assault and violence;
4 sexual offences;
5 drug and alcohol offences;
6 others.

Missing data

There were 566 patients on the register in the appropriate categories; notes were available on 517 (91%). Twenty-eight patients were excluded (either because these were not first contact patients, or had an obvious organic basis for their illness (such as delirium tremens or neurosyphilis), or did not receive any psychiatric diagnosis at first contact). The final sample was 538. There were more missing notes for the controls, since more controls had very brief contact with services (for example, a single visit to a hospital casualty department) and the standard of record taking was lower.

There was no reason to suspect a systematic bias in the missing records. The principal reason for missing data was that 38 records covering contacts occurring at one of the participating hospitals (King's College Hospital, a general hospital) that took place during the first 10 years of the study had been destroyed because of lack of storage space. Patients with missing notes did not differ significantly from the rest of the sample in age, gender or place of birth.

Valid case-notes were obtained on 491 cases (91·3%) and 383 controls (71·2%). For 31 cases and 25 controls there was no trace at OPCS, suggesting an error in the demographic details in the register and/or case-notes. Any criminal convictions obtained by these subjects can be assumed also to be missing. Thus, outcome data were obtained on 94·3% of cases and 95·4% of controls.

One female case with over 100 convictions for prostitution would have resulted in substantial distortions in the analysis, and was treated as an outlier. She was arbitrarily coded as having one pre- and one post-illness offence.

RESULTS

Four different questions were addressed in this study, each using a different analytical strategy. The first question concerned the overall rate of conviction, which takes into account all convictions obtained by all subjects. Rates and rate ratios, utilizing person years at risk, were used to determine differences in overall rates of conviction comparing the schizophrenic and non-schizophrenic cohorts.

The second question concerns possible differences in the proportion of each group acquiring a criminal record, and the time taken to do so. This looks at first conviction only. The risks of acquiring a criminal record over time were calculated using a life table approach, and compared to both internal and external control cohorts.

The third question was the effect of possible predictor variables on the risk of acquiring a criminal conviction. These were first calculated using simple odds ratios, but, as many of the variables are not independent of each other, regression techniques were used based on survival analyses. An identical strategy was used to address the fourth question, the predictors of conviction after the onset of illness.

Questions three and four were also approached in two different ways. The predictors of both first and post-illness conviction were established across the entire study cohort, thus enabling calculation of the effect of psychosis itself. Following that, the effect of individual predictor variables was studied within the schizophrenic cohort alone.

A detailed description of the methods and results follows, organized by the topic addressed.

Rates of conviction

The first stage of the analysis was to obtain the rates and rate ratios for convictions between cases and controls, further divided by diagnostic

Table 3. *Rate ratios for convictions by offence categories: cases* versus *controls*

	All ICD-9 diagnoses				DSM-III-R schizophrenia only			
	Males		Females		Males		Females	
Offence	Rate ratio (95% CI)	*P*	Rate ratio (95% CI)	*P*	Rate ratio (95% CI)	*P*	Rate ratio (95% CI)	*P*
All	1·0 (0·9–1·2)	0·27	3·3 (2·3–4·7)	< 0·001	1·4 (1·2–1·5)	< 0·001	4·1 (1·7–10·0)	< 0·001
Assault and serious violence	2·1 (1·5–2·9)	< 0·001	3·1 (1·3–7·4)	< 0·001	3·1 (1·8–5·5)	0·01	—	
Theft	0·9 (0·8–1·0)	0·04	3·1 (2·0–4·7)	< 0·001	0·9 (0·7–1·2)	0·25	3·8 (1·3–11·5)	< 0·001
Criminal damage	1·2 (0·9–1·6)	0·09	2·5 (0·8–8·0)	0·10	2·0 (1·2–3·2)	0·003	2·0 (0·4–11·1)	0·33
Alcohol and drug related	0·9 (0·6–1·3)	0·19	—		1·3 (0·7–2·4)	0·29	—	
Sexual	0·8 (0·4–1·6)	0·20	6·6 (0·8–54·7)	0·05	0·5 (0·2–1·5)	0·07	—	

and offence category. Person years corresponded to the time at risk for each subject. The exact person years were obtained using the Person-years (PYRS) program (Coleman *et al.* 1989). A full description of the calculation of rates and rate ratios is contained in Appendix 1, with a worked example. Table 3 contains the summary statistics for the rate ratios by each offence category for all ICD-9 diagnoses and DSM-III-R schizophrenia respectively. Some cells are empty, i.e. where a subcategory contained no offences, the rate ratios thus being infinite. Principal confounders in this data set (social class and ethnicity) were controlled for using Poisson regression available in the EGRET statistical package. The finding that social class might be a confounder is unexpected, but we have presented elsewhere evidence of an association between paternal social class and the risk of schizophrenia in this data set (Castle *et al.* 1993*b*). The association between social class and criminal convictions is well known (Braithwaite, 1981).

The overall rate of conviction did not differ between cases and controls in male subjects (Table 3), although there was a trend for the rate ratio to increase as increasingly stringent diagnostic criteria were used (comparing cases of DSM-III-R schizophrenia spectrum disorder to controls gave a rate ratio of 1·2, lying midway between that for all ICD-9 categories (1·0) and that for DSM-III-R schizophrenia only (1·4)). However, the rates of assault were significantly higher in male cases than male controls, with a threefold increase in the rate of convictions for assault and serious violence occurring in males with DSM-III-R schizophrenia.

In contrast, the female cases showed an overall increased rate of conviction for all offences, and also for both violent convictions and theft (Table 3). Although the rate ratios for criminal damage and sexual offences are also elevated, the wide confidence limits and lack of statistical significance mean these should be interpreted with caution, being based on only nine offences for criminal damage, and six sexual offences, four of which were for prostitution.

These rate ratios are unadjusted, although the sampling strategy means that there is no confounding effect of time period or age, confirmed by negative tests for heterogeneity. The influence of gender, class and ethnicity is complicated. In the women there was no evidence of heterogeneity between the strata (class, ethnicity), and thus adjustment for both class and ethnicity could be made using Poisson regression. The rate ratio for effect of schizophrenia on convictions in women was 2·1 (95% CI: 1·4–3·1) adjusted for social class and ethnicity.

However, a more complex picture emerged in the men. There was evidence for heterogeneity by ethnic group, but not class. The rate ratio for the effect of schizophrenia in Afro-Caribbeans, adjusted for class, was 3·4 (1·9–6·3), but in the

Table 4a–d. *Kaplan–Meier estimations: time to first acquiring criminal conviction*

Age	Risk of conviction (This study)	95% CI	No. at risk	No. acquired conviction each period	Risk of acquiring conviction (National data*)
a. *Males: Controls* (N = 279)					
15	8·4	5·5–12·6	240	21	6·0
20	18·3	14·1–23·6	220	26	21·8
25	24·5	19·8–30·0	207	16	26·6
30	27·8	22·8–33·6	190	9	30·3
35	29·0	23·9–34·9	167	3	
40	30·0	24·8–36·0	139	2	35·8
45	31·8	26·3–38·1	73	3	
b. *Males: Cases* (N = 279)					
15	6·9	4·1–11·3	198	14	6·0
20	23·5	18·4–29·7	188	37	21·8
25	31·8	26·2–38·2	187	21	26·6
30	40·0	34·1–46·5	157	22	30·3
35	43·7	37·7–50·2	130	9	
40	45·6	39·5–52·1	114	4	35·8
45	47·8	41·6–54·4	90	4	
50	49·9	43·5–56·2	72	3	39·4
55	51·8	45·3–59·0	55	2	
c. *Females: Controls* (N = 259)					
15	0·4	0·1–3·0	236	1	
20	4·6	2·5–8·1	236	10	4·7
25	6·0	3·7–10·0	235	4	6·2
30	6·3	4·0–10·2	230	1	7·9
35	7·3	4·6–11·4	217	1	
40	8·9	5·9–13·3	200	4	10·6
45	9·5	7·3–14·0	163	1	
d. *Females: Cases* (N = 259)					
15	2·1	0·8–5·6	189	4	
20	7·5	4·6–12·2	197	11	4·7
25	10·6	7·1–15·7	210	7	6·2
30	12·3	8·6–17·6	206	4	7·9
35	13·6	9·7–19·0	196	3	
40	14·4	11·0–21·0	170	3	10·6
45	15·3	11·5–21·6	155	1	
50	16·2	11·9–22·0	134	1	12·3

* Data calculated by Farrington (1981) from the National Crime Statistics for England and Wales for 1977.

other ethnic groups combined (nearly all Caucasians) it was 0·6 (0·5–0·7). Thus, schizophrenia considerably increased the risk of conviction in Afro-Caribbean men, but not other groups. The overall rate ratio for the effect of schizophrenia, which was close to unity (Table 3), in fact comprises two opposing effects.

Lifetime risk of conviction and criminal careers

The risk of conviction over time was obtained using the Kaplan–Meier method (Table 4). This is a non-parametric method of obtaining time to a specific event in the presence of censored observations (a censored observation is any observation that ceases to contribute time towards the study – i.e. has left the study because of death, emigration and so on). It is necessary because subjects in the study contribute different numbers of years to the cohort – i.e. have different entry and exit times. For ease of comprehension the Kaplan–Meier statistics (which is the risk of surviving without an offence) were converted into risks of acquiring an offence by subtraction from unity. It is also presented graphically (Fig. 1).

An external control cohort exists for lifetime

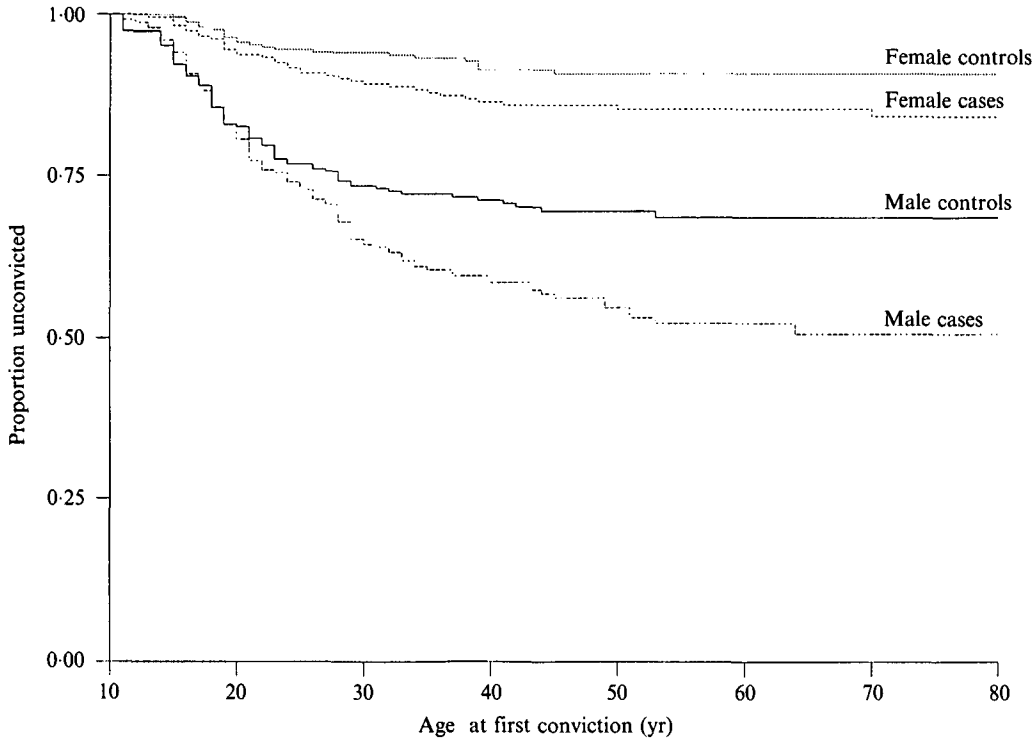

FIG. 1. Time to first conviction.

risk of conviction. This is the data calculated by Farrington (1981) from the National Crime Statistics for England and Wales for 1977, in the middle of the study period. Table 4 thus contains the risks of acquiring a criminal record over the life span obtained in this study, and the national data. The missing age strata in the national data reflect the differences in the strata chosen by Farrington from those used here. The results show that both male and female controls do not differ from the expected results using national data, since the national values lie well within the observed confidence intervals for the controls. However, in the male cases a steady trend is noted in which the risks of conviction consistently exceed those of both the controls, and the national data. By age 30 this difference exceeds the 95% confidence limits. Formal significance testing using the Log Rank test (Kalbfleisch & Prentice, 1980) showed the score tests for both terms (caseness and gender) to be highly significant; the overall score test statistic was 114·75 (df = 2, $P < 0{\cdot}001$).

A second comparison cohort also exists. This is the Cambridge Delinquency Cohort, a prospective follow-up of 411 males born in Camberwell between 1952 and 1954. Fortuitously, this cohort thus comes from the identical catchment area as the current study, and 94% of the Cambridge cohort were from Social Class III and below, compared to 87% of the controls in the current study. Up to age 32 (the last year of data collection) the prevalence of convictions in the Cambridge study was above that of the male controls in this study (37% compared to 28%), but below that of the cases (37% compared to 42%). Farrington (1990*b*) also reported that 12·4% of convictions in the Cambridge cohort were for violent offences. In this study the similar figure was 8·6% (controls) and 15·7% (cases). It is true that neither the local delinquency study nor the national data are ideal control groups, largely because of differences in ethnic composition between the current study and the two reference cohorts, but the comparisons do suggest that those with mental disorders other than schizophrenia have lifetime risks of convictions that are either the same or

slightly below the reference cohorts, while the cases of schizophrenia had a significant increase in risk compared with both national and local data.

Inspection of Fig. 1 shows that the difference between cases and controls is not marked in the early years, but subjects with schizophrenia continue to obtain a first conviction ('commence criminal careers') for longer than subjects with other psychiatric illnesses. This pattern is also reflected in the differences in the age of first conviction between cases and controls. Controls had a mean age at first conviction of 21·7 years while that of the cases was 24·6 years ($t = -2{\cdot}24$, df = 248, $P = 0{\cdot}026$). However, the average criminal career of the cases (defined as the number of years from first to last recorded conviction) was significantly shorter than in controls (cases = 5·7 (4·6–6·9), controls = 8·1 (6·4–9·9); $t = 2{\cdot}31$, df = 246, $P = 0{\cdot}022$). The absolute figures may be misleading, since many of the recently recruited subjects have not yet finished their criminal careers, but the matching by age means that this does not introduce a bias between cases and controls.

Predictors of first conviction (unadjusted)

The effect of possible predictors of acquiring a criminal record was calculated as follows. Crude (unadjusted) odds ratios were used to estimate the strength of the association between a possible predictor variable and the risk of acquiring a criminal record. The following variables were entered as dummy variables (0,1) – gender, employment, unemployment (not having a job while available for work, thus excluding students), diagnostic subgroups of schizophrenia, ethnicity and substance abuse. Social class and period were entered as factored variables, with odds ratios cited relative to Social Class I/II, or the period 1965–9. The effect of age of onset of illness was calculated using survival analysis.

The influence of 'caseness' (i.e. ICD-9 schizophrenia and related disorders as defined by the Camberwell register) was obtained from the entire sample. The effect of more stringent categories of schizophrenia, compared with non-psychotic controls, was obtained by removing case–control pairs in which the case did not fulfil the criteria (otherwise the case would have contributed to the odds ratio as a quasi control). Alternatively, the contribution made by more stringent categories of schizophrenia compared to the looser clinical definitions was studied within the cases themselves (see Tables 6, 8, 9, 11).

The results showed that ICD-9 schizophrenia was associated with a significant increase in the risk of acquiring any criminal conviction (odds ratio = 1·7, 95% CI 1·2–2·2, $P < 0{\cdot}001$). This risk increased slightly for DSM-III-R schizophrenia spectrum disorder (OR = 1·9, 95% CI 1·4–2·7, $P < 0{\cdot}0001$) and again for DSM-III-R schizophrenia itself (OR = 2·0, 95% CI 1·4–2·9, $P < 0{\cdot}001$), although the differences between the categories were not significant. These are odds ratios, but, as expected, hazard ratios calculated using survival analysis gave very similar results, but are not cited for ease of comprehension and brevity.

Table 5 shows the effect of a large number of variables on the risk of first conviction, cited as odds ratios. Cases and controls were analysed separately, since information was not available on all variables equally for cases and controls. The odds ratios for DSM-III-R schizophrenia spectrum disorders (schizophrenia, schizophreniform and delusional disorders) and schizophrenia are compared to the clinical diagnosis (ICD-9) of schizophrenia. The more stringent criteria have a modest effect on the risk of criminality.

Age of onset of illness, defined above, was treated as a continuous variable. Its effect was obtained using survival analysis, which results in a hazard, rather than an odds ratio. Increasing age of onset of illness was associated with a decrease in the risk of conviction in both cases (hazard ratio = 0·95, 95% CI 0·93–0·96, $P < 0{\cdot}001$) and controls (hazard ratio = 0·93, 95% CI 0·91–0·95, $P < 0{\cdot}001$). Hence for each year in which the onset of illness was delayed, the overall risk of acquiring any lifetime conviction decreased by 5%.

Predictors of first conviction (adjusted)

It is well known that many of the variables studied are not independent of each other, and that correlations exist between, for example, ethnicity, unemployment and social class. The method of adjustment for confounders was as follows. Once crude odds ratios had been obtained, significant associations (at the 5% level) were then entered into a Cox's pro-

Table 5. *Factors contributing to first criminal conviction: unadjusted (crude) odds ratio*

	Cases (ICD-9 schizophrenia, $N = 538$)			Controls (Other mental disorders, $N = 538$)		
	Odds ratio	95% CI	P	Odds ratio	95% CI	P
DSM-III-R Schizophrenic spectrum[1]	1·5	1·0–2·2	0·051	—	—	—
DSM-III-R Schizophrenia[1]	1·3	0·9–2·0	0·131	—	—	—
Being female	0·2	0·1–0·3	< 0·001	0·2	0·1–0·4	< 0·001
Job	0·6	0·4–0·9	0·02	—	—	—
Unemployed	1·5	1·0–2·4	0·053	—	—	—
Ethnicity[2]	2·6	1·7–4·0	< 0·001	1·6	0·7–3·4	0·227
Pre-morbid work adjustment	2·5	1·6–3·8	< 0·001	—	—	—
Pre-morbid social adjustment	2·1	1·4–3·2	< 0·001	—	—	—
Substance abuse	4·9	2·8–8·4	< 0·001	3·8	2·3–6·2	< 0·001
Married or cohabiting	0·5	0·3–0·7	< 0·001	0·7	0·4–1·1	0·213
Social class III	1·7	0·9–3·3	0·073	1·6	0·7–3·9	0·252
Social class IV and V	1·8	0·9–3·4	0·061[3]	1·6	0·7–3·9	0·213[4]
Period 1970–4	0·9	0·5–1·6	0·400	1·2	0·6–2·4	0·649
1975–9	1·1	0·6–2·0	0·473	1·6	0·8–3·1	0·165
1980–4	1·5	0·9–2·7	0·072[5]	1·7	0·8–3·3	0·120[6]

[1] *Versus* ICD-9 psychoses.
[2] Ethnicity compares all Afro-Caribbeans with all other groups. It is by ethnicity, and not place of birth.
[3] Test for trend, $P = 0·106$.
[4] Test for trend, $P = 0·303$.
[5] Test for trend, $P = 0·04$.
[6] Test for trend, $P = 0·078$.

portional hazards model (Kalbfleisch & Prentice, 1980). This is a form of regression analysis using continuous time data in the presence of censored observations. The end point was the date of conviction – i.e. the number of years to acquiring a criminal record. If no record was ever obtained, the subject thus exited the cohort (known as 'censoring'), either by simply reaching the final year of the study (1990) without a criminal record, or alternatively by dying or emigrating. The earliest anyone could enter the cohort was set at 10 years, since before that it is impossible to acquire a conviction (see above). Because of the number of immigrants in the sample, not every person enters the study aged 10. 'Left censoring' was therefore used, which meant that subjects entering the United Kingdom after age 10 enter the model at the age at which they arrived in this country: those entering before age 10 are unaffected.

The significance of adjusted associations was calculated from the decrease in deviance when that variable was added to the regression (the change in deviance following a χ^2 distribution). The key statistic is again the hazard ratio, which is analogous to the better known odds ratio.

Table 6. *Independent predictors of first conviction*

Term	Hazard ratio	95% CI	P
Ethnicity	2·3	1·6–3·2	< 0·001
Being female	0·3	0·2–0·4	< 0·001
Substance abuse	2·5	1·7–3·5	< 0·001
Age at onset of illness	0·95	0·93–0·96	< 0·001
Schizophrenia (ICD-9)	1·4	1·0–2·0	0·047

Adjusted model: cases and controls: Cox's proportional hazards ($N = 1076$).

Table 6 shows the fully adjusted model for first conviction across the entire sample, incorporating both cases and controls. Clinically defined schizophrenia (ICD-9) makes a significant contribution, although ethnicity, gender,

Table 7. *Independent risk factors contributing to first conviction in subjects with clinically defined schizophrenia*

Term	Hazard ratio	95% CI	P
Ethnicity	2·2	1·5–3·1	< 0·001
Being female	0·3	0·2–0·5	< 0·001
Substance abuse	2·0	1·2–3·4	0·013
Age at onset of illness	0·95	0·94–0·98	< 0·001
Poor pre-morbid adjustment	1·6	1·0–2·5	0·068
Schizophrenia (DSM-III-R)	1·3	0·9–1·8	0·194
Social class	1·2	0·9–1·5	0·268
Being married	1·3	0·8–2·0	0·292
Job	0·8	0·5–1·2	0·307
Unemployed	0·9	0·6–1·4	0·628

Adjusted model: cases only: Cox's proportional hazards; $N = 538$.

Table 8. *Possible interaction between schizophrenia and ethnicity on the risk (hazard ratio) of first offending*

	Case *v.* control	
Ethnicity	Control	Case
Other groups	1·0	1·3
Afro-Caribbean	1·6	2·9

substance abuse and age of onset all have stronger associations.

Table 7 contains a similar analysis, but now restricted to the cases alone, in order to incorporate a wider range of predictor variables. Social class, marriage, having a job, or being unemployed, no longer make significant contributions, while the most stringent category of schizophrenia (DSM-III-R) is also not significant. It should be emphasized that this simply means that the operationally defined category of schizophrenia conveys no further risk of criminality compared to more loosely defined schizophrenia (ICD-9). Age of onset is confounded by premorbid social adjustment, but although poor pre-morbid adjustment significantly improved a model containing age of onset (likelihood ratio statistic = 8·46, df = 2, $P = 0·015$), it made no independent contribution to the final model.

Still looking at first conviction only, the effect of ethnicity is shown in Table 8. There is a suggestion of an interaction between schizophrenia and ethnicity, but it is not substantial, unlike that noted in the rate ratio analyses. The interaction term (schizophrenia.ethnicity) was not significant, and adding it to the model caused little effect. Schizophrenia remained associated with a modestly increased risk of conviction when the sample was restricted to non-Afro-Caribbean men (hazard ratio = 1·25). This should be contrasted with the very different pattern of results obtained looking at the effect of ethnicity on the overall rate of convictions, rather than risk of acquiring any conviction.

As expected the chance of acquiring a criminal record increased during the study period. In a twin study Coid *et al.* (1993) noted a similar time trend in their probands with schizophrenia, but a non-significant trend in the non-psychotic co-twin. Coid and her colleagues argued that deinstitutionalization has led to a greater increase in convictions among the mentally ill over and above that observed in the controls. The possibility that crime is increasingly differentially between cases and controls in this study was investigated by looking for a possible interaction between caseness (psychosis) and period. The likelihood ratio statistics was 0·05 ($P = 0·819$), and the hazard ratio for the interaction term (period × case) was 0·96 (95% CI 0·77–1·21, $P = 0·96$). The secular trend of increasing criminality was, therefore, equal in both cases and controls. We were thus unable to replicate the results of Coid *et al.* (1993), and our results do not support a hypothesis of increasing 'criminalisation' of the mentally ill.

Post-illness conviction

To model post-illness convictions a similar plan of analysis, moving from crude odds ratio to an adjusted regression model, was used with some modifications. When offence and illness onset appeared to be simultaneous (e.g. when the offence was the first evidence of illness, or when the date of illness onset as recorded in the notes coincided with an offence) an arbitrary figure of 1 month was used for time to post-illness conviction. This was necessary since any survival analysis using time to failure (in this case post-illness conviction) can only deal with a positive integer.

Unadjusted odds ratios were obtained to determine the influence of key predictor variables

Table 9. *Predictors of first post-illness conviction in ICD-9 schizophrenia* v. *other mental disorders; crude odds ratios*

	Cases (ICD-9 schizophrenia)			Controls (Other mental disorders)		
	Odds ratio	95% CI	*P*	Odds ratio	95% CI	*P*
DSM-III-R Schizophrenic spectrum	1·5	1·0–2·4	0·057	—	—	—
DSM-III-R Schizophrenia	1·6	1·0–2·5	0·036	—	—	—
Being female	0·2	0·1–0·4	< 0·001	0·2	0·1–0·4	< 0·001
Job	0·7	0·4–1·1	0·117	—	—	—
Unemployed	2·0	1·2–3·2	0·004	—	—	—
Previous conviction	8·2	4·9–13·9	< 0·001	23·1	12·6–44·6	< 0·001
Ethnicity	3·6	3·3–5·7	< 0·001	2·1	0·9–4·8	0·067
Substance abuse	4·2	2·4–7·4	< 0·001	5·3	2·5–11·8	< 0·001
Married	0·4	0·2–0·6	< 0·001	0·7	0·4–1·3	0·239
RGSC III	1·4	0·7–3·0	0·273	1·0	0·4–2·7	0·976
RGSC IV and V	1·6	0·8–3·3	0·172[1]	1·5	0·6–3·9	0·369[2]
Period 1970–4	1·0	0·5–1·9	0·931	1·3	0·6–2·9	0·479
1975–9	1·2	0·6–2·4	0·403	1·1	0·5–2·4	0·84
1980–4	1·5	0·8–2·7	0·236[3]	1·2	0·5–2·7	0·615[4]

[1] Test for trend, $P = 0·205$.
[2] Test for trend, $P = 0·178$.
[3] Test for trend, $P = 0·163$.
[4] Test for trend, $P = 0·768$.

Table 10. *Adjusted model: post-illness first conviction: cases and controls combined* (N = 1076)*: Cox's proportional hazards*

Term	Hazard ratio	95% CI	*P*
Previous conviction	3·9	2·71–5·63	< 0·001
Ethnicity	2·3	1·56–3·30	< 0·001
Being female	0·4	0·24–0·60	< 0·001
Substance abuse	1·6	0·99–2·58	0·055
Age at onset of illness	0·95	0·93–0·97	< 0·001
Schizophrenia (ICD-9)	1·4	0·86–2·13	0·185

Table 11. *Independent predictors of post-illness first conviction in* ICD-9 *schizophrenia* (N = 538)*: Cox's proportional hazards model: fully adjusted*

Variable	Hazard ratio	95% CI	*P*
Previous conviction	2·8	1·9–4·5	< 0·001
Ethnicity	2·2	1·5–3·2	< 0·001
Substance abuse	1·8	1·2–2·7	0·012
DSM-III-R Schizophrenia	1·4	0·9–2·1	0·09
Age at onset of illness	0·95	0·93–0·97	< 0·001
Being female	0·4	0·3–0·7	0·004

on post-illness conviction (Table 9). Cox's proportional hazard model was again used to determine the fully adjusted associations of post-illness conviction across the cohort (Table 10). The significance of the association was again calculated from the decrease in deviance when that variable was added to the regression. As before, to maximize the use of possible predictor variables that were only available in the cases alone (marital status, employment category and other illness variables) an unadjusted analysis was carried out in the cases and controls separately (Table 9), and a fully adjusted model developed for the cases alone (Table 11).

Broadly defined schizophrenia was significantly associated with obtaining a criminal record after the onset of illness, with almost a two-fold increase in risk (odds ratio = 1·81, 95% CI 1·28–2·55; $P < 0·001$). A very similar range of factors were all significantly associated with criminality after the onset of illness (Table 9). Age of onset of illness remains associated (cases, hazard ratio = 0·94, 95% CI 0·92–0·96,

$P < 0{\cdot}001$; controls, hazard ratio = 0·94, 95% (CI 0·91–0·96, $P < 0{\cdot}0001$), but not age at first offence (cases, hazard ratio = 0·99, 95% CI 0·97–1·01, $P = 0{\cdot}35$; controls, hazard ratio = 1·00, 95% CI 0·97–1·07, $P = 0{\cdot}97$). Looking at cases and controls together in the fully adjusted model (Table 10) previous conviction, gender, ethnicity, substance abuse and age of onset of illness continue to be significant, but not clinically defined schizophrenia. However, in the cases alone (Table 11) there is a weak trend for an increased risk for DSM-III-R over ICD-9 schizophrenia.

DISCUSSION

This study tested the hypothesis that schizophrenia is associated with increased risk of criminal convictions compared to other mental disorders. Controls are a random sample of all non-psychotic psychiatric disorders, and hence contained a substantial number of subjects, especially in the men, with diagnoses well known to be associated with criminal behaviour, such as substance abuse and personality disorder. On the other hand, there were also substantial numbers of female subjects with diagnoses such as depression or dementia that may be associated with lower rates of offending. The study thus tests the hypothesis that schizophrenia *per se*, rather than all forms of mental illness, is associated with an increased risk of criminality compared to all other mental disorders.

Limitations

The main limitation of the study is that it consists solely of detected criminality, and thus is subject to all the biases that intervene between offending and criminal conviction (Monahan & Steadman, 1983; Wessely & Taylor, 1991). The choice of controls reduces (but by no means eliminates) such unquantifiable confounders such as the stigma of mental illness and the ease of detection of mentally abnormal offenders. Nevertheless, it is important to emphasize this is a study of detected criminality only, and not offending behaviour in general. One weakness is that diagnoses were made using operational criteria, but not following standardized interviews. Another possible bias, from the higher proportion of subjects born outside the United Kindgom in the cases compared to the controls, is a differential loss of early offences, committed before entering the United Kindgom. However, such a bias would reduce any observed relative risks, and would only reduce the power of the study to detect differences. Furthermore, all the analyses outlined above were repeated using only those born in the United Kingdom or entering before age 10. The effect of schizophrenia on both convictions for 'violent offending' and 'all offending' by women was unchanged, although the power of the study was inevitably reduced. Some of the predictor variables were also imprecise – for example, paternal social class could not be obtained on approximately half the sample, and since social class of the subject at presentation had to be substituted, some effect of social drift must remain, especially in those born outside the United Kingdom.

On the other hand, the study has some advantages. Subjects were incident cases. The use of population-based cases, rather than cases identified after hospital discharge, reduces one bias, since hospital admission is a potentially important confounder of crime and mental illness – violent behaviour is a frequent reason for admission to hospital, confirmed in this data set in which there was a significant association between the presence of violent behaviour and/or police involvement and the decision to admit to hospital (Castle *et al.* 1994).

Results

The results show that men with clinically defined schizophrenia do not have an overall increased risk of criminality compared to other mental disorders. This risk increases as the definitions of schizophrenia become more stringent, but is never substantial. However, the risk of being convicted for violent offences is at least twice that of men with other mental disorders, even when compared with a control sample containing a substantial minority of subjects with psychiatric disorders in which there is an established and non-controversial association with criminal behaviour. In contrast, women with schizophrenia have an overall increased rate of convictions compared to all other mental illnesses, found across several offence categories, including violence.

These results for both men and women replicate those found by Lindqvist & Allebeck (1900*a*) in their Swedish study of hospital

discharges, this time compared to national data. The results are also consistent with those of Hodgins (1992), also in Sweden. In the latter study, if one compares 'other mental disorder' with 'major mental disorder', the closest to the current analyses, then although all crime categories are commoner in the latter, the higher relative risk occurs for violent offending and drug-related offences.

The use of life tables gives a graphical impression of the differences between cases and controls. Looking at the age of first conviction, cases and controls do not differ in early years, but deviate more with increasing age. The data on the controls with other mental illnesses do not differ substantially from national data from the middle of the study period (Farrington, 1981). This pattern is also reflected in the differences of mean age of first conviction between cases and controls. This has been found in previous studies of selected groups of mentally abnormal offenders compared to 'normal' offenders (Hafner & Boker, 1982; Gibbens & Robertson, 1983; Taylor, 1994), and is now shown in an epidemiologically defined population. It is consistent with the data of Farrington & West who, in the Cambridge Study of Delinquent Development, found that 'normal' males convicted for the first time after their 21st birthday had higher scores on a self-report measure of psychiatric disorder than those convicted earlier (Farrington & West, 1990). In general these subjects with late onset of criminal careers more closely resembled those with no criminal convictions than those convicted earlier.

Gender

As expected rates of conviction were substantially lower among women. It is already known that in every age group, men are five or more times more likely to be found guilty or cautioned (Lewis, 1990), as was found here. However, in this study, compared with controls, women with schizophrenia had a dramatic increase in the rate of convictions for a number of offences, although the rates continue to be far lower than in men.

Could this be for methodological reasons? The first possible explanation is internal to the study. Compared to the males, the female controls contained a higher proportion of subjects with depression, and lower proportions with substance abuse or personality disorder. However, comparisons were made within the sexes, and not between. The diagnostic breakdown within the controls reflected the diagnostic breakdown within the community, and hence it is still appropriate to make comparisons about rates of offending in those with schizophrenia compared to all other mental disorders. Finally, the age-matched data provided by Farrington (1981) from national data were used as a 'normal' comparison group, and gave a similar pattern of results. The second methodological explanation is external to the study. It is often argued that differences exist in the way the police and the courts treat female offenders. Women appearing before courts are approximately twice as likely to receive psychiatric disposal (Allen, 1987). In a study of the same Inner London Courts in which most of convictions recorded in this study occurred, Gibbens and colleagues (1977) found that twice as many women as men charged with violent offences against property (mainly criminal damage in the classification adopted here) were remanded for medical reports. Medical surveillance and diversion away from the criminal justice system are more efficient for female than male offenders (Edwards, 1984; Maden, 1992). It is frequently argued that the courts, out of a sense of what has been termed 'chivalry', show a general reluctance to convict women, especially those seen as in need of treatment (Pollak, 1950), although in practice the situation is more complex (Edwards, 1984; Allen, 1987). Overall, the direction even of these alleged biases is against convicting women, so any gender differences between women and men will be reduced, rather than increased. Thus, the true difference between female and male rate ratios of conviction in schizophrenia may be even greater than that detected here.

A more likely explanation for the observed gender differences relates to the relative proportions of male and female criminality. Maden has argued that the higher rates of mental abnormality among female prisoners in England and Wales is partly because of the lower rates of 'normal' offending among women, which means that a greater proportion of female offenders are likely to be psychiatrically abnormal (Maden, 1992). A similar argument has been used to explain the wide national variations in the ratio

of 'normal' to 'abnormal' homicides (Coid, 1973; Schipkowensky, 1973). Any increase in violent offending occurring as a result of psychosis, which, unlike crime, is not associated with substantial overall differences in prevalence by gender, will have a dramatic effect on female than male rate ratios.

Predictors of conviction

Turning to the predictors of acquiring a criminal record, many of our findings confirm what is known from the criminological literature, enhancing the credibility of the methodology employed. The risk of conviction was substantially reduced by being female, married or having a job, and increased by substance abuse, ethnic origin, unemployment, lower social class, poor social adjustment and period (the risk of conviction increasing over the study period in both cases and controls). Having schizophrenia, however defined, also increased the risk of criminal conviction. This association remained significant after adjusting for confounders, although ethnicity, gender, substance abuse and age of onset exerted more substantial effects. Social class did not remain significant after adjustment, suggesting that the effect of social class on offending was confounded by a combination of ethnicity, substance abuse and psychosis. There was an association between pre-morbid social adjustment and criminal behaviour, in contrast to the findings of a recent paper with a smaller sample size (Schanda *et al.* 1992).

Substance abuse independently increased the risk of acquiring a criminal record in the cases, confirming the association between schizophrenia, substance abuse and criminal conviction reported by Lindqvist & Allebeck (1990*b*). However, the prevalence of substance abuse was low, in keeping with the literature on substance abuse and schizophrenia (Bernadt & Murray, 1986; Schneier & Siris, 1987) (drug-induced psychosis was excluded from the cohort, together with other organic psychoses). This suggests that the overall contribution of substance abuse to offending behaviour among schizophrenics is low. We calculated the population attributable risk (Rothman, 1986), which can be interpreted as the proportion by which convictions would be reduced if substance abuse was eliminated from the cohort, to be 16·7%.

The presence of schizophrenia also increased the risk of post-illness conviction by nearly two fold, and there was a separate contribution from more rigorously defined illnesses. Once again, being female, married or having a job decreased the risk, while ethnicity, unemployment and substance abuse increased it. The strongest association was for possessing a previous criminal record, in line with the findings of several other studies (Payne *et al.* 1974; Durbin *et al.* 1977; Steadman *et al.* 1978; Holcomb & Ahr, 1988; Shore *et al.* 1989). A weak effect for social class, and also for period (albeit largely in the cases) was also found. Survival analysis showed that previous conviction, ethnicity, gender and substance abuse, but not schizophrenia, remained independent predictors of post-illness conviction. Age of onset of illness continued to exert an independent effect, in that for each year that onset of schizophrenia was delayed, the risk of conviction decreased. Age at first conviction had no effect. This may seem surprising, since age of first conviction was significantly correlated with age of onset of illness ($r = 0{\cdot}53$, $P = 0{\cdot}01$), as noted in another study of psychosis (Coid *et al.* 1993); however, the correlation was not sufficiently strong to make the latter variable inevitably associated with post-illness conviction. Instead, the data suggest that the earlier the onset of illness, the more likely the subject is to then acquire a criminal record.

The effect of age of onset of illness is complex. It is not simply that an earlier age of onset leaves more time to acquire a criminal record, since the effect was for a lifetime criminal record, not just post-illness conviction. Instead, early onset could be associated with previous antisocial behaviour, as it was in this data set. This is compatible with data suggesting that early onset schizophrenia, particularly in men, has a poor prognosis, and is associated with a higher risk of developmental abnormalities (Castle & Murray, 1991) – pre-morbid offending may thus be part of the prodrome of early onset illness. Although Hodgins (1992) did not measure age of onset, she noted that 'the clinical behaviour of subjects who eventually developed major disorders often appeared in early adolescence, well before the mental disorder would have been diagnosed'. However, the effect of age of onset is not specific for schizophrenia, since it is also found in the

controls. Perhaps early presentation with mental disorder is more likely to be associated with behavioural disturbance in several diagnostic categories.

Ethnicity

The influence of Afro-Caribbean ethnicity on conviction rates is of concern. It was expected that ethnicity would be a strong confounder of any association between crime and schizophrenia. We have shown, in this data set, that Afro-Caribbeans in this area of London are at considerably greater risk of schizophrenia than those of other ethnic origins (Wessely *et al.* 1991), confirming similar observations made elsewhere in the United Kingdom (Harrison *et al.* 1988). It is also known that Afro-Caribbeans have higher rates of conviction than other ethnic groups (Farrington, 1993). This must in part be due to the greater incidence of poverty, school failure, family breakdown and unemployment in the Afro-Caribbean community in the United Kingdom (Brown, 1984), since these are known associations of offending (Farrington & West, 1990).

Age of onset of illness may be another confounder. In the same data set we have shown that men with an early age of onset (before age 25) are characterized by a particularly severe form of schizophrenia, with long prodrome and lack of affective symptomatology (Castle *et al.* 1993*a*). These patients were more likely than their female counterparts to have remained single, to have poor pre-morbid social and employment records, and to exhibit personality disorder. The current study suggests that it is these young black men with schizophrenia who also show recidivist criminal behaviour, accounting for the interaction between ethnicity, schizophrenia and rates of criminal conviction noted in the men, but not women. The mean age of onset of Afro-Caribbeans was indeed lower than that of UK born non-Afro-Caribbeans (males, 28·3 *v.* 33·7; females, 31·2 *v.* 46·2 years). However, there was no difference when schizophrenia was diagnosed using the DSM-III criteria, which have an upper limit of 45. Thus, age of onset does not differ once late life schizophrenia is excluded.

The identification of a group of young black men with both schizophrenia and criminal recidivism may explain the otherwise puzzling discrepancy between the effect of ethnicity and gender on the rates of offending and the risk of first offence. In females there was no interaction between illness, schizophrenia and ethnicity, which permitted the calculation of effect of schizophrenia on offending, adjusted for class and ethnicity (rate ratio = 2·1). However, in men there was a difference in the effect of schizophrenia on offending by ethnic group. Because of this interaction, it was thus only possible to adjust for class, and present separate rate ratios by ethnic group. On the other hand, no such interaction by ethnicity was noted for the risk of first conviction. Schizophrenia increased the risk of conviction, albeit to a small extent, regardless of ethnic group, and there was no interaction term for schizophrenia and ethnicity. These differences can be explained by recidivism in young black males with schizophrenia. Hence the interaction between gender, schizophrenia and ethnicity was only noted in the rate ratio analyses (which takes into account the total number of convictions), but not those for first or post-illness conviction.

The effect of ethnicity persisted independently of measures of social deprivation, such as unemployment, social class and substance abuse, as well as age of illness onset. One possibility is that these were inadequate controls for social deprivation. Unemployment and lower social class are only proxy measures for various forms of social deprivation, and may well not be adequate. The recording of drug abuse is by no means complete. Another possible bias that cannot be controlled for is the operation of the criminal justice system. Two surveys (Stevens & Willis, 1979; Smith & Gray, 1983) in London showed that Afro-Caribbeans are at increased risk of arrest by the police. Crow (1987) argued that this increase in arrests and convictions among black people is because they are more likely to be apprehended, charged and brought to court than Caucasians as a result of police bias. It has been shown that black youths are less likely to be cautioned, and more likely to be prosecuted than Caucasian youths (Landau, 1981; Commission for Racial Equality, 1992). However, victim surveys show that police bias is far from a complete explanation (see Hindelang, 1983; Home Office Statistical Bulletin, 1989).

The general effect of ethnicity on conviction, as seen in cases and controls, could also be due

to selection bias. It is possible that Afro-Caribbeans only come to the attention of mental health services in the context of disturbed behaviour, unlike Caucasians. However, it remains true that, particularly in developed countries, nearly all of those with schizophrenia eventually come to the attention of mental health services (Eaton, 1985). There is no evidence of substantial numbers of subjects with schizophrenia unknown to mental health services in Camberwell (Bebbington *et al.* 1981). We have also found no evidence that the excess of schizophrenia in Afro-Caribbeans is the consequence of diagnostic bias (Wessely *et al.* 1991). Despite occasional assertions to the contrary, racial bias in the diagnosis of schizophrenia in the United Kingdom has not been substantiated (Lewis *et al.* 1990). Finally, the data presented here could be biased if ethnicity influenced the tolerance of disturbed behaviour – for example, if clinicians were more likely to discharge Afro-Caribbean than Caucasian patients as a result of disturbed behaviour. It is, however, impossible to determine if this did indeed take place.

CONCLUSION

This study confirms and extends recent findings of an increased risk of criminal conviction in those with schizophrenia, particularly for assaultive offending in men, but most offences in women. Like others who have noted similar findings (Swanson *et al.* 1990; Link *et al.* 1992) we advise caution in interpreting these results. The risk is small. Viewed in terms of attributable risk, the contribution made by those with schizophrenia to the level of recorded crime in the community is slender. The strongest predictors of crime in those with schizophrenia are the same as those in subjects without psychosis. Nevertheless, serious mental illness also exerts a small, but significant, independent effect on recorded crime. Low risk is not the same as no risk, and these findings must be taken seriously. Furthermore, since minor offending by those with schizophrenia, even when detected, frequently does not lead to convictions (Lagos *et al.* 1977; Mackay & Wight, 1984; Johnstone *et al.* 1991), the true differences may be more marked than those presented here. These findings, and those reviewed above, suggest that the current upsurge of interest on both sides of the Atlantic in the problems of the mentally abnormal offender is timely.

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APPENDIX I

To obtain rates and rate ratios the data are first organized as a 2 by 2 table, illustrated below (Rothman, 1986).

Notation for a 2 by 2 table; Person Time Data

	Cases	Controls	Total
Events	a	b	M
Person years	N_1	N_2	T

where a is the number of offences in the cases, b is the number of offences in the controls, M is the total number of events, N_1 is the person years contributed by the cases, N_2 is the person years contributed by the controls, T is the total number of person years.

The rate is obtained from the total number of offences and the person years at risk contributed by cases and control respectively. Thus, for cases it is a/N_1, and for controls it is b/N_2. The rate ratio is simply the ratio of the two rates. The 95% confidence limits for this ratio are obtained using the method described by Rothman (1986), based on the formula for the standard deviation of the rate ratio:

$$\text{Standard deviation (ln RR)} = \sqrt{(1/a + 1/b)},$$

where ln RR is the natural logarithm of the rate ratio, a is again the number of events (in this case offences) in the cases, and b is the number of events in the controls. The ratio of the person years (N_1/N_2) is the odds of acquiring a criminal record in the cases under the null hypothesis. The expected number of convictions in the cases is thus the total number of offences multiplied by these odds. The P value can thus be obtained either directly from the binomial distribution or by using the normal approximation.

This is illustrated in a full worked example:

Rate (rate ratios) of all offending; cases and controls; all diagnoses

	Males		Females	
	Case	Control	Case	Control
Total no. of offences	574	633	123	41
P years	8367·0	9535·6	10466·7	11498·0
Rate	0·0686	0·0663	0·0117	0·00357
Rate ratio	1·03		3·29	
95% CI	0·92–1·16		2·31–4·69	
Z	0·79		6·94	
P	0·27		> 0·0001	

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