

From conduct disorder to severe mental illness: associations with aggressive behaviour, crime and victimization

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Background. Conduct disorder (CD) prior to age 15 has been associated with an increased risk of aggressive behaviour and crime among men with schizophrenia. The present study aimed to replicate and extend this finding in a clinical sample of severely mentally ill men and women.

Method. We examined a cohort of in-patients with severe mental illness in one mental health trust. A total of 205 men and women participated, average age 38.5 years. CD was diagnosed using a structured diagnostic tool. Alcohol and illicit drug use, aggressive behaviour and victimization were self-reported. Information on convictions was extracted from official criminal records. Analyses controlled for age and sex.

Results. CD prior to age 15 was associated with an increased risk of assault over the lifespan [odds ratio (OR) 3.98, 95% confidence interval (CI) 1.87–8.44], aggressive behaviour in the 6 months prior to interview (OR 2.66, 95% CI 1.24–5.68), and convictions for violent crimes (OR 3.19, 95% CI 1.46–6.97) after controlling for alcohol and illicit drug use. The number of CD symptoms present prior to age 15 significantly increased the risk of serious assaults over the lifespan, aggressive behaviour in the past 6 months, and violent crime after controlling for alcohol and illicit drug use.

Conclusions. Men and women with severe mental illness who have a history of CD by mid-adolescence are at increased risk for aggressive behaviour and violent crime. These patients are easily identifiable and may benefit from learning-based treatments aimed at reducing antisocial behaviour. Longitudinal, prospective investigations are needed to understand why CD is more common among people with than without schizophrenia.

Received 23 February 2007; Revised 21 September 2007; Accepted 11 October 2007; First published online 8 November 2007

Key words: Conduct disorder, schizophrenia, violence.

Introduction

For reasons that are currently unknown, conduct disorder (CD) prior to age 15 is an antecedent of schizophrenia. In 1966, Robins noted that a disproportionately high number of juvenile delinquents subsequently developed schizophrenia and recently this was confirmed in a study of all juvenile delinquents in Denmark (Gosden *et al.* 2005). Studies of children defined as high risk because of a family history positive for schizophrenia observed that a subgroup of boys displayed conduct problems in childhood and adolescence prior to the onset of schizophrenia (Asnarow, 1988; Olin *et al.* 1997). In the Epidemiological Catchment Area study that examined 20 000 persons representative of the US population,

CD prior to age 15 was found to be much more common among men and women with schizophrenia than among those without a severe mental illness (Robins & Price, 1991; Robins *et al.* 1991; Robins, 1993). More recently, a follow-up of the Dunedin New Zealand birth cohort has reported that 40% of the cohort members who developed schizophrenic disorders by age 26 had fulfilled diagnostic criteria for CD prior to age 15 (Kim-Cohen *et al.* 2003). In clinical samples of persons with schizophrenia, the prevalence of CD varies depending on where the sample is recruited. For example, among well-functioning individuals with schizophrenia living in the community, 23% of the men and 17% of the women were found to have presented CD prior to age 15. In a sample of men with schizophrenia who had been found not guilty by reason of insanity for a criminal offence, 27% displayed CD prior to age 15. Among a representative sample of men with schizophrenia who were convicted for a criminal offence and received a sentence of 2 years or longer, 62% met

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criteria for CD prior to mid-adolescence (Hodgins *et al.* 1996).

Among persons without severe mental illness, CD in childhood is prognostic of poor outcomes in multiple domains in adulthood, including criminality, mental and physical health, violence in the home, and a lack of financial autonomy (Farrington *et al.* 1988; Moffitt *et al.* 2002; Fergusson *et al.* 2005; Odgers *et al.* 2007). When CD onsets prior to age 10 and is accompanied by low IQ, attention deficit hyperactivity disorder (ADHD), under-controlled temperament, maltreatment, low socio-economic status, and a mother with low IQ, adult outcomes across these domains are poorest (Odgers *et al.* 2007).

Among persons who develop schizophrenia and schizo-affective disorder, recent evidence suggests that CD prior to age 15 is associated with aggressive behaviour and violent crime up to middle age. We have reported on a multi-site study conducted in Canada, Finland, Germany and Sweden, of men with schizophrenia and schizo-affective disorder living in the community after discharge from in-patient general adult and forensic services (Hodgins *et al.* 2005). Patients were aged, on average, 38.6 years. The diagnosis of CD prior to age 15 was associated with a fourfold increase in the risk of convictions for non-violent crimes and a two and a half times increase in the risk of convictions for violent crimes. Importantly, the increased risks remained significant after controlling for lifetime diagnoses of alcohol and illicit drug abuse and dependence. More surprisingly, each symptom of CD prior to age 15 was associated with an increased risk in the numbers of convictions for non-violent and violent crimes and again the risks remained significantly elevated after controlling for history of substance abuse/dependence. We further examined these patients for 2 years when they were living in the community and collected information on physically aggressive behaviour towards others and both objective and subjective measures of alcohol and illicit drug use. Among these middle-aged men with schizophrenia or schizo-affective disorder, each CD symptom present before age 15 was significantly associated with an increased risk of aggressive behaviour after controlling for past diagnoses of substance abuse/dependence and current use of alcohol and illicit drugs.

These findings indicating that childhood CD continues to impact on men with schizophrenia well into middle age have been replicated. The Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) were conducted at 56 sites across the USA and included 1410 out-patients, three-quarters of whom were men with schizophrenia who had experienced at least one prior episode. Again, childhood

symptoms of CD predicted aggressive behaviour whereas substance misuse did not (Swanson *et al.* 2006). These findings concur with those from other studies of clinical samples of adults with schizophrenia (Mueser *et al.* 1997, 2006; Fulwiler & Ruthazer, 1999; Tengström *et al.* 2001), and from a study of the 39 persons in the Dunedin birth cohort who had developed a schizophrenic disorder by age 21 (Arseneault *et al.* 2000).

Most adolescents with CD misuse alcohol and/or illicit drugs (Armstrong & Costello, 2002) and their misuse begins at younger ages than that of youth who do not display conduct problems (Robins & McEvoy, 1990). Substance misuse persists across the lifespan (Odgers *et al.* 2007). Teasing apart the influence of conduct problems and substance misuse is difficult. Studies of siblings and twins suggest that substance misuse is one aspect of a child-onset lifelong syndrome of externalizing behaviours that is determined, in part, by genes (Rhee & Waldman, 2002). Many studies have reported an association between substance misuse and aggressive behaviour and criminality among persons with schizophrenia (for example, Eronen *et al.* 1996; Swartz *et al.* 1998), but these studies did not take account of CD. As noted above, investigations that assessed both CD prior to age 15, or conduct problems in childhood, and substance misuse observe that it is the childhood conduct problems rather than substance misuse that are associated with aggressive behaviour and criminality in adulthood (Rice & Harris, 1995; Tengström *et al.* 2004; Hodgins *et al.* 2005; Swanson *et al.* 2006).

Epidemiological investigations of large birth cohorts followed through adulthood have shown that persons who develop severe mental illness are at increased risk as compared to the other cohort members to commit both non-violent and violent crimes (Hodgins, 1992; Hodgins *et al.* 1996). This increased risk for criminality among persons with severe mental illness is due largely to persons with schizophrenia and schizo-affective disorders.

Among persons with schizophrenia, rates of non-violent and violent crime are increased as compared to the general population where they live. The association between schizophrenic disorders and aggressive behaviour is a robust finding. It has been reported by several independent research groups working in industrialized (Swanson *et al.* 1990; Arseneault *et al.* 2000; Brennan *et al.* 2000) and underdeveloped countries (Volavka *et al.* 1997) with distinct cultures, health, social service and criminal justice systems, who have examined different cohorts and samples using various experimental designs including prospective, longitudinal investigations of birth cohorts (Tiihonen *et al.* 1997; Arseneault *et al.* 2000; Brennan *et al.* 2000) and

population cohorts (Wallace *et al.* 2004), follow-up studies comparing patients and their neighbours (Belfrage, 1998), random samples of incarcerated offenders (Fazel & Danesh, 2002), and complete cohorts of homicide offenders (Erb *et al.* 2001). This population of offenders with schizophrenia is heterogeneous as to age of onset, persistence, and types of antisocial and aggressive behaviour (Hodgins & Müller-Isberner, 2004). Those characterized by conduct problems in childhood commit more crimes, and particularly more violent crimes than the others (Hodgins, 2004).

Externalizing problems often precede the onset of bipolar disorder (Geller *et al.* 1992; Carlson & Weintraub, 1993). There is no evidence, however, that the childhood and adolescent conduct problems are antecedents of aggressive behaviours in adults with bipolar disorder. A small group of children and adolescents present both conduct problems and depression. In many cases, both problems persist into adulthood (Fombonne *et al.* 2001). The epidemiological investigations of large birth cohorts that compared the prevalence of criminality among severely mentally ill and non-ill persons were conducted before bipolar disorder and major depression were distinguished in diagnostic classifications. The largest of these studies included more than 358 000 persons followed into their early forties. Affective psychosis was associated with an increased risk of violent crime but this association only held among patients with co-morbid substance misuse (Brennan *et al.* 2000).

Despite the available evidence that has accumulated regarding aggressive behaviour among people with severe mental illness, mental health policy (Department of Health, 1999; Royal College of Psychiatrists and British Psychological Society, 2003) in the UK fails to address the issue, as do general adult psychiatric services. There has been a dramatic increase in the numbers of forensic psychiatric beds in the UK and across Europe (Priebe *et al.* 2005). Most of these beds are filled with men who suffer from schizophrenia or schizo-affective disorder, most of whom were previously treated in general adult services for many years, during which time they were committing many crimes (Grounds *et al.* 2004; Hodgins & Müller-Isberner, 2004; Scott *et al.* 2004). If antisocial behaviour was identified and treated earlier in the course of psychosis, much crime might be prevented along with the subsequent transfer to costly forensic services.

Evidence also shows that persons with severe mental illness are more likely than others to be the victims of physical assaults (Teplin *et al.* 2005). One of the strongest predictors of physical victimization is aggressive behaviour (Silver *et al.* 2002; Walsh *et al.* 2003; Hodgins *et al.* unpublished observations), along

with neighbourhood social deprivation (Silver *et al.* 2002). Again, however, neither mental health policy nor practice attends to these elevated rates of victimization and the impact on compliance with treatments for the severe mental illness is unknown.

The present study

The present study examined the association between a diagnosis of CD and CD symptoms prior to age 15 on aggressive behaviour, criminality and victimization in a sample of severely mentally ill in-patients in a socially deprived urban area in the UK. The study aimed to: (1) replicate findings from studies in other countries with different health and criminal justice systems and rates of crime showing an association between CD diagnosis and symptoms prior to age 15 and aggressive behaviour and crime in adulthood among persons with severe mental illness; (2) extend previous findings by examining the association of CD prior to age 15 on aggressive behaviour and crime by women with severe mental illness; and (3) validate the usefulness of the CD module of the Structured Clinical Interview for DSM-IV (SDID) in a clinical setting to identify severely mentally ill patients who present an elevated risk of aggressive behaviour and criminality. Many studies have reported dose-response relationships between the number of CD symptoms and adult outcomes such as schizophrenia (Robins & Price, 1991), antisocial behaviour (Robins *et al.* 1991) and drug use (Robins & McEvoy, 1990). Consequently, throughout we examine the associations between both the diagnosis of CD and the number of CD symptoms and our outcomes of interest.

Method

Between July 2004 and April 2005, we assessed all of the patients ($n=325$) on general adult psychiatric wards of an inner-city mental health trust providing services to a catchment area of 1 105 200 inhabitants. Patients with the following characteristics were invited to participate in the study: legal resident; able to communicate in English; 18–65 years old; principal diagnosis of schizophrenia, schizo-affective disorder, bipolar disorder, major depression, non-toxic psychosis. Forty-nine patients did not meet these inclusion criteria: 21 had other diagnoses, 18 were not UK residents, eight were too old or too young, and two were mute. Of the remaining 276, 21 (7.6%) were discharged before they could be invited to participate, 50 (18.1%) refused to participate, and 205 consented. All 205 completed an interview, authorized their careworker to provide information about them, and authorized access to their medical and criminal records.

The research team arranged with each ward to assess all patients during a 2-week period. Upon arrival on the ward, a census of the patients was made. All patients meeting the eligibility criteria were invited to participate. If the patient consented, researchers first read the patient's file, conducted the interview with the patient, and then interviewed the key worker. Patients too ill to consent were contacted when symptoms had remitted. Family members were contacted, most often by telephone, and if they agreed the interview was completed. It quickly became apparent, however, that the majority of patients did not know how to contact their parents or elder siblings. Only two-thirds (68.8%) of the patients named an individual who they thought could provide information about them. For only 20.5% of the sample, a collateral informant was found and interviewed about the patient's childhood. For 24.4% of the sample a collateral was interviewed about the patient's aggressive behaviour and victimization during the 6 months prior to the interview. Information was also extracted from psychiatric and criminal records.

Sociodemographic information was collected from patients and files. Histories of psychiatric treatment were documented from medical files. The interview with the patient included two modules (CD and Antisocial Personality Disorder) of the SCID (First *et al.* 1996) and self-reports of aggressive behaviour using the MacArthur Community Violence Instrument (Steadman *et al.* 1998), and of substance misuse using the Alcohol Use Disorders Identification Test (AUDIT; Saunders *et al.* 1993) and the Drug Use Disorders Identification Test (DUDIT; Berman *et al.* 2005). Interviews were conducted by a consultant forensic psychiatrist, a specialist registrar in forensic psychiatry, and two research workers with M.Sc. degrees, one in psychology and one in criminology. Interviewers were trained to use each instrument. All interviews were video-taped and 19 were selected randomly for independent rating. Inter-rater reliability was high: the intra-class correlation for number of CD symptoms was 0.985 and κ for CD diagnosis equalled 0.787.

The final sample included 120 men and 85 women aged, on average, 38.5 years. More than one-quarter (28.4%) of these patients had been born outside of the UK. One-third had no educational qualifications, 36.8% had GSEs and 30.4% had completed A-levels. More than one-half (52.9%) lived in their own home and 11.8% were homeless. Most (79.8%) had previously been in-patients and 60.5% were currently held on the ward involuntarily. Most (73.7%) of the patients had a primary diagnosis of schizophrenia or schizo-affective disorder, 18.5% bipolar disorder, 4.4% major depression, and 3.4% other psychosis.

As recommended, alcohol misuse was defined as an AUDIT score of 8 for men and 6 for women, alcohol dependence as an AUDIT score of 16, drug misuse as a DUDIT score of 6 for men and 2 for women, and drug dependence as a DUDIT score of 25 for men and women (Berman *et al.* 2005). Fifty-four per cent of the patients did not fulfil criteria for misuse of alcohol and/or illicit drugs.

Serious assaults over the lifespan were defined as killing, injuring another person so seriously that they required in-patient hospital care, using a gun, knife or other object to injure someone. One-third (33.2%) of the patients reported having engaged in at least one serious assault over the lifespan. Serious aggressive behaviour during the previous 6 months was defined as hitting, beating, forcing someone to have sexual relations against their will, threatening someone with a weapon, using a gun or knife to injure someone, or causing someone to be unconscious, inflicting internal injuries, broken bones, or death. Forty-five per cent of the patients reported engaging in at least one incident of aggressive behaviour in the past 6 months. Victimization during the previous 6 months was defined as having been a victim of any of the above and was reported by 53.2% of the patients. The prevalence of CD was similar across diagnostic groups: 35.3% of those with schizophrenia or schizo-affective disorder, 26.3% of those with bipolar disorder and three of the nine patients with major depression fulfilled criteria for CD prior to age 15.

Criminal records were obtained from the Home Office Offenders Index and from the Police National Computer base. If an offence was recorded in only one of the databases, it was counted as an offence. More than half (51.2%) of the patients had a record of at least one conviction. Violent crimes were defined as crimes included in the Offender Index categories violence against the person, sexual offences minus prostitution-related offences, and robbery. Forty-seven per cent of the patients had at least one conviction for a violent crime. All other crimes were defined as non-violent.

Results

Among the severely mentally ill men, 42% fulfilled the criteria for CD prior to age 15 and the mean number of symptoms was 2.68 (s.d.=3.09). Among the women, 22.4% fulfilled criteria for the diagnosis of CD and the mean number of symptoms was 1.27 (s.d.=2.12). Comparisons of patients with and without CD diagnoses are presented in Table 1. Among these severely mentally ill patients, those with CD, as compared to those without CD, included greater proportions of men and greater proportions with substance abuse and/or dependence. Those with CD were younger

Table 1. Characteristics of the patients

	CD prior to age 15 (n = 69)	No CD (n = 135)	Test
% Male	72.5 (50/69)	48.9 (66/135)	$\chi^2(1, n = 204) = 8.57, p = 0.003$
Mean (s.d.) age (years)	34.30 (10.96)	40.72 (12.61)	Mann-Whitney, $z = 3.44, p = 0.007$
% born outside the UK	23.2 (53/69)	31.3 (42/134)	$\chi^2(1, n = 203) = 1.48, p = 0.223$
Education (%)			
Compulsory secondary education	37.7 (26/69)	36.3 (49/135)	$\chi^2(2, n = 204) = 8.19, p = 0.017$
College or above	18.8 (13/69)	36.3 (49/135)	
Accommodation (%)			
Own home	48.5 (33/68)	55.6 (75/135)	
Hostel	13.2 (9/68)	10.4 (14/135)	
Parents' home	7.4 (5/68)	10.4 (14/135)	$\chi^2(4, n = 203) = 2.16, p = 0.706$
Homeless	14.7 (10/68)	10.4 (14/135)	
Other	16.2 (11/68)	13.3 (18/135)	
Have children (%)	35.3 (24/68)	43.6 (58/133)	$\chi^2(1, n = 201) = 1.29, p = 0.256$
Parents and/or siblings with			
Mental illness (%)	44.8 (30/67)	29.9 (40/134)	$\chi^2(1, n = 201) = 4.38, p = 0.036$
At least one criminal conviction (%)	30.4 (21/69)	14.9 (20/134)	$\chi^2(1, n = 203) = 6.80, p = 0.009$
Principal diagnosis (%)			
Schizophrenia	71.0 (49/69)	61.5 (83/135)	
Schizo-affective disorder	5.8 (4/69)	10.4 (14/135)	
Bipolar disorder	14.5 (10/69)	20.7 (28/135)	
Depression	4.4 (3/69)	4.4 (6/135)	$\chi^2(4, n = 204) = 2.94, p = 0.568$
Other	4.4 (3/69)	3.0 (4/135)	
Substance misuse (%)			
No substance misuse	20.0 (12/60)	55.5 (71/128)	$\chi^2(1, n = 188) = 20.84, p = 0.000$
Alcohol misuse	48.3 (29/60)	27.3 (35/128)	$\chi^2(1, n = 188) = 8.01, p = 0.005$
Alcohol dependence	26.7 (16/60)	6.3 (8/128)	$\chi^2(1, n = 188) = 15.29, p = 0.000$
Drug misuse	71.7 (43/60)	31.3 (40/128)	$\chi^2(1, n = 188) = 27.06, p = 0.000$
Drug dependence	23.3 (14/60)	6.3 (8/128)	$\chi^2(1, n = 188) = 11.54, p = 0.001$
Prior in-patient treatment			
% for whom this was the first admission	17.7 (12/68)	20.2 (27/134)	$\chi^2(1, n = 202) = 0.18, p = 0.670$
Mean (s.d.) length of in-patient stay prior to interview (in days)	123.43 (172.67)	109.21 (156.54)	$z = -0.08, p = 0.935$
Legal status at admission			
% involuntary admission	57.1 (36/63)	61.9 (78/126)	$\chi^2(1, n = 189) = 0.40, p = 0.528$

CD, Conduct disorder; s.d., standard deviation.

and more poorly educated than those with no history of CD. The parents and siblings of patients with CD, as compared to those without, had higher rates of mental illness and of criminality. There was no difference between patients with and without CD as to the proportions born outside the UK, type of accommodation, legal status during in-patient stay, and principal diagnosis.

As presented in Table 2, the severely mentally ill patients characterized by CD prior to age 15 had significantly higher rates of aggressive behaviour towards others, victimization, and criminal convictions than the patients without a childhood history of CD.

The associations, expressed as odds ratios (ORs), of alcohol use, illicit drug use, CD diagnosis and number of CD symptoms with assaultive behaviour and victimization are presented in Table 3. All analyses control for sex and age. CD diagnosis and CD symptoms that were present prior to age 15 were associated with aggressive behaviour and violent crime in adulthood, after controlling for alcohol and illicit drug use. Alcohol use was not associated with serious assaults over the lifespan, serious assaults in the past 6 months, or being a victim of an assault in the past 6 months after controlling for CD diagnosis and illicit drug use or CD symptoms and illicit drug use. By contrast, illicit

Table 2. Violent acts, victimization, and criminal offending

	CD prior to age 15	No CD	Test
Engaged in at least one serious assault over lifetime (%)	63.8	17.8	$\chi^2(1, n=204)=43.46, p=0.000$
Engaged in at least one serious assault during past 6 months (%)	37.7	11.9	$\chi^2(1, n=204)=18.63, p=0.000$
Victim of at least one assault during past 6 months (%)	66.7	46.7	$\chi^2(1, n=204)=7.34, p=0.007$
At least one criminal conviction (%)	76.8	37.8	$\chi^2(1, n=204)=19.93, p=0.000$
At least one conviction for a non-violent offence (%)	71.0	34.1	$\chi^2(1, n=204)=25.04, p=0.000$
At least one conviction for a violent offence (%)	55.1	23.7	$\chi^2(1, n=204)=19.93, p=0.000$
Among the offenders, mean number (s.d.) of non-violent offences	12.47 (15.5)	8.51 (16.3)	Mann-Whitney, $z = -5.30, p=0.000$
Among the offenders, mean number (s.d.) of violent offences	2.38 (3.4)	2.10 (3.17)	Mann-Whitney, $z = -4.44, p=0.000$

CD, Conduct disorder; s.d., standard deviation.

Table 3. Odds ratios (and 95% confidence intervals) for risks of physical aggression towards others and of physical victimization among patients with severe mental illness conferred by a diagnosis of conduct disorder (CD), number of CD symptoms, alcohol and illicit drug use

	Lifespan	Previous 6 months	
	Engaged in at least one serious assault	Engaged in at least one serious assault	Victim of at least one serious assault
Alcohol use (per unit score on the AUDIT)	1.04 (1.00–1.09)	1.04 (1.00–1.08)	1.01 (0.98–1.05)
Alcohol use (per unit score on the AUDIT) controlling for drug use and CD	1.00 (0.95–1.05)	0.99 (0.95–1.04)	1.00 (0.95–1.04)
Alcohol use (per unit score on the AUDIT) controlling for drug use and CD symptoms	0.99 (0.94–1.04)	0.99 (0.94–1.04)	1.00 (0.95–1.04)
Illicit drug use (per unit score on the DUDIT)	1.06 (1.03–1.10)	1.06 (1.03–1.09)	1.02 (0.99–1.05)
Drug use (per unit score on the DUDIT) controlling for alcohol use and CD	1.05 (1.01–1.09)	1.04 (1.01–1.08)	1.01 (0.98–1.04)
Drug use (per unit score on the DUDIT) controlling for alcohol use and CD symptoms	1.04 (1.00–1.08)	1.03 (1.00–1.07)	1.01 (0.98–1.04)
CD diagnosis prior to age 15	7.03 (3.54–13.95)	3.89 (2.03–7.43)	2.19 (1.18–4.05)
CD diagnosis prior to age 15 controlling for alcohol and illicit drug use	3.98 (1.87–8.44)	2.66 (1.24–5.68)	1.92 (0.96–1.86)
Number of CD symptoms prior to age 15	1.62 (1.38–1.90)	1.33 (1.18–1.51)	1.16 (1.03, 1.29)
Number of CD symptoms prior to age 15 controlling for alcohol and illicit drug use	1.49 (1.25–1.77)	1.29 (1.11–1.50)	1.12 (0.98–1.29)

AUDIT, Alcohol Use Disorders Identification Test; DUDIT, Drug Use Disorders Identification Test.

All analyses control for age and sex.

drug use continued to be associated with aggressive behaviour after controlling for CD diagnosis and alcohol use and CD symptoms and alcohol use. CD diagnosis, after controlling for alcohol and illicit drug use, was associated with a fourfold increase in the risk of a serious assault over the lifespan and a two and a half times increase in the risk of a serious assault in the past 6 months. Each CD symptom present before

the age of 15 was associated with a 1.5-fold increase in the risk of a serious assault over the lifespan and with a 1.3-fold increase in the risk of assaults in the past 6 months. The interaction terms, CD diagnosis or number of CD symptoms and sex, scores for alcohol and illicit drug use, were not associated with serious assaults over the lifespan, assaults or victimization in the past 6 months. Neither alcohol misuse, illicit drug

Table 4. Odds ratios (and 95% confidence intervals) for risks of criminal convictions among patients with severe mental illness conferred by a diagnosis of conduct disorder (CD) and number of CD symptoms before age 15, alcohol and illicit drug use

	Any criminal conviction	A conviction for a non-violent crime	A conviction for a violent crime
Alcohol use (per unit score on the AUDIT)	1.04 (1.00–1.09)	1.05 (1.00–1.09)	1.04 (1.00–1.09)
Illicit drug use (per unit score on the DUDIT)	1.03 (1.00–1.06)	1.04 (1.01–1.08)	1.04 (1.00–1.07)
CD diagnosis prior to age 15	5.67 (2.70–11.91)	4.81 (2.37–9.78)	3.53 (1.80–6.93)
CD diagnosis prior to age 15 controlling for alcohol use (per unit score on the AUDIT) and illicit drug use (per unit score on the DUDIT)	4.36 (1.92–9.90)	3.19 (1.46–6.97)	2.50 (1.17–5.36)
Number of CD symptoms prior to age 15	1.32 (1.14–1.52)	1.29 (1.13–1.48)	1.27 (1.12–1.43)
Number of CD symptoms prior to age 15 controlling for alcohol use (per unit score on the AUDIT) and illicit drug use (per unit score on the DUDIT)	1.23 (1.05–1.45)	1.17 (1.01–1.37)	1.16 (1.01–1.35)

AUDIT, Alcohol Use Disorders Identification Test; DUDIT, Drug Use Disorders Identification Test.
All analyses control for age and sex.

use nor CD diagnosis or symptoms was associated with victimization.

The associations, expressed as ORs, of alcohol use, illicit drug use, CD diagnosis prior to age 15 and number of CD symptoms with criminal convictions are presented in Table 4. Again, sex and age were controlled in all analyses. The associations of alcohol and illicit drug use with convictions for any crime, non-violent and violent crime disappeared after controlling for CD diagnosis and CD symptoms prior to age 15. A diagnosis of CD prior to age 15 was associated with a fivefold increase in the risk of any conviction, with a fivefold increase in the risk of conviction for a non-violent offence, and with a 2.5-fold increase in the risk of a conviction for a violent offence, after controlling for alcohol and illicit drug use. Each CD symptom present prior to age 15 was associated with an increase in the risk of any conviction, a conviction for a non-violent offence, and a conviction for a violent crime, after controlling for alcohol and illicit drug use. The interaction terms, CD diagnosis or number of CD symptoms and sex, scores for alcohol and illicit drug use, were not associated with any conviction, convictions for non-violent or violent offence.

Discussion

We examined a representative sample of in-patients with severe mental illness in an inner-city mental health trust. Forty-two per cent of the men and 22% of the women were characterized by a history of CD. Among the men, the rates of CD were higher than

those previously reported for other clinical samples, while among the women the rate was similar to that observed in other samples (Hodgins *et al.* 1998, 2005). The prevalence of CD among the male patients with severe mental illness was, however, similar to that reported for members of the Dunedin cohort who at age 26 presented schizophrenic disorders (Kim-Cohen *et al.* 2003). The mental health trust studied provides services to four inner-city boroughs that rank high on a measure of social deprivation (ODPM, 2004). While we have no information on where the patients lived as children, it is known that the prevalence rates of CD increase with the level of social deprivation (Meltzer *et al.* 2003).

The results of the present study confirm and extend previous findings indicating that CD present prior to age 15 has long-term consequences for both men and women who subsequently develop severe mental illness. The subgroup of patients with CD prior to age 15 were more likely than the others to engage in assaults and to have been convicted of non-violent and violent crimes. Consistent with results from a previous study (Hodgins *et al.* 2005), each CD symptom present before age 15 was associated with an increased risk of assaults and criminal convictions through adulthood after taking account of alcohol and illicit drug use. This finding demonstrates again that even a few symptoms of CD in childhood or adolescence increased the likelihood of aggressive behaviour and violent crime in adulthood. Similarly, in the CATIE trial of patients with schizophrenia, two or more CD symptoms remained associated with aggressive behaviour in the past 6 months after controlling for

substance misuse (Swanson *et al.* 2006). Thus, in a UK sample of in-patients with severe mental illness, a diagnosis of CD and the number of CD symptoms prior to age 15 continued to be associated with aggressive behaviour and criminal activity into middle age. While the proportion of female patients with CD was only half that observed among the male patients, the associations of CD with lifelong patterns of aggressive behaviour and crime did not differ by sex.

Although the long-term negative outcomes of CD in general population cohorts has been well documented (Farrington *et al.* 1988; Ferguson *et al.* 2000; Moffitt *et al.* 2002; Odgers *et al.* 2007), these recent findings confirm that among both men and women who develop severe mental illness, CD is a precursor of persistent antisocial and aggressive behaviour and criminality. Aggressive behaviour and criminality have serious consequences, particularly for persons with severe mental illness. They lead to incarceration in prisons where violence is common and treatment of severe mental illness is limited (Wolf *et al.* 2007). Aggressive behaviour and crime by persons with severe mental illness also leads to rejection from certain types of mental health services and supported accommodation. In addition, aggressive behaviour is associated with being the victim of an assault. In the sample from the present study, having engaged in aggressive behaviour in the prior 6 months was associated with a sixfold increase [OR 6.57, 95% confidence interval (CI) 3.51–12.28] in victimization experiences in the same period (Hodgins *et al.* 2007a). Patients with severe mental illness who have a history of CD display antisocial attitudes as well as antisocial behaviours. These attitudes and behaviours limit the extent to which they will follow the advice of mental health professionals who care for them.

Findings from the present study concur with those from other recent investigations showing that among patients with severe mental illness, those with prior CD, as compared to those without, are more likely to be abusing alcohol and/or illicit drugs. Results from the present study also concur with those from previous investigations, showing that substance abuse is not associated with aggressive behaviour and criminal activity among those with prior CD. By contrast, in patients with no history of conduct problems prior to onset of severe mental illness, substance misuse may be more directly related to aggressive behaviour (Mueser *et al.* 2006). These findings demonstrate again that among people with severe mental illness who engage in aggressive behaviour and criminality, there are several subgroups who probably have distinct aetiologies and responses to treatment (Hodgins & Müller-Isberner, 2004; Hodgins, *in press*). The findings from the present study also suggest that among

the subgroup of severely mentally ill patients with a history of CD, reducing substance misuse will not be sufficient to eliminate the antisocial and aggressive behaviours.

More of the severely mentally ill patients with, than without, a history of CD were victims of assaults in the 6 months prior to interview, consistent with a report from the CATIE trial (Swanson *et al.* 2007). However, neither the diagnosis of CD nor the number of CD symptoms was associated with victimization after controlling for substance alcohol and illicit drug use. It may be that individuals who are using alcohol and illicit drugs put themselves into situations where the risk of victimization is increased. It is known that persons with severe mental illness are at increased risk, as compared to the general population, of being victims of aggressive behaviours and crimes (Teplin *et al.* 2005). In addition, three studies have shown that among severely mentally ill patients, aggressive behaviour is a significant predictor of victimization (Silver *et al.* 2002; Walsh *et al.* 2003; Hodgins *et al.* 2007a). We hypothesize that certain environments foster, even teach, the use of aggressive behaviour to solve problems. Research is urgently needed to understand the link between victimization and aggressive behaviour among persons with severe mental illness and to identify the factors associated with reductions in both.

Strengths and limitations of the present study

The strengths of the study include examination of a complete cohort of in-patients with severe mental illness within one mental health trust, a relatively high participation rate, self-reports of aggressive behaviour and victimization using a standardized diagnostic instrument, and use of official criminal records. Aggressive behaviour was measured using the same instrument that had been used in previous studies (Hodgins *et al.* 2005; Swanson *et al.* 2006). Weaknesses include the low rate of participation of collateral informants that may have resulted in underestimates of aggressive behaviour. The mental health trust studied provides services to four boroughs. In the period that patients were recruited into the study, two of these boroughs had crime rates higher than the national average and two had similar rates (Nicolas *et al.* 2004/2005). Consequently, the proportions of patients with criminal records and who experienced victimization may be higher than in similar samples recruited from areas with lower crime rates. The associations that were observed between CD diagnosis and CD symptoms prior to age 15 and aggressive behaviour and violent crime in adulthood are probably generalizable to other samples of severely mentally ill patients. The

sample was not large enough to examine the association of CD and later aggressive behaviour and criminality by type of severe mental illness.

Implications for general adult services

The study showed that among severely mentally ill patients requiring hospitalization in the inner city, a subgroup have a long history of antisocial and aggressive behaviours. These patients are easily identifiable, as we have shown, simply by conducting the interview for the CD and antisocial personality disorder modules of the SCID. Once identified, however, their characteristics suggest that they might benefit from interventions that address their multiple problems including aggressive behaviour, substance abuse, and a lack of pro-social and employment skills. Cognitive-behavioural programmes have been shown to be effective in reducing these problems among non-mentally ill persons (Hollin, 2004) and they are currently being adapted and evaluated for use with severely mentally ill patients. Importantly, some evidence suggests that men with schizophrenia and prior CD are less compromised neurologically than other patients with schizophrenia, making them good candidates for learning-based interventions (Naudts & Hodgins, 2006). Engagement with mental health services is a major challenge, however, with this subgroup of patients. Such programmes cannot be undertaken until psychotic symptoms are reduced and patients are compliant with medication. Community care orders coupled with adequate neuroleptic treatment have been shown to be associated with reductions in aggressive behaviour of patients living in the community (Swartz & Swanson, 2004). Two studies have demonstrated reductions in aggressive behaviour in the community with the use of atypical neuroleptic medications (Swanson *et al.* 2004*a,b*). Another study has shown that aggressive patients with schizophrenia show greater reductions in positive and negative symptoms with clozapine than patients who do not engage in aggressive behaviour (Volavka *et al.* 2004). In addition, follow-up studies of community programmes that identify and manage the risk for violence achieve good outcomes (Heilbrun & Peters, 2000; Hodgins *et al.* 2007*b*). Patients with severe mental illness and childhood CD commit more crimes than other patients with severe mental illness (Hodgins, 2004). Furthermore, they persist in committing crimes while in and out of general adult services and are eventually transferred to in-patient forensic services (Hodgins & Müller-Isberner, 2004; Hodgins *et al.* 2006). By identifying this subgroup of patients with severe mental illness at first contact with services and providing them with an intensive and

structured package of interventions, it might be possible to reduce their criminal activities and thereby reduce the numbers of transfers to expensive forensic beds, and increase compliance with medication that would in turn reduce readmissions.

Childhood interventions

Although it is known that parent training programmes are effective in reducing conduct problems among children (Farmer *et al.* 2002; Scott & Davies, 1999), it is not known whether children with conduct problems who are developing severe mental illnesses would benefit from such interventions. Interventions in childhood designed to reduce conduct problems and to teach pro-social skills would, if effective, prevent the development of substance misuse and of persistent antisocial and aggressive behaviour. The absence of antisocial behaviour and substance misuse, and the addition of pro-social skills, would also make it easier for the individual to cope with severe mental illness.

Implications for research on aetiology

It is currently not known why CD is more prevalent among persons who develop schizophrenia than in the general population. Results from the present study confirmed previous findings showing elevated rates of criminality among the parents and siblings of the severely mentally ill patients with a history of CD (Mueser *et al.* 1999; Tengström *et al.* 2001; Hodgins *et al.* 2005). Previous studies have also shown elevated rates of substance misuse among the parents of persons with schizophrenia and a history of childhood conduct problems. These elevated rates of crime and substance misuse among the first-degree relatives of the subgroup of patients with severe mental illness and childhood CD could reflect a distinct genetic loading. Many twin and family studies have confirmed a genetic contribution to an early-onset stable pattern of antisocial behaviour (Rhee & Waldman, 2002). However, suggesting that these individuals inherit a vulnerability for CD as well as for schizophrenia fails to explain why CD is more prevalent among persons with than without schizophrenia.

Criminality and substance misuse among the parents may be associated with poor parenting practices and failure to teach the offspring how to cope with stress in a healthy manner. When children with CD enter adolescence and begin experiencing prodromal symptoms such as anxiety, they may lack, even more than other adolescents developing psychosis, effective cognitive and behavioural coping skills. They may then begin taking illicit drugs, such as cannabis, in an effort to diminish prodromal symptoms. As heavy cannabis use has been associated with increased risk

of schizophrenia (Zammit *et al.* 2002; Arseneault *et al.* 2005), the presence of CD may have contributed to the development of schizophrenia.

It may also be that children carrying the susceptibility genes for severe mental illness are more likely than other children to be exposed to specific environmental factors that interact with specific genes to promote early-onset stable antisocial behaviour. For example, physical abuse in childhood is more common among individuals who subsequently develop severe mental illness than others (Bebbington *et al.* 2004), and in a previous study, we found that it is most common among those with a history of CD prior to age 15. Three studies have now reported that among individuals who carry the low activity allele of the genetic polymorphism encoding monoamine oxidase A, physical abuse in childhood is associated with CD and violent offending in adulthood (Caspi *et al.* 2002; Foley *et al.* 2004; Widom & Brzustowicz, 2006). It could be that parents who carry the susceptibility genes for severe mental illness are more likely than parents without such genes to engage in behaviours such as physical maltreatment (Caspi *et al.* 2002), maternal hostility (Caspi *et al.* 2004) and smoking during pregnancy (Maughan *et al.* 2004) that are known to contribute to the development of antisocial behaviour. Given the very negative impact of childhood conduct problems on the lives of individuals who develop severe mental illnesses, it is essential to undertake longitudinal prospective studies to identify potential targets for prevention.

The future

In the present study, more than one-third of the severely mentally ill patients with a history of CD had children. These children are at increased risk of displaying antisocial behaviour and developing severe mental illness as a consequence of both genetic inheritance and parenting practices. Effective interventions targeting known precursors such as physical abuse, early cannabis use, aggressive behaviour, and early symptoms of the severe mental illness could lead to significant reductions in human suffering and costs to society. The available evidence strongly suggests that doing nothing will lead to the creation of another cohort of patients similar to the one examined here.

Acknowledgements

The study was supported by a grant from the R&D programme of the South London and Maudsley Mental Health Trust. The authors thank the patients, family members and staff who contributed to the project.

Declaration of Interest

None.

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