Risk Factors for Violent Crime in Schizophrenia: A National Cohort Study of 13,806 Patients

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Objective: To determine risk factors for and prevalence of violent crime in patients with schizophrenia, and in particular, to explore the contribution of familial risk factors.

Method: We designed a cohort study that followed up patients with 2 or more hospitalizations for schizophrenia (ICD-8, ICD-9, and ICD-10 criteria) and investigated the risk for a violent conviction using Cox proportional hazards models. All 13,806 patients with 2 hospital discharge diagnoses of schizophrenia from January 1, 1973, through December 31, 2004, in Sweden were followed until violent conviction, emigration, death, or end of follow-up (December 31, 2004), and associations with sociodemographic, individual (substance abuse comorbidity, and previous violence), and familial (parental violent crime and parental alcohol abuse) factors were examined.

Results: Over an average follow-up period of 12 years, 17.1% (N = 1519) of the men and 5.6% (N = 273) of the women with 2 or more hospitalizations for schizophrenia had a violent conviction after discharge from hospital. Familial risk factors had moderate effects, increasing the risk for violent convictions by 50% to 150%. After adjustment for sociodemographic and individual risk factors, the associations between parental violent crime and risk of violent convictions remained in men (adjusted hazard ratio [HR] = 1.65, 95% CI = 1.33 to 2.04) and in women (adjusted HR = 1.83, 95% CI = 1.11 to 3.01), whereas parental alcohol abuse was no longer significantly associated with violent crime.

Conclusion: Parental violent crime had moderate associations with violent crime in male and female offspring with at least 2 hospitalizations for schizophrenia, which were mostly stronger than the better documented sociodemographic risk factors. This suggests that familial (genetic or early environmental) risk factors have an important role in the etiology of violent offending among individuals with schizophrenia and should be considered in violence risk assessment.

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High rates of violence committed by individuals with schizophrenia have been widely reported. Retrospective studies conducted in the United States[1,2] and Europe[3] have found that 20%–50% of individuals with schizophrenia have perpetrated major violent acts in the previous 6 months, and prospective studies have estimated that 20%–25% of psychiatric patients are violent within 2 years of follow-up.[4,5] Risk factors for violence in schizophrenia include previous violence,[2,5] young age,[2] poor educational attainment,[6] substance abuse,[1,7] treatment adherence,[8,9] recent victimization,[2] comorbid psychopathic traits,[10] and childhood conduct disorder.[2]

Despite the interest in the role of genetic and early environmental risk factors for violence in general population samples,[11,12] little is known about the contribution of these risk factors to violence in schizophrenia. An important contribution has come from the MacArthur Risk Assessment study, which followed psychiatric patients, 194 (20%) of whom had schizophrenia, for 1 year after discharge from inpatient facilities and examined a wide range of risk factors for violence.[13] Among the novel risk factors for violence examined were family history variables. Strong associations between paternal substance abuse and paternal criminality and subsequent violence in the patients were reported.[13] However, these associations were not adjusted for possible confounders, and the role of these family history variables requires further investigation. Furthermore, information on familial factors in the MacArthur study came from interviews with inpatients that were acutely ill rather than from independent and potentially more reliable sources.

We conducted a national longitudinal study of 13,806 patients discharged from hospital in Sweden with

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FOR CLINICAL USE

- In predicting future violent crime in patients with schizophrenia, previous violence and comorbid substance abuse are strong predictors in both men and women.
- Clinicians need to inquire about any family history of substance abuse or violence, as these factors are also helpful to identify patients with schizophrenia at high risk for future violent crime.
- Particular attention should be given to those factors that are potentially treatable, including comorbidity with drug and alcohol abuse.

diagnoses of schizophrenia on 2 or more occasions to examine risk factors associated with violent crime and, in particular, to investigate the role of familial factors. This study has a number of strengths. First, we examined associations with violence longitudinally after schizophrenia had been diagnosed. Second, risk factors in women with schizophrenia were investigated, for which there have been few previous investigations. Third, information on familial factors was drawn from high quality national longitudinal registers. Fourth, the sample size was several orders of magnitude larger than previous studies, yielding more precise estimates. With a potential follow-up period of up to 33 years, this is, to our knowledge, the longest and largest study of risk factors for violence in schizophrenia.

METHOD

Study Setting

We linked several nationwide population-based registries in Sweden: The Hospital Discharge Registry (HDR; held at the National Board of Health and Welfare), The Migration Register (Statistics Sweden), the Cause of Death Register (National Board of Health and Welfare), the National Crime Register (National Council for Crime Prevention), Education Registers (Statistics Sweden), the National Censuses from 1970 and 1990 (Statistics Sweden), and the Multi-Generation Register (MGR; Statistics Sweden). In Sweden, all residents, including immigrants, have a unique 10-digit personal identification number that is used in all national registers, thus making linking of data in these registers possible.

The HDR includes data on all individuals admitted to any hospital for assessment and/or treatment in Sweden (including secure hospitals and the few private providers of inpatient healthcare). We identified all 13,806 individuals aged 15 years and older who had been discharged from hospitals from January 1, 1973, to December 31, 2004, and who had been diagnosed with schizophrenia on at least 2 separate occasions. Diagnoses were based on the *International Classification of Diseases, Eighth Revision* (ICD-8) (1973–1986, code 295), ICD-9 (1987–1996, code 295) and ICD-10 (1997–2004, code F20). Two diagnoses were used as part of our inclusion criteria to increase diagnostic precision by minimizing false-positive diagnoses. These patients were followed longitudinally after their second discharge until the first conviction for a violent offense (see Outcome Measures for definition) or were censored due to emigration (according to the Migration Register), death from any cause (according to the Cause of Death Register), or end of follow-up (Dec. 31, 2004).

Schizophrenia diagnoses in the HDR concord well with diagnoses obtained by an OPCRIT[14] record review and interview (generating a DSM-IV diagnosis of schizophrenia) reflected in κ values of 0.74–0.76.[15] In another study, 86% of HDR schizophrenia diagnoses corresponded with diagnoses of DSM-IV schizophrenia syndrome made from file-based reviews by psychiatrists.[16] However, the specificity is poor to fair.[15] Hence, some individuals with an HDR schizophrenia diagnosis will be diagnosed with other mental disorders in any 1 inpatient episode, which led to our decision to use diagnoses on 2 different occasions to define cases. Only around 1% of hospital discharges have missing personal identification numbers.[17] Because of these quality indicators, the HDR has been used in a variety of recent psychiatric epidemiologic investigations.[17–19]

Outcome Measures

Data on all convictions for violent crime during the years 1973–2004 were retrieved for all individuals in the cohort from the National Crime Register, which includes conviction data on all persons aged 15 years (the age of criminal responsibility) and older. Violent crime was defined as homicide and attempted homicide, aggravated assault (an assault that is life-threatening in nature or causes severe bodily harm), common assault, robbery, arson, any sexual offense (rape, sexual coercion, child molestation, and sexual harassment [including indecent exposure]), and illegal threats or intimidation.[17]

Conviction data were used because the Criminal Code in Sweden determines that individuals are convicted as guilty regardless of mental illness (i.e., being judged as not guilty by reason of insanity is not possible). Thus, conviction data included persons who received custodial

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or noncustodial sentences and individuals transferred to forensic hospital (e.g., individuals who were psychiatrically assessed and thought to have suffered from psychosis or other severe mental disorder at the time of the offense). Furthermore, conviction data included those cases in which the prosecutor decided to caution or fine (e.g., less serious sexual crimes and some juvenile cases). In addition, as plea-bargaining is not permitted in the Swedish legal system, conviction data more accurately reflect the extent of officially resolved criminality in the population. The crime register has total national coverage—only 0.05% of all registered convictions had incomplete personal identification numbers during the years 1988–2000.[17]

Sociodemographic Factors

Data on civil status, having children, and income were gathered from the 1970 and 1990 national censuses. For income, if there were no 1990 census data, we used 1970 data and multiplied it by a factor of 5.01 (so that it was equivalent to the 1990 monetary value). This figure was then divided into tertiles for the purposes of further analysis. When data on individual income were missing, we used the household income of the family-of-origin for those 15 years or younger at the time of the 1990 or 1970 censuses. For education, the highest completed level was collated from the 2004, 1990, or 1970 Education Registers, and a binary comparison was made with those who had 9-year compulsory school as the highest level and those with education beyond this level. Immigrant status described an individual that had been born outside of Sweden.

Familial Factors

Using personal identification numbers, we merged data on all individuals with schizophrenia with the Multi-Generation Register (MGR) in order to identify the patients' parents. The MGR connects each person born in Sweden from 1933 and ever registered as living in Sweden after 1960 to their parents.[20] For immigrants, similar information exists for those who became Swedish citizens before the age of 18 years together with one or both parents. In addition, we linked the parents to the HDR to extract information on parental alcohol use disorders (principal or comorbid diagnoses as defined in Individual Factors (below) during the years 1973–2004) and to the National Crime Register to determine whether either parent had a conviction for a violent offense (as defined previously). The father of each patient in the MGR is defined as the mother's spouse when she gave birth or otherwise "by acknowledgment" of the mother.

Individual Factors

Data were extracted for every individual on whether they had any admission during the years 1973–2004 with principal or comorbid diagnoses of alcohol abuse or dependence (ICD-8: 303; ICD-9: 303, 305.1; ICD-10: F10, except x.5), and drug abuse or dependence (ICD-8: 304; ICD-9: 304, 305.9; ICD-10: F11–F19, except x.5). This information was used as a marker for comorbidity for alcohol and/or drug use disorders. Bergman et al.[21] investigated the agreement between HDR diagnoses of substance use disorders and those from a 4-week inpatient assessment in a specialist forensic psychiatric unit. Using their data, we calculated interrater agreement between these 2 diagnostic methods—for substance use disorder, the κ value was 0.32, indicating fair agreement (whereas a κ of ≥ 0.6 would indicate good agreement). In addition, data on any conviction for a violent offense before discharge from hospital (see Outcome Measures for definition of violent crime) were extracted.

Analyses

Patients were followed longitudinally after discharge until their first conviction for a violent offense, emigration, death from any cause, or end of follow-up (Dec 31, 2004). Varying time at risk was accounted for with Cox regression modeling that provided hazard ratios (HRs) with 95% confidence intervals (95% CIs). All analyses were stratified by gender. In the adjusted models, all risk factors significantly associated with violent offending in bivariate analyses were taken into account simultaneously. Adjustments were made for variables associated with violent offending at the 5% level. Interactions between risk factors were explored. In the first model, adjustments were made by age. In the second model, adjustments were made by age and co-varying sociodemographic variables. In the third model, adjustments were made by age and sociodemographic and individual (previous violent crime, alcohol, or drug abuse comorbidity) variables. Cohort effects were explored by comparing those born before and after 1960 (the median birth year in the sample). Kaplan-Meier survival curves were used to illustrate the timing of violent convictions after discharge from hospital. All analyses were conducted using SPSS, version 15 (SPSS Inc., Chicago, Ill.) and STATA, version 10 (Stata Corp., College Station, Tex.).

The Ethics Committee at the Karolinska Institutet approved the study (2005/174-31/4).

RESULTS

We collected information on all 13,806 individuals who had 2 or more hospital discharge diagnoses of schizophrenia during the years 1973–2004. There were 8891 men and 4915 women (Table 1). The mean age at second discharge was 28.7 years (SD = 7.1 years) for the men and 29.6 years (SD = 7.5 years) for the women. The mean (SD) follow-up time was 12.4 (8.0) years (range, 0–32.0 years).

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Table 1. Descriptive Data on All Individuals With 2 or More Hospital Diagnoses of Schizophrenia in Sweden, 1973–2004[a]

Variable	Men (N = 8891)	Women (N = 4915)
Sociodemographic factors		
Age, mean (SD), y	28.7 (7.1)	29.6 (7.5)
Income in lowest tertile[b]	2867 (36.3)	1663 (37.4)
Low education (did not complete 9-year compulsory school)[c]	3197 (38.7)	1599 (34.4)
Immigrant status[d]	1382 (15.8)	736 (15.3)
Having children	1422 (16.0)	1902 (38.7)
Unmarried[e]	7867 (91.7)	3787 (79.1)
Familial factors		
Parental alcohol abuse	873 (9.8)	434 (8.8)
Parental violent crime	427 (4.8)	208 (4.2)
Individual factors		
Alcohol abuse comorbidity	1606 (18.1)	509 (10.4)
Drug abuse comorbidity	1761 (19.8)	496 (10.1)
Previous (predischarge) violent crime	2054 (23.1)	260 (5.3)

[a]Data are presented as N (%) unless otherwise noted.
[b]Data were missing for 999 men and 468 women.
[c]Data were missing for 620 men and 270 women.
[d]Data were missing for 118 men and 92 women.
[e]Data were missing for 314 men and 126 women.

Prevalence and Types of Violent Crime

After discharge from hospital, 17.1% (N = 1519) of the men and 5.6% (N = 273) of the women had at least 1 violent conviction. Each conviction date could potentially include more than 1 crime, and there were 2656 violent crimes in the 1519 convictions in men, and the 273 convictions in women included 380 violent crimes. The most common violent crime was physical assault, with 1190 such crimes committed by men and 196 by women, followed by threats and harassment (men, 863; women, 98), sexual crimes (men, 205; women, 3), robbery (men, 180; women, 13), and arson (men, 109; women, 54). There were 109 homicides perpetrated by men and 16 by women.

Risk Factors: Univariate Associations

In men, 9 of the 10 tested sociodemographic and historical factors differed significantly between offenders and nonoffenders (Table 2). In women, eight factors differed significantly by postdischarge conviction status, whereas being unmarried and having low income did not. After adjustment for age, the strongest association with violent offending was found for any past violent conviction (in men, HR = 3.54, 95% CI = 3.20 to 3.93; in women, HR = 7.43, 95% CI = 5.59 to 9.87) (Table 2).

Familial Risk Factors

Familial risk factors had moderate effects on violent offending during follow-up, which were mostly stronger than the sociodemographic risk factors investigated. In men, there was a stronger association with parental violent crime (age-adjusted HR = 2.33, 95% CI = 1.92 to 2.82) than with parental alcohol abuse (age-adjusted HR = 1.51, 95% CI = 1.30 to 1.75). In women, the sizes

Table 2. Prevalence of Risk Factors and Risk of Violent Convictions in Men and Women With Schizophrenia in Sweden, 1973–2004

	Men (N = 8891)			Women (N = 4915)		
Risk Factor	No Violent Crime (N = 7372), N (%)	Violent Crime (N = 1519), N (%)	Age-Adjusted Hazard Ratio (95% CI)	No Violent Crime (N = 4642), N (%)	Violent Crime (N = 273), N (%)	Age-Adjusted Hazard Ratio (95% CI)
Sociodemographic factors						
Low income[a]	2317 (35.5)	550 (40.4)	1.12 (1.01 to 1.25)	1552 (37.0)	111 (44.2)	1.25 (0.97 to 1.61)
Low education[a]	2496 (36.6)	701 (48.2)	1.21 (1.09 to 1.35)	1467 (33.5)	132 (49.8)	1.74 (1.36 to 2.23)
Immigrant status[a]	1102 (15.1)	280 (18.7)	2.09 (1.84 to 2.39)	689 (15.1)	47 (17.4)	1.54 (1.12 to 2.12)
Having children	1102 (14.9)	320 (21.1)	1.36 (1.20 to 1.54)	1774 (38.2)	128 (46.9)	1.38 (1.08 to 1.75)
Unmarried[a]	6515 (91.9)	1352 (91.1)	1.04 (0.89 to 1.23)	3535 (78.2)	202 (75.4)	1.03 (0.78 to 1.36)
Familial factors						
Parental alcohol abuse	668 (9.1)	205 (13.5)	1.51 (1.30 to 1.75)	390 (8.4)	44 (16.1)	2.13 (1.54 to 2.94)
Parental violent crime	313 (4.2)	114 (7.5)	2.33 (1.92 to 2.82)	187 (4.0)	21 (7.7)	2.46 (1.57 to 3.86)
Individual factors						
Alcohol abuse comorbidity	1063 (14.4)	543 (35.7)	2.35 (2.11 to 2.61)	422 (9.1)	87 (31.9)	4.52 (3.50 to 5.84)
Drug abuse comorbidity	1094 (14.8)	667 (43.9)	3.22 (2.91 to 3.56)	402 (8.7)	94 (34.4)	4.98 (3.88 to 6.40)
Previous (predischarge) violent crime	1376 (18.7)	678 (44.6)	3.54 (3.20 to 3.93)	197 (4.2)	63 (23.1)	7.43 (5.59 to 9.87)

[a]Due to some missing data, total numbers of subjects with data on income, education, and immigrant and marital status vary.

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Figure 1. Risk of Violent Crime Stratified by Familial Risk Factors in Men (N = 8991; A) and in Women (N = 4915; B) With Schizophrenia in Sweden, 1973–2004

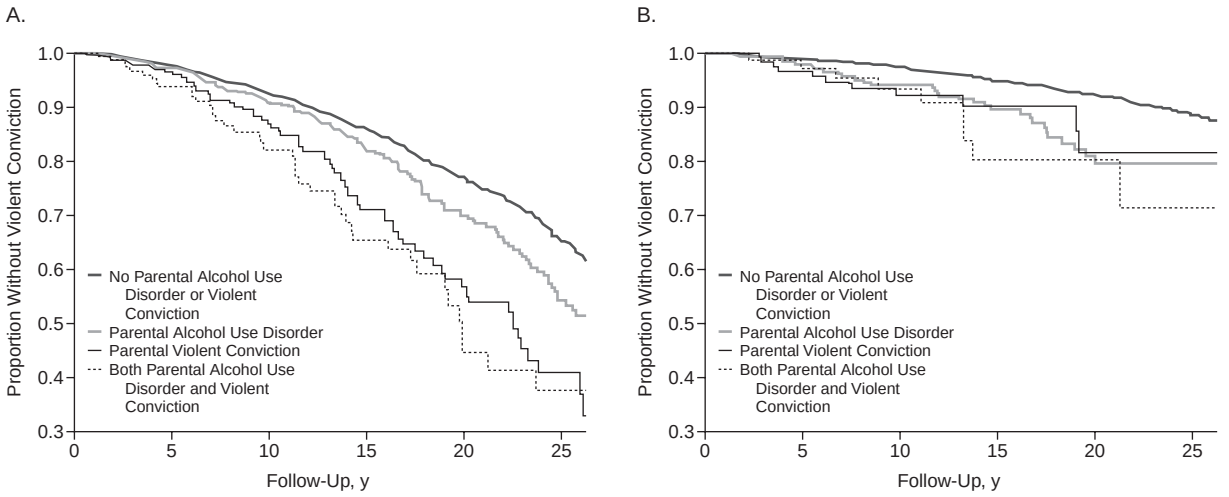

Table 3. Association of Parental Alcohol Abuse and Parental Violent Crime With Violent Convictions in Men and Women With Schizophrenia in Sweden, 1973–2004, Hazard Ratio (95% CI)

	Men		Women	
Adjustment	Parental Alcohol Abuse	Parental Violent Crime	Parental Alcohol Abuse	Parental Violent Crime
Adjusted by age	1.51 (1.30 to 1.75)	2.33 (1.92 to 2.82)	2.13 (1.54 to 2.94)	2.46 (1.57 to 3.86)
Adjusted by age and sociodemographic risk factors[a]	1.54 (1.31 to 1.80)	2.12 (1.71 to 2.62)	1.82 (1.28 to 2.61)	2.22 (1.35 to 3.65)
Adjusted by age and sociodemographic and individual risk factors[b]	1.08 (0.92 to 1.26)	1.65 (1.33 to 2.04)	1.42 (0.99 to 2.04)	1.83 (1.11 to 3.01)

[a]Low income, immigrant status, low educational level, and having children.
[b]Low income, immigrant status, low educational level, having children, previous (predischarge) violent crime, alcohol abuse comorbidity, and drug abuse comorbidity.

of the associations of parental violent crime and parental alcohol abuse with patient violent offending were similar. A survival analysis demonstrated clear effects of familial risk factors in a dose response manner among the men—men with both parental alcohol abuse and parental violent crime offended more often than men with only 1 of these 2 factors (Figure 1). In women, clear differences were found between those with no familial risk factors present and individuals with both parental alcohol abuse and parental violent crime.

Next, we explored whether the familial risk factors were mediated by sociodemographic and individual risk factors (Table 3). There was little evidence that sociodemographic risk factors moderated the relationship between familial factors and violent crime, since the risk estimates did not change materially when controlling for sociodemographic variables. However, there was some attenuation of the risk estimates when further adjustment was made for individual risk factors (previous violent crime, alcohol abuse comorbidity, and drug abuse comorbidity). After adjustment for sociodemographic and individual risk factors, parental alcohol abuse was no longer significantly associated with violent crime, but the modest associations between parental violent crime and risk of violent offending remained in both genders (in men, HR = 1.65, 95% CI = 1.33 to 2.04; in women, HR = 1.83, 95% CI = 1.11 to 3.01).

There was evidence of cohort effects with increased rates of violent offending in those born after 1960. In the men, after adjustment for age and alcohol and drug abuse comorbidity, the increased risk for violent crime in those born in 1960 and after compared with those born before 1960 was 5-fold (HR = 5.08, 95% CI = 4.44 to 5.81), and in the women, it was 3-fold (HR = 3.32, 95% CI = 2.47 to 4.47). However, adjusting for birth year (using 1960 as the cutoff) in the Cox regression model did not substantially alter the effect of familial risk factors. In both genders, the modest association with parental violent crime persisted; the adjusted HR in men was 1.39 (95% CI = 1.12 to 1.72), whereas a nonsignificant trend in the same direction was found in women (adjusted HR = 1.55, 95% CI = 0.94 to 1.72). The lack of association of parental alcohol abuse and patient violent crime remained for both men and women as well (data not shown).

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Maternal and Paternal Risk Factors in Men

In the male patients, we explored whether there was a differential association for maternal or paternal factors with violent convictions, after adjustment for sociodemographic and individual factors. Maternal factors appeared to have stronger associations with violent crime. Maternal violent crime was the strongest risk factor (adjusted HR = 2.50, 95% CI = 1.62 to 3.84), although significant but smaller associations were found for paternal violent crime (adjusted HR = 1.50, 95% CI = 1.18 to 1.90). The effect of maternal alcohol abuse was not significant, although there was a trend toward a weak association (adjusted HR = 1.28, 95% CI = 0.99 to 1.25). Paternal alcohol abuse was not associated with violent crime (adjusted HR = 1.03, 95% CI = 0.86 to 1.24). In the women, there were insufficient numbers for an analysis separately by maternal and paternal factors.

DISCUSSION

This national cohort study of 13,806 patients with 2 or more hospitalizations for schizophrenia included an average follow-up time of approximately 12 years. There were a number of important findings. First, the prevalence of any violent criminal conviction after hospital discharge was 17.1% among male patients and 5.6% among female patients. Second, the strongest risk factors were previous violent crime and drug and alcohol abuse comorbidity, each of which increased risk by at least 2-fold in men and 4-fold in women. Third, parental violent crime was shown to be significantly associated with violent crime in both male and female patients with schizophrenia. Finally, in the men, we found that maternal rather than paternal violent crime was more strongly associated with violent crime.

One objective of the study was to examine the contribution of parental violent crime and parental alcohol abuse to violent offending in patients with schizophrenia, potential risk factors for violence that have not been as widely studied as sociodemographic and criminal history variables. We found that parental violent crime predicted violent offending in offspring with schizophrenia. The increased risk was at least as large as risks seen with sociodemographic variables previously demonstrated to be associated with violent crime. To our knowledge, the presence of parental violent crime is ignored in current risk assessment schedules,[22,23] and this result, if replicated, underlines the importance of obtaining a full family history in risk assessment. This finding also suggests the importance of early environmental and/or genetic influences on the etiology of violent crime in psychiatric patients. Although parental alcohol abuse was not related to violent crime once individual risk factors, including alcohol abuse, were controlled for, it is still possible that genetic effects and/or modeling by social learning in the home causes parental and offspring alcohol abuse to covary. However, from these data, it is not possible to conclude which of these familial effects (violent crime or alcohol abuse) are the most pertinent, and the extent of the interaction between them. It is also not possible to know whether this effect is unique to schizophrenia, and future research could examine whether a similar pattern is found in persons not affected by schizophrenia. Nevertheless, whether it exists or not in the general population does not discount the potential importance of these findings for patients with schizophrenia, particularly as they are at increased risk of violence, and understanding the underlying mechanisms may enable development of targeted interventions.

The reduction in risk for violent crime when individual risk factors were included in the adjustments made to familial factors is congruent with both genetic and environmental mechanisms. Previous twin studies have shown that both genetic and shared environmental effects are important for antisocial behavior,[24] and specific genotypes[11] and specific early environments (e.g., obstetric complications,[12] maternal smoking,[25] and being an only child[26]) have already been found to account for some of these familial effects. In schizophrenia, birth complications have not been shown to be associated with later criminality,[6] and clarifying the relative contribution of these potential risk factors requires further work. Nevertheless, since the genetic contribution from mothers and fathers should be equal, our finding of a trend toward higher risk of violent offending in male offspring with schizophrenia with a history of maternal rather than paternal violent criminality suggests that early environmental factors account for at least part of the association (since children usually spend more time with their mothers when growing up).

Our prevalence data for violent offending in patients with 2 or more hospitalizations for schizophrenia are in keeping with prior research from different countries demonstrating rates in excess of 15%, particularly in men. However, our prevalence estimates are not directly comparable to previous research due to the long follow-up time and definition of violence in this study. This would explain why, in contrast to previous reports,[2,5] we found that the gender divide in the prevalence of violent crime remained in patients with schizophrenia. One possible explanation for the discrepancy is that the gender divide is not present when lower thresholds for violence are used, such as self-report and informant-based information in previous work. In keeping with this explanation, the MacArthur Risk Assessment Study demonstrated that women were more likely to engage in acts of violence that did not lead to arrest.[27] Nevertheless, the gender ratio for the prevalence of violent crime in men with schizophrenia compared to women with schizophrenia, which we found was 3-fold, was less pronounced than the corresponding 10-fold ratio in the general population.[17] The gender ratio

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in this study is consistent with other register-based population studies in Denmark and Finland[6,28] and with certain clinical samples.[29] We also report cohort effects, with significant increases in violent offending in patients born in 1960 and after. Although these patients are likely to have had most of their service contact after the deinstitutionalization of psychiatric care started in Sweden in the 1970s, this finding should be interpreted with caution as overall violent crime rates have risen substantially during this period.[30] This interpretation agrees with the findings of an Australian study comparing rates of offending over time in patients with schizophrenia with non–mentally disordered controls.[31]

As this study used national registers, its strengths were in its sample size, information from independent sources on family and sociodemographic variables, clear and replicable outcomes, and length of follow-up. To our knowledge, this cohort is 3 times larger than any previous report,[7] and includes more patients with schizophrenia followed up for violent crime than previous work combined.[32,33] Limitations of the present study include generalizability, the reliance on conviction data, and the lack of victim information. We included only those patients with schizophrenia who had 2 or more discharges from hospital in order to improve diagnostic specificity, but it is uncertain whether the risk factors are similar in patients with only 1 admission or no hospitalizations, which future research could investigate. The reliance on conviction data will underestimate the prevalence of violence and, in particular, undetected violence, which includes domestic violence against partners and children. It is unlikely, however, that this would alter risk estimates for sociodemographic and individual risk factors since there is no theoretical reason to predict that the degree of underestimation will be significantly different in patients with schizophrenia with or without these risk factors. In relation to parental risk factors, patients with schizophrenia with parental histories of violent crime may be less likely to report incidents of domestic violence to the police than other patients with schizophrenia. This could be examined by controlling for victim category when examining the contribution of parental risk factors, which we were unable to do and which represents an important limitation to our work. Future research should clarify the prevalence of domestic violence in this population and if parental violence also alters the likelihood of domestic violence in offspring.

Information on clinical factors was limited to alcohol and drug abuse comorbidity recorded on discharge from hospital, and, hence, it complements previous research that used more detailed and sensitive recording of clinical variables.[1,2,4] Alcohol and drug abuse were both significantly associated with violent crime in the present report, consistent with previous studies that have reported associations with any substance abuse.[1] Although this finding contrasts with a UK study in which alcohol abuse was independently associated with violence but drug abuse was not,[5] and the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) investigation in which there was a trend for drug abuse to be associated with violence,[2] different ascertainment criteria were used for alcohol and drugs in these 2 studies and in ours. We used a highly specific but not particularly sensitive measure—that of a principal or comorbid hospital discharge diagnosis for alcohol or drug use disorders during the years 1973–2004—whereas other work has used self-report information.

We studied risk factors for violent crime in 4915 women with 2 or more hospital discharge diagnoses of schizophrenia. Violence in women with schizophrenia has previously attracted relatively little research. A previous longitudinal study, which included 304 women with psychosis (and 94 with schizophrenia), reported a number of associations with violence, including a history of assault and nonviolent convictions.[34] Our data confirm the importance of previous criminality, which we found associated with a 7-fold increased risk of violent crime. However, in contrast to this previous investigation that may have been underpowered, we also found that low educational achievement, having children, and alcohol and drug abuse comorbidity were all significantly associated with violent crime after adjustment for age. Our findings on substance abuse are consistent with the MacArthur study, which included 469 female patients, of whom 57 had schizophrenia, and found a 2-fold increased risk for violence in patients with comorbid substance abuse.[27] The risks associated with substance abuse comorbidity in the current report were increased 4- to 5-fold, suggesting that further work could explore the association of comorbidity with severity of violence in female psychiatric patients. One other investigation demonstrated that the absence of a father (which may be associated with criminal lifestyle or substance abuse in the father) is a strong risk factor for violent crime in women, underlining the importance of family history in the assessment of women at risk.[35]

In conclusion, in a cohort of 13,806 patients with 2 or more hospital discharge diagnoses of schizophrenia, we found that around 17% of male patients and 5% of female patients committed violent crimes after hospital discharge. Parental violent crime was significantly associated with violent offending in patients with schizophrenia, after adjustment for a range of possible confounders, providing risk estimates as large as the better documented sociodemographic factors. This association suggests that familial (genetic or early environmental) factors have an important role in the etiology of violent offending among individuals with schizophrenia.

Disclosure of off-label usage: The authors have determined that, to the best of their knowledge, no investigational information about

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pharmaceutical agents that is outside US Food and Drug Administration–approved labeling has been presented in this article.

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