Is Arson the Crime Most Strongly Associated With Psychosis?—A National Case-Control Study of Arson Risk in Schizophrenia and Other Psychoses

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Background: The association of psychosis with certain serious crimes, such as homicide, has been clearly demonstrated, but it is uncertain to what extent psychotic disorders are associated with arson.

Methods: We used a case-control design to investigate the association of being diagnosed with schizophrenia and other psychoses and committing arson. Data were obtained from Swedish national registers for criminal convictions, hospital discharge diagnoses (International Classification of Diseases, Ninth Revision [ICD-9], and International Classification of Diseases, Tenth Revision [ICD-10]), and sociodemographic factors for 1988–2000. We included all convicted arson offenders of both sexes in Sweden (N = 1689) and compared them with a random sample of general population control subjects (N = 40 560).

Results: After adjustment for sociodemographic confounders, arson offenders were more likely to be diagnosed with schizophrenia (in men, adjusted odds ratio [OR] = 22.6, 95% confidence interval [CI] = 14.8–34.4; in women, adjusted OR = 38.7, 95% CI = 20.4–73.5) or other psychoses (in men, adjusted OR = 17.4, 95% CI = 11.1–27.5; in women, adjusted OR = 30.8, 95% CI = 18.8–50.6). Conclusions: Individuals with schizophrenia and other psychoses have significantly increased risks of an arson conviction. These risk estimates are higher than those reported for other violent crimes and place arson in the same category as homicide as crimes that are most strongly associated with psychotic disorders.

Key words: schizophrenia/violence/crime/fire-setting behavior/case-control studies

Introduction

Considerable attention has been directed to the association between homicide and schizophrenia, and it is estimated that the risk of homicide in individuals with psychosis is 10–20 times higher than in the general population.1–3 Supporting this strong association, a recent systematic review of 10 studies demonstrated that treatment could reduce homicide rates in first-episode psychosis by 15 times.4 Risk increases for other crimes, including property,5 drug,5 sexual,6 and other violent offences,7,8 have also been demonstrated, but the associations are not as strong as they are for homicide.9 Clinical studies have identified high rates of arsonists in secure hospitals, and one study found high rates of schizophrenia in a selected sample of severe cases of arson10; however, the association of psychotic disorders with arson remains uncertain. Around 10% of all individuals admitted to forensic psychiatric services in United Kingdom, Sweden, and Finland have been convicted for arson.11–13 These rates appear to be higher for women in high-security hospitals; 36% of women admitted to English high-security hospitals had committed property offences, mostly arson.14 In contrast, studies comparing prisoners and forensic patients that have used other offenders as control subjects did not find associations between arson and severe mental illness,15,16 nor did a population-based study,17 although the latter may have been underpowered.

Although its effects on psychiatric services are high, the wider impact of arson is notable. In the United States, there were a reported 64 000 offences in 2007, corresponding to 25 offences per 100 000 inhabitants.18 In the United Kingdom, the conviction rate for arson was higher at 65 per 100 000 persons19 and was estimated to cost £2.8 billion annually, with around 40 000 offences recorded by the police, and an estimated 3600 fires started deliberately every week in 2007.20 In Australia, arson is estimated to cost more than $1 billion per year, and recent widespread fires are thought to have been started deliberately.21 Thus, if risk factors for arson were modifiable, this could make a significant impact on public health and safety.

As the association of arson with schizophrenia and other psychoses is uncertain, and few population-based studies have been conducted, we carried out
a case-control study of all individuals convicted of arson in Sweden over 13 years. We used high-quality national registers to link data on hospitalization, crime, and socioeconomic factors. We hypothesized that the risk of arson in patients with schizophrenia and other psychoses would be significant, even after adjustment for sociodemographic factors but not as high as the risks reported for homicide.

Methods

Study Setting

In Sweden, all residents, including immigrants on arrival to the country, are given a unique identification number that is used in national registers for sociodemographic information, health care, and crime. A government agency, Statistics Sweden, holds registers that include information on every individual’s education, income, employment, and living arrangements. The Hospital Discharge Register (HDR) monitors all psychiatric hospitals and is the largest inpatient register worldwide. Reporting to the register is compulsory for all healthcare providers, including secure psychiatric hospitals and private hospitals. All patients are given one or more clinical diagnoses on discharge according to the International Classification of Diseases, Ninth Revision (ICD-9), (through 1996) and International Classification of Diseases, Tenth Revision (ICD-10), (from 1997) registered by their unique identification number. The register is of high quality: Of the 1 421 795 discharges from hospital for psychiatric diagnoses from 1988 through 2000, no personal identification number was available for only 105 (0.05%) had incomplete personal identification numbers and were therefore excluded from subsequent analyses. Consequently, the register has been used in a variety of recent epidemiologic investigations in which the information on psychiatric hospitalization has been linked. Further, this register has been demonstrated to be valid and reliable for diagnoses of psychosis (eg, 86% of those diagnosed with schizophrenia had the same diagnosis confirmed by a file-based review by psychiatrists). Swedish HDR schizophrenia diagnoses show good concordance rates ($\kappa > 0.70$) with diagnoses based on OPCRIT record review (Operational Criteria Checklist: a 90-item checklist of signs and symptoms generating Diagnostic and Statistical Manual of Mental Disorders and ICD diagnoses developed for use in both European and US samples) and interview (generating a Diagnostic and Statistical Manual of Mental Disorders [Fourth Edition] diagnosis of schizophrenia). As the diagnostic validity for disorders other than the psychoses is uncertain, we focused on patients with the psychoses. This was defined as schizophrenia, bipolar affective disorder, and other psychoses (including drug-induced psychoses). Diagnoses were based on the principal discharge diagnosis of the first admission during the study period. For schizophrenia, these were 295 except 0.7 (ICD-9) and F20 (ICD-10); for bipolar affective disorder, these were 296.0, 296.2–296.6 (ICD-9, and F31 (ICD-10); and for other psychoses, these were 291, 292, 295.7, 296.1, 296.8–296.9, 297, 298 (ICD-9), and x.5 in F10–F19, F21–F29, F32.3, F33.3 (ICD-10).

The Crime Register includes conviction data on all persons aged 15 years (the age of criminal responsibility) and older. Conviction data were used because in Sweden, in common with only a few countries; individuals are convicted as guilty regardless of mental illness (ie, being judged as not guilty by reason of insanity is not an option). Thus, conviction data included persons who received custodial or noncustodial sentences and also those transferred to forensic hospital (eg, individuals who were psychiatically assessed and suffering from psychosis at the time of the offence). Furthermore, conviction data included those cases in which the prosecutor decided to caution or fine (eg, in less serious crimes and some juvenile cases). In addition, because plea bargaining is not permitted in the Swedish legal system, conviction data accurately reflect the extent of officially resolved criminality in the population. Sweden does not substantially differ from other members of the European Union in the rates of violent crime and their resolution. The Crime Register is of high quality: There were 205 846 court convictions comprising 324 383 violent crimes, committed by 136 931 offenders during the period from 1988 through 2000. Of the convictions, only 105 (0.05%) had incomplete personal identification numbers and were therefore excluded from subsequent analyses.

Arson was defined as a deliberately started fire entail- ing danger to another person’s life or health or extensive destruction to property. The Swedish Penal Code distinguishes “plain” and “aggravated” arson. Plain arson is defined as fire setting that is a possible threat to human life or somebody’s property. Aggravated arson is fire setting in densely populated areas, where multiple human lives or property of particular importance is threatened. Clearance rates in Sweden for arson are 34%, which are higher than in some other jurisdictions, such as the United States, where it is 17%.

Study Design

As arson offenders are relatively infrequent, cohort studies would have to be unfeasibly large. As with a related study of sexual offending, case-control investigations are an alternative. Using the Crime Register, we identified 1340 men and 349 women who were convicted for arson during a 13-year period, 1988–2000 (in cases of more than one conviction for arson, the year of the first crime of arson was chosen as index year), yielding a total of 2303 crimes. This corresponded to an average of 1.4 arson crimes per offender. Controls were drawn
from a random selection of 50 000 individuals of the general population using the total population register based at Statistics Sweden (all individuals living in Sweden including immigrants). The randomization was stratified for time of entry for the cases so that 3846 persons (ie, 50 000 divided by 13) for each year from 1988 up to and including 2000 were included. We then excluded individuals aged less than 15 years at index year and those convicted of arson resulting in a final control group of 40 560. The index year was the year of the offence and the equivalent year for the controls. No data on treatment status were available.

Statistical Analyses

Demographic and socioeconomic information for the index year suggested in previous literature to confound the relationship between mental disorders and arson offending was compared between arson offenders and controls.\textsuperscript{6,21} (tables 1 and 2). The variables were age at index year, immigrant status, unemployment, and being single (see Supplementary Table 1). On the basis of this comparison and significant associations between demographic information and psychiatric disorder (data not shown), age, immigrant status, unemployment, and single status were identified as confounders and adjusted for in subsequent multivariate logistic regression models. Data on income were only available for 77.3\% of male arson offenders and 60.5\% of female arson offenders. The proportions with available income data were even lower in those with a history of psychiatric hospitalization, at 30.5\% for male and 19.1\% for female patients, precluding its inclusion in the model. Similarly, education data were available for 68.3\% of male arsonists and 52.4\% of female arsonists. Again, the proportions available for men and women with a history of psychiatric hospitalization were substantially lower, with only 27.7\% available for male patients and 17.5\% for female patients.

All effect sizes with P value and 95\% confidence intervals (CIs) are reported in the tables. Univariate and multivariate binary (binomial) logistic regression analyses were conducted using SPSS, version 17.0 (SPSS Inc, Chicago, IL), generating odds ratios (ORs; the \(e^b\) estimate) with 95\% CIs of principal psychiatric diagnoses in arson offenders compared with controls. For the univariate logistic regression that generated crude ORs, no adjustment was made for any of the confounders. For the multivariate regression, the adjusted ORs were derived from a model in which the 4 identified confounders were adjusted for simultaneously.
Research ethics approval was received from Huddinge University Hospital, Sweden.

Results

Information on 1340 men and 349 women convicted of arson was collected and compared with data on 40,560 controls. All demographic variables tested were significantly different in prevalence between arsonists and controls, apart from the proportion living in a metropolitan area and the proportion unemployed (women only). For both men and women, the largest differences were found in the proportion being on social welfare, in a single household, and single (tables 1 and 2).

Arson and Severe Mental Illness

The combined prevalence of psychotic disorders was 8.1% in arson offenders compared with 0.7% in the control subjects for the males and 14.0% compared with 0.8% for the females. After adjustment, the OR was substantially increased in both genders for the psychoses. For schizophrenia, the adjusted OR was 22.6 (95% CI 16.4–28.6). For bipolar disorder, the adjusted OR was 2.2 (95% CI 1.7–2.9).

Table 3. Any Psychiatric Hospitalization and Psychosis Among All Convicted Arson Offenders in Sweden in 1988–2000 Compared With General Population Control Subjects: Men

<table>
<thead>
<tr>
<th>Variable</th>
<th>Arson Offenders (N = 1340)</th>
<th>Control Subjects (N = 19,963)</th>
<th>Crude OR (95% CI)</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any psychiatric hospitalization, % (n)</td>
<td>50.4 (676)</td>
<td>4.7 (934)</td>
<td>20.7 (18.3–25.5)</td>
<td>35.5 (30.3–41.6)</td>
</tr>
<tr>
<td>Schizophrenia, % (n)</td>
<td>4.3 (58)</td>
<td>0.3 (51)</td>
<td>17.7 (12.1–25.8)</td>
<td>22.6 (14.8–34.4)</td>
</tr>
<tr>
<td>Bipolar disorder, % (n)</td>
<td>0.3 (4)</td>
<td>0.1 (20)</td>
<td>3.0 (1.0–8.7)</td>
<td>7.0 (2.2–22.3)</td>
</tr>
<tr>
<td>Other psychosis, % (n)</td>
<td>3.5 (47)</td>
<td>0.3 (55)</td>
<td>13.2 (8.9–19.5)</td>
<td>17.4 (11.1–27.5)</td>
</tr>
</tbody>
</table>

Note: OR, odds ratio; CI, confidence interval.

*Simultaneously adjusted for age at index year, immigrant status, employment, and single status in multiple logistic regression models.
Rates of comorbidity of the psychotic disorders with personality disorder were 30.6% (N = 60) in men and 42.6% (N = 40) in women. There were 48.5% men (N = 95) with a psychotic disorder and comorbid substance use disorders and 38.3% women (N = 36) with such comorbidity. We estimated crude ORs for those with these 2 groups of comorbid disorders (table 5).

Conclusions

This large population-based case-control study demonstrated a substantially increased risk of arson in patients with schizophrenia and other psychoses. The strengths of the study include a large sample size with 1340 male and 349 female arson offenders and 40,560 general population control subjects, and the ability to adjust for sociodemographic confounding. We used high-quality national registers in Sweden and linked them using unique personal identification numbers. Furthermore, in the Swedish legal system, all offenders are convicted irrespective of their mental state at the time of the offence, which means that the Crime Register captures the vast majority of mentally ill arson offenders.

The study had 2 principal findings. First, patients with schizophrenia and other psychoses had a significantly increased risk of being convicted for arson and were responsible for approximately 8% of arson episodes in Sweden during 1988–2000. The adjusted risk estimate (reported as an OR) for being diagnosed with schizophrenia among arson offenders was increased more than 20 times compared with the general population. Second, we found higher rates of psychosis among women arsonists than their male counterparts, a gender gap consistent for all violent crimes.

The risk estimates in this investigation were not lower than those reported in epidemiologic studies of homicide offenders. For example, studies that compared rates of schizophrenia among male homicide offenders with the general population have reported ORs between 6 and 17, 10 was reported in a national survey in Finland, 6 in Austria, 3 10 in a state in Australia, 17 and 17 in a German province. 32 Thus, this would suggest that arson and homicide are the 2 categories of crime with the strongest associations with schizophrenia and other psychoses.

The main clinical implication of these findings is the potential importance of pretrial psychiatric assessment of arson offenders. We found that 8% of convicted male arsonists and 14% of female arsonists had a psychotic illness. Some jurisdictions recommend that all homicide offenders should receive pretrial assessments, and consideration should be given to extending this to arson offenders. Hence, one implication is that it might be appropriate to screen all arsonists in prison for psychiatric illness. We found that any psychiatric hospitalization, a crude marker of psychiatric morbidity, also had very strong associations with arson, and future work may establish that some other diagnoses are even more closely related to arson, including learning disability that has been highlighted in a forensic psychiatric example. 16

Given that 20% of psychotic arsonists were found to be recidivists in a large Finnish sample, 33 such screening may contribute to reducing reoffending rates if appropriate treatment is provided, particularly for substance abuse.


<table>
<thead>
<tr>
<th>Variable</th>
<th>Arson Offenders (N = 349)</th>
<th>Control Subjects (N = 20 597)</th>
<th>Crude OR (95% CI)</th>
<th>Adjusted ORa (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any psychiatric hospitalization, % (n)</td>
<td>77.7 (271)</td>
<td>4.6 (950)</td>
<td>71.9 (55.4–93.2)</td>
<td>111.4 (83.3–149.1)</td>
</tr>
<tr>
<td>Schizophrenia, % (n)</td>
<td>4.6 (16)</td>
<td>0.3 (51)</td>
<td>23.0 (12.8–41.2)</td>
<td>38.7 (20.4–73.5)</td>
</tr>
<tr>
<td>Bipolar disorder, % (n)</td>
<td>1.7 (6)</td>
<td>0.1 (24)</td>
<td>15.0 (6.1–37.0)</td>
<td>27.5 (10.6–71.5)</td>
</tr>
<tr>
<td>Other psychosis, % (n)</td>
<td>7.7 (27)</td>
<td>0.4 (76)</td>
<td>22.6 (14.4–35.6)</td>
<td>30.8 (18.8–50.6)</td>
</tr>
</tbody>
</table>

Note: OR, odds ratio; CI, confidence interval.

*Simultaneously adjusted for age at index year, immigrant status, employment, and single status in multiple logistic regression models.

### Table 5. Relative Risk of Arson Among Individuals Diagnosed With Any Psychosis With and Without PD and/or SUD Comorbidity in Sweden in 1988–2000

<table>
<thead>
<tr>
<th>Comorbidity Status</th>
<th>Males (Crude OR 95% CI)</th>
<th>Females (Crude OR 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No comorbidity</td>
<td>12.5 (8.9–17.5)</td>
<td>12.6 (7.8–20.5)</td>
</tr>
<tr>
<td>Comorbid PD</td>
<td>15.3 (11.1–21.0)</td>
<td>27.2 (18.4–40.2)</td>
</tr>
<tr>
<td>Comorbid SUD</td>
<td>18.4 (13.9–24.4)</td>
<td>23.4 (15.7–34.8)</td>
</tr>
<tr>
<td>Comorbidity with PD or SUD</td>
<td>19.2 (14.6–25.2)</td>
<td>32.1 (22.1–46.6)</td>
</tr>
</tbody>
</table>

Note: PD, personality disorder; SUD, substance misuse; OR, odds ratio; CI, confidence interval.

*Risk of arson conviction as compared with general population control subjects.

*N too small to calculate ORs for Comorbidity with PD and SUD.

CI = 14.8–34.4) in men and 38.7 (95% CI = 20.4–73.5) in women (tables 3 and 4).
comorbidity. Although risk assessment and management tools exist for violent and sexual offenders, future research could investigate if arson offenders have specific risk factors for reoffending and, therefore, if a specialized risk assessment instrument for arsonists is warranted. The other clinical implication is consideration to asking questions about fire setting as part of routine assessment of all patients with schizophrenia and related psychoses, particularly if other risk factors are present. The risk and benefits of such an approach may be different for each population of patients. In one US study of inpatients in a general psychiatric hospital, where 27% reported a lifetime history of fire setting, screening may be beneficial as part of a risk management process for all patients. The importance of comorbidity with substance abuse and personality disorder, highlighted in other work investigating all violent outcomes, is also underlined by our findings in arson offenders and suggests that assessment for comorbidity needs to be carefully done in risk assessment and management for patients with schizophrenia. An interesting finding in our study is that bipolar disorder appeared to be less strongly associated than schizophrenia with arson offending. Interview-based studies may be able to examine if certain psychotic symptoms associated with arson are more prevalent in schizophrenia than bipolar disorder, such as delusions of body/mind control, command hallucinations, and delusions that are not mood congruent.

Weaknesses of this study include the reliance on registers for information on crime and psychiatric diagnoses. Fire setting is a much more common phenomenon, and it is possible that its association with severe mental illness is different from that of arson. Furthermore, due to the Swedish criminal code, we were not able to separate arson by severity. Future research could examine whether arson that has endangered life has different links with mental illness than less severe forms of arson. Another limitation is the reliance on routinely collected data for diagnosis. These data were based on standardized diagnoses, and previous work has demonstrated that diagnostic information in Swedish hospital registers has good to excellent coverage and high diagnostic validity for the psychoses. In contrast, the diagnostic validity for psychotic disorders comorbidity with substance abuse is fair to moderate and not specifically examined for personality disorder. It is possible that higher clearance rates for arson in those with mental illness contribute to the high risk estimates reported here, although this needs to be balanced by the effect of the police not charging or dropping charges toward those with mental illness. In support of the latter is a study of more than 500 psychiatric inpatients in the United Kingdom where 12% of the patients had a history of criminal charges having been dropped by the police. Future research should investigate the potential mediating role of treatment and whether high rates of smoking in patients with schizophrenia contribute to the observed association. Of further interest would be prospective studies to observe the temporal relationship between the onset of a psychotic illness and gaining a conviction for arson and to examine whether there is a correlation between recidivistic fire setting and acute episodes of psychosis.

An interesting finding was that the adjusted ORs for risk of psychoses in arson offenders were higher than the crude ones, which is unusual in psychiatric epidemiological research. In this study, this was primarily a result of sociodemographic disparities between arsonists who were psychiatric patients and nonpatient arsonists who appeared to have lower socioeconomic status, as indicated by lower rates of employment. This finding is consistent with a national study of suicide risk in psychiatric patients in Denmark, which reported that suicide risk in psychiatric patients did not follow the pattern in the general population. In the general population, lower income was associated with suicide risk, while in patients those in the highest income quartile had increased risk.

In summary, this study demonstrated a strong association between arson and psychotic disorders, at least as high than that previously reported for homicide. The psychiatric screening of all arson offenders and the comprehensive assessment and treatment of mentally ill arsonists may confer important public health and safety benefits.

Supplementary Material

Supplementary Table 1 is available at http://schizophrenia.oxfordjournals.org.

Acknowledgment

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References