Risk Factors for Filicide and Homicide: 36-Year National Matched Cohort Study

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ABSTRACT

Objective: To identify specific risk factors for filicide, parental killing of one's own children.

Method: A nationwide matched cohort study of filicides, including filicide-suicide, was conducted in Sweden 1973–2008 (N = 151). We linked longitudinal national registry data on offender psychiatric and neurologic morbidity (*ICD* codes), suicide attempts, traumatic injury, and previous criminality. We compared filicide offenders and their children to age- and sex-matched general population controls and their children. To compare homicide perpetrator subtypes, parallel analyses were made with nonfilicide homicide offenders (N = 3,979) and matched controls.

Results: History of major psychiatric disorder, defined as psychotic, affective, or personality disorder, was more common among filicide perpetrators even after adjusting for socioeconomic factors and other potential perpetrator and child confounders (adjusted odds ratio [AOR] = 8.6; 95% CI, 3.7–20.0). Substance misuse was not an independent risk factor, whereas prior suicide attempt conferred a marked increase of filicide risk (AOR = 11.6; 95% CI, 4.0–33.3). Multiple birth was the only child risk factor for filicide that was significant (AOR = 4.8; 95% CI, 1.3–17.6) in multivariate analyses. Overall, nonfilicide homicide offenders exhibited similar risk factors as filicide perpetrators; additionally, substance misuse and violent crime were significantly more frequent and suicide attempt less common (nonoverlapping 95% CIs) than in filicide offenders.

Conclusions: Major psychiatric disorder and previous suicide attempt were strong independent risk factors of filicide; however, substance misuse and prior violent crime were less common than among nonfilicide homicide offenders. Filicide prevention attempts should focus major psychiatric disorder and suicidal behavior in particularly strained parents, instead of more general risk factors for interpersonal violence such as substance misuse.

J Clin Psychiatry 2014;75(2):127–132

Submitted: *January 5, 2013; accepted July 8, 2013.*
Online ahead of print: *December 10, 2013 (doi:10.4088/JCP.13m08372).*
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Filicide is the killing of a child by a parent, and, when children are murdered in high-income regions, the perpetrator is most likely a parent.[1] In Sweden, filicide constituted 87% of all child homicide from 1971 to 1980,[2] a finding similar to recent Danish data.[3] In the United States, homicide of young children increased during the second half of the 20th century,[4] most of the deaths being recorded as filicide.[1] Risk factors for filicide occur at different levels. For instance, in societies with fewer negative attitudes toward premarital or extramarital motherhood, the relative importance of individual perpetrator characteristics, such as psychiatric morbidity and substance misuse, may increase.[1] Previous studies suggest increased psychiatric morbidity in filicide perpetrators, including psychotic symptoms, depression, and personality disorder.[2,4–12] Further, the strains of parenting a child with functional impairments, perhaps following suboptimal intrauterine conditions or perinatal complications, may increase filicide risk.[13]

Several methodological limitations characterize prior work on filicide. First, offenders were usually recruited from correctional or forensic psychiatric settings, resulting in substantial selection bias; specifically, researchers excluded perpetrators who also committed suicide (filicide-suicide)[14,15] and who represent 16%–65% of all filicide cases.[2,10] Second, small sample sizes have led to imprecise results. Third, suitable controls to filicide cases, which are necessary to identify potential risk factors, have not been used. Fourth, the potential risk increase related to parenting a child with special needs has not been systematically addressed.[13] Testing this child variable requires longitudinal follow-up of children from the fetal stage to filicide. Fifth, previous studies did not explicitly separate general risk factors for severe interpersonal violence from those possibly specific for filicide. For example, psychiatric morbidity might be more common among filicide offenders than in the general population but also characterizes nonfilicide homicide offenders.[16] It is possible that different psychiatric disorders and suicidal behavior more specifically describe filicide offenders, rather than the substance misuse and previous violence usually found among nonfilicide homicide offenders. Such distinctions might elucidate the relative importance of different psychiatric disorders for filicide versus other severe violent crime and inform preventive efforts, including risk assessment and management.

We aimed at identifying filicide risk factors, primarily by focusing on offender psychiatric disorder, substance misuse, and prior suicidal or violent behavior. We linked nationwide longitudinal registers for a matched cohort study of all filicide cases (including filicide-suicide) in Sweden over 36 years. To expand on previous research, we investigated child victim and sibling characteristics that could increase parental stress and violent behavior and conducted a parallel comparison of nonfilicide homicide offenders with matched controls to elucidate risk factors specific for filicide.

Clinical Points

- Filicide perpetrators are more likely than other homicide offenders to have been admitted to inpatient care because of major psychiatric ill health, such as psychotic, affective, or personality disorders.
- Substance misuse, a risk factor for nonfilicidal homicide in general, does not increase filicide risk.
- Previous violent criminal behavior is a risk factor for filicide, albeit less prominent than for homicide in general. On the contrary, prior suicide attempt was a risk factor for filicide but less so for nonfilicidal homicide.

METHOD

Study Setting

We linked a series of Swedish longitudinal, nationwide, population-based registries through the unique personal identification number given to every Swedish citizen at birth and to immigrants at citizenship.[17] We conducted a matched cohort study with filicide offenders, their child victims (and the sibling[s] of these) as cases. Registry data were collected prospectively. Filicide cases and nonfilicide homicide offenders were matched separately to general population controls.

Case and Control Identification

Using the Cause of Death Register (held by the National Board of Health and Welfare [Sweden]), we identified all children less than 18 years of age killed in 1973–2008 by an intentional act or in unusual accidents in which intention was possible. The Multigeneration Register (Sweden) allowed linkage to each child's biological and adoptive parents. A case was established if 1 or more of the identified parents had been convicted of murder, manslaughter, or filicide with the determined date of the crime within 3 days of the child's unnatural death (National Crime Register). Having a parent who died of suicide 3 days following the child's death generated a filicide-suicide case.[18] Definitions were based on the assumption that homicide and suicide are so rare in Sweden (similar to most parts of the European Union and other Western countries) that the occurrence of both events within 1 family at exactly the same time reflected the same underlying event. If the killed child's father or mother had a child with another individual, he or she was considered a stepparent and underwent the same linking procedure as described above.

General population controls were identified and matched 10:1 according to offender birth year and sex and number of children within the family. Similar to filicide offenders, nonfilicide homicide offenders (defined as any conviction of murder or manslaughter) were also matched 10:1 on birth year and sex to general population controls.

Sociodemographic Factors

Data on highest obtained education were available for 1970 and 1990–2008 from the National Censuses and the Education Register. *Low education* was defined as having completed no more than compulsory school versus higher education and *immigrant status* as being born outside of Sweden versus not.

Psychiatric Morbidity

The high-quality National Patient Register includes information on all individuals admitted to hospital in Sweden.[19] At discharge, all patients receive best estimate clinical *ICD* diagnoses[19]; coverage is excellent for severe mental illness. Validity for severe mental illness diagnoses is high; fair to excellent validities have been reported for schizophrenia[20] and bipolar disorder,[21] and the register has been used extensively in psychiatric epidemiologic research.[21,22]

We extracted diagnostic information on all case and control individuals discharged from hospital from January 1, 1973, to December 31, 2008, with any principal diagnosis of a psychiatric disorder (for personality disorder or substance misuse we also included additional diagnoses). For psychotic disorders, we included schizophrenia (defined as *ICD-8*/*ICD-9* code 295, *ICD-10* code F20) and nonorganic psychoses (*ICD-8*: 291, 296.6, 297–299; *ICD-9*: 291–292, 296.X, 297, 298; *ICD-10*: F21–F25, F28–F29, F32.3, and x.5 in F10–F19). For affective disorders, we included bipolar disorder (*ICD*-8: 296.1, 296.3–8; *ICD-9*: 296A, 296C–296E, 296W; *ICD-10*: F30–F31) and depressive disorders (*ICD-8*: 300.4, 296.0, 296.2; *ICD-9*: 300E, 311, 296B; *ICD-10*: F32 [except 32.3], F33–F39). Alcohol abuse/dependence (*ICD-8*: 303; *ICD-9*: 303, 305A; *ICD-10*: F10, except F10.5) and drug abuse/dependence (*ICD-8*: 304; *ICD-9*: 304, 305X; *ICD-10*: F11–F19, except x.5) were merged into substance misuse. For personality disorders, *ICD*-8/*ICD-9* code 301 and *ICD-10* code F60 were included. *Major psychiatric disorder* was defined as any diagnosis of a psychotic, affective, or personality disorder. Phobic, anxiety, obsessive-compulsive, eating, and adjustment disorders were based on *ICD-8*: 300, except 300.4; *ICD-9*: 300, except 300E, 307B, and 307F; and *ICD-10*: F40–F42, F44–F45, F48, and F50. Together with all other specified diagnostic entities above, they constituted any psychiatric disorder.

Previous suicide attempt that lead to inpatient care was also linked and, following prior research,[22] involved both certain and uncertain attempts (*ICD-8/ICD-9*: E950–E959, E980–E989; *ICD-10*: X60–X84, Y10–Y34).

Previous Violent Criminal Offending

For the period 1973–2008, we obtained convictions of *violent crime*, defined as homicide, assault, robbery, threats and violence against an officer, gross violation of a person's/woman's integrity, unlawful threats, unlawful coercion, kidnapping, illegal confinement, arson, intimidation, and sexual offenses (rape, indecent assault or exposure, or child molestation). Attempted and aggravated forms were also included when applicable.[19]

The age of criminal responsibility in Sweden is 15 years; antisocial acts committed before this age are not recorded.

Plea bargaining is not permitted, and all convictions are registered (caution or fines, custodial or noncustodial sentences) whether the defendant was judged to suffer from insanity at the time of perpetration or not. Overall, Sweden does not differ substantially from other members of the European Union regarding rates and resolution of violent crime.[23]

Somatic Morbidity

Data on 3 specific neurologic diagnoses previously established as possible risk factors for violent behavior[24,25] were collected: Huntington's disease (*ICD-8*: 331.0; *ICD-9*: 333E; *ICD-10*: G10), epilepsy (*ICD-8/ICD-9*: 345; *ICD-10*: G40.0–41.9), and traumatic brain injury (*ICD-8/ICD-9*: 850–854; *ICD-10*: S06). External cause codes reflecting traumatic injuries (*ICD-8*: E800–E999; *ICD-9*: E800–E866, E880–E999; *ICD-10*: V01–Y36) were used as proxy for impulsive, risk-prone, or reckless behavior.

Birth Complications and Child Morbidity

The Medical Birth Register contains information on all births in Sweden since 1973. We included multiple births, pregnancy length, Apgar score (0–10 points at 1, 5, and 10 minutes after delivery based on 5 vital parameters), weight in reference to pregnancy length (small for gestational age and large for gestational age), and instrumental delivery. We also included information regarding congenital malformations (*ICD-8/ICD-9*:740–759; *ICD-10*: Q00-Q99.9) and perinatal disorders (*ICD-8/ICD-9*: 760–779; *ICD-10*: P00–P99). Information was included for both victim child or children and siblings within each family, since suboptimal functioning in any child is likely to increase parental strain. Analyses of nonfilicide homicide offenders did not include child variables.

Statistical Analyses

Filicide offenders and nonfilicide homicide offenders were compared with matched general population controls. First, we calculated unadjusted conditional odds ratios (ORs) with 95% confidence intervals (CIs) to identify risk factors with significant bivariate associations ($P < .05$); these were entered into multivariate analyses. Second, we performed multivariate logistic regression modeling by initially adjusting for offender education level. The following model adjusted also for all other bivariately significant offender variables, and a final model included all significant variables, including child variables. To retain statistical power, we grouped psychotic, affective, and personality disorder into major psychiatric disorder. All analyses were performed using SAS software, version 9.3 (SAS Institute Inc, Cary, North Carolina), with the Proc Logistic command for conditional logistic regression.

RESULTS

We identified 151 unique filicide offenders who killed 184 children in Sweden 1973–2008. Importantly, 64 of 151 (42.4%) were filicide-suicide cases. A comparison with filicide data collected with a court and police record–based method (filicide-suicide included, Hans Temrin, PhD, oral communication, June 28, 2012) over a comparable 20-year period suggested excellent coverage; more than 90% of the court and police record cases were captured with our ascertainment method. Eighty-two perpetrators (54.3%) were men and 69 (45.7%), women; the majority were biological parents. Five (3.3%) were stepfathers and 1 (0.7%), stepmother. One adoptive mother killed 1 child, and another mother killed 2 children at different occasions. Male perpetrators were somewhat older than female offenders (mean [SD] age = 36.9 [10.0] vs 32.4 [7.0] years; Mann-Whitney *U* test, $P < .001$). Child victim mean age was 4.9 years (SD = 4.5).

We also identified 3,979 convicted nonfilicide homicide offenders (matched individually 10:1 by age and sex to general population controls) (90.4% men, mean [SD] age = 34.6 [12.5] years).

Risk Factors for Filicide

In bivariate analyses, filicide perpetrators more often had low education than matched general population controls. Further, filicide offenders had been substantially more often diagnosed with a psychiatric disorder before the offense. This increased prevalence held across all specified psychiatric disorders, including substance misuse. Previous suicide attempt and violent crime were also more frequently reported in filicide perpetrators (Table 1).

Further, multiple birth was more frequent among children within filicide families compared to children of matched controls, whereas instrument-assisted delivery was less common. No other tested child variable differed significantly between case and control children (Table 1).

Adjusting the crude association between major psychiatric disorder and filicide offender caseness for education did not substantially change the association (Table 2). Also including all offender variables significant at $P < .05$ in bivariate analyses into a regression model attenuated the risk increase conveyed by major psychiatric disorder slightly (adjusted odds ratio [AOR] = 9.0; 95% CI, 4.6–17.5). Adding child variables to the model resulted in a quite similar effect (AOR = 8.6; 95% CI, 3.7–20.0). In the fully adjusted model, previous suicide attempt (AOR = 11.6; 95% CI, 4.0–33.3) and previous violent crime (AOR = 6.6; 95% CI, 3.0–14.2) were attenuated but remained strong independent filicide risk factors. In contrast, substance misuse and traumatic injury did not persist as independent risk factors (Table 2).

Among child risk factors carried forward from bivariate analyses, multiple birth retained an independent risk effect (AOR = 4.8; 95% CI, 1.3–17.6). Conversely, instrumental delivery was negatively associated with filicide (AOR = 0.4; 95% CI, 0.2–0.7) (Table 2).

Since we anticipated possibly meaningful differences in psychiatric morbidity by sex,[14,26] we attempted to investigate this variable (see Supplementary eTable 1 at PSYCHIATRIST.COM). Albeit the difference fell short of statistical significance (overlapping 95% CIs) due to limited statistical power,

Table 1. Prevalence of Risk Factors Among Filicide Offenders, Filicide Offenders' Children, and Nonfilicide Homicide Offenders Compared to Matched Population Controls in Sweden, 1973–2008[a]

	Filicide vs Controls					Nonfilicide Homicide vs Controls				
	Cases n = 151		Controls n = 1,503		*P* Value	Cases n = 3,979		Controls n = 38,279		*P* Value
Variable	n	%	n	%)	(χ^2)	n	%	n	%	(χ^2)
Perpetrator										
Low education[b]	60	39.7	396	26.3	<.001	2,061	51.6	10,420	27.2	<.001
Immigrant status[c]	37	24.5	293	19.5	.137	1,178	29.5	6,475	16.9	<.001
Any psychiatric disorder[d]	37	24.5	63	4.2	<.001	1,451	36.3	1,214	3.2	<.001
Major psychiatric disorder[e]	29	19.2	34	2.3	<.001	827	20.7	588	1.5	<.001
Psychotic disorder	13	8.6	13	0.9	<.001	434	10.9	262	0.7	<.001
Affective disorder	15	9.9	18	1.2	<.001	230	5.8	293	0.8	<.001
Personality disorder	5	3.3	12	0.8	.004	404	10.1	161	0.4	<.001
Substance misuse	9	6.0	33	2.2	.008	1,061	26.6	706	1.8	<.001
Prior suicide attempt	21	13.9	20	1.3	<.001	554	13.9	401	1.1	<.001
Neurologic disorder[f]	5	3.3	40	2.7	.430	513	12.8	1,563	4.1	<.001
Traumatic injury	29	19.2	151	10.1	<.001	1,344	13.7	4,611	12.0	<.001
Any prior crime	38	25.2	168	11.2	<.001	2,912	73.2	5,667	14.8	<.001
Any prior violent crime	20	13.3	36	2.4	<.001	1,973	49.6	1,292	3.4	<.001
Child										
Multiple birth[g]	6	5.1	9	0.8	.001	NA	NA	NA	NA	NA
Instrumental delivery[g,h]	23	19.5	335	31.8	.016	NA	NA	NA	NA	NA
Low Apgar score (0–7 vs 8–10)[g,i]	0	0	10	1.0	.985	NA	NA	NA	NA	NA
Short gestational length[g,j]	15	12.6	98	9.3	.333	NA	NA	NA	NA	NA
Small for gestational age[g]	4	3.5	48	4.6	.743	NA	NA	NA	NA	NA
Large for gestational age[g]	5	4.4	34	3.3	.499	NA	NA	NA	NA	NA
Congenital malformation	4	2.6	34	2.3	.773	NA	NA	NA	NA	NA
Perinatal disorder[k]	4	2.6	18	1.2	.158	NA	NA	NA	NA	NA

[a]All risk factors were measured *before* the index killing among offenders and the corresponding time point in matched controls.
[b]Only compulsory school compared to higher education.
[c]Born outside of Sweden.
[d]Included 3 specified psychiatric disorders (psychotic, affective, and personality disorders), substance misuse and anxiety, phobic, obsessive, eating, and adjustment disorders.
[e]Included psychotic, affective, and personality disorders.
[f]Included traumatic brain injury, epilepsy, and Huntington's disease.
[g]Values were missing for 22.4% of cases and 29.7% of controls.
[h]Included cesarean section, vacuum extraction, and forceps-assisted delivery.
[i]Best score at 5 or 10 minutes.
[j]Gestation length < 37 weeks compared to normal (38–41 weeks).
[k]Defined as *ICD-8*/*-9* codes 760–779 and *ICD-10* codes P00-P99.
Abbreviations: NA = not applicable, NS = nonsignificant.

affective disorder was more strongly associated with filicide in men than in women. On the contrary, psychotic disorders and previous violent crime appeared more strongly associated with filicide in female compared to male offenders.

Nonfilicide Homicide Offenders

Previous violent crime remained the strongest independent risk factor of nonfilicide homicide (AOR = 17.3; 95% CI, 15.7–19.1) when all bivariately significant risk factors were introduced simultaneously in a multivariate regression model. All other variables introduced in the adjusted model, except neurologic disorder, also remained weak to strong independent risk factors (Table 2). Substance misuse and prior violent crime were stronger risk factors for nonfilicide homicide than for filicide (as suggested by nonoverlapping 95% CIs), whereas the opposite was found for prior suicide attempt (Table 2).

DISCUSSION

We used nationwide longitudinal registers to elucidate possible risk effects of psychiatric morbidity, prior suicide attempt, and violent offending in all filicide offenders in Sweden 1973–2008. There were 3 main findings. First, in agreement with indications from studies with smaller or more selected samples (eg, forensic psychiatric evaluations and studies without filicide-suicide cases[3,28,29]), previous suicide attempt, major psychiatric disorder, and prior violent crime were moderate to strong independent filicide risk factors in a multivariate prediction model. Second, among child factors that could increase strain in at-risk parents, multiple birth remained an independent risk factor for filicide. Third, when comparing filicide with nonfilicide homicide offenders to identify filicide-specific risk factors, prior suicide attempt was a significantly stronger risk factor for filicide compared to other homicide, while both substance misuse and prior violent crime were significantly weaker.

In contrast to previous research,[26–29] usually without filicide-suicide offenders, substance abuse was no longer a risk factor for filicide after controlling for other offender and child variables. The inconsistency could result from our calculation of adjusted, independent risk effects; this approach usually led to both halved ORs and wider CIs compared to unadjusted

Table 2. Multivariate Logistic Regression Including Bivariately Significant Risk Factors for Filicide and Nonfilicide Homicide Offenders (*P* < .05; from Table 1) in Sweden, 1973–2008[a]

	Filicide (n = 151)										Nonfilicide Homicide, Fully Adjusted for Offender Covariates (n = 3,979)[b]	
	Crude				Adjusted for Education		Fully Adjusted for Other Offender Covariates		Fully Adjusted for All Offender and Child Covariates[b]			
Variable	n	%	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Perpetrator												
Major psychiatric disorder[c]	29	19.2	12.4	7.0–21.9	11.5	6.4–20.4	9.0	4.6–17.5	8.6	3.7–20.0	5.0	4.3–5.9
Substance misuse	9	6.0	2.9	1.3–6.3	2.6	1.2–5.6	0.5	0.2–1.4	0.5	0.2–1.5	3.4	2.9–3.9
Prior suicide attempt	21	13.9	16.1	7.9–32.6	16.0	7.8–32.8	7.9	3.2–19.5	11.6	4.0–33.3	2.0	1.6–2.4
Any prior violent crime	20	13.3	6.8	3.6–12.9	6.6	3.4–12.6	7.0	3.4–14.3	6.6	3.0–14.2	17.3	15.7–19.1
Traumatic injury	29	19.2	2.2	1.4–3.0	2.3	1.4–3.5	1.0	0.5–1.7	1.1	0.6–2.1	1.5	1.3–1.7
Neurologic disorder[d]	5	3.3	1.5	0.6–3.8	NA	NA	NA	NA	NA	NA	1.1	0.9–1.3
Child												
Multiple birth[e]	6	5.1	6.4	2.1–20.2	7.0	2.2–22.5	NA	NA	4.8	1.3–17.6	NA	NA
Instrumental delivery[e,f]	23	19.5	0.5	0.3–0.9	0.6	0.3–0.9	NA	NA	0.4	0.2–0.7	NA	NA

[a]All risk factors were measured *before* the index killing among offenders and at the corresponding time point in matched controls. Odds ratios designate conditional ORs with 95% CIs. Adjusted models include risk factors significant at *P* < .05 in bivariate analyses (Table 1) and that were correlated less than .70 with each other.
[b]Adjusted for the effects of all other tested covariates in multivariate logistic regression models.
[c]Included psychotic, affective, and personality disorders.
[d]Not entered into the filicide multivariate model due to nonsignificance in the bivariate analysis.
[e]Values were missing for 22.4% of cases and 29.7% of controls.
[f]Included cesarean section, vacuum extraction, and forceps-assisted delivery.
Abbreviation: NA = not applicable.

risk estimates. Further, since the relative importance of filicide risk factors may vary across sex and offense subtype, the inclusion of offenders of both sexes and filicide-suicide cases might have diluted the risk effect of substance misuse. Finally, only subjects with an inpatient substance misuse diagnosis were included, hence true substance misuse rates were underestimated. However, since we have no reason to believe that this underestimation was different between offenders and general population controls, the relative risk for filicide would not be affected, only estimate precision.

To our knowledge, we are the first to address relative risk effects of perpetrator and child variables within the affected family in multivariate models; however, only multiple birth (eg, having a twin) remained an independent risk factor. Multiple compared to single birth is associated with prematurity and increases parenting workload, stress, and depression.[30] However, absolute numbers were small and replication is needed. Somewhat surprisingly, instrumental delivery (including emergency and elective cesarean section) was independently associated with lower filicide risk. Recent research may provide a lead: women who underwent elective cesarean section in Scotland appeared to have greater social support.[31] Further studies are needed to evaluate the robustness of this effect.

Additionally, we attempted to separate filicide-specific from general risk factors for lethal violence. The unadjusted risk increase related to a previous suicide attempt was the same among filicide and homicide offenders and a difference did not appear until adjustment was made. This may partly explain the inconsistency with data presented by Liem et al,[28] suggesting similar frequencies of previous suicide attempts in filicide compared to homicide offenders. In agreement with the present findings, Putkonen and colleagues[32] found significantly less prior violent offending and substance misuse in filicide compared to homicide offenders.

Finally, we found some differences in perpetrator characteristics when analyses were separated by sex (Supplementary eTable 1). Mothers were more often diagnosed with prior psychosis than fathers and, conversely, fathers had affective disorder more frequently.[14,29,33] However, since these sex-divided analyses were underpowered, conclusions should be drawn cautiously.

Strengths and Limitations

Study strengths included high representativity due to inclusion of the important filicide-suicide offender subgroup, regularly excluded in prior research due to the absence of a living perpetrator. Indeed, filicide-suicide constitutes a substantial proportion of all filicide,[3,14,33] particularly among male perpetrators.[14] Further, we carefully selected general population and nonfilicide homicide offender controls. We obtained longitudinal national registry data on offender socioeconomic characteristics, psychiatric and neurologic history, criminality, and child vulnerability variables, all registered before the index killing in cases and at the same time points among matched controls.

The study also has limitations. Despite being one of the largest national population studies so far, the sample size was modest. This resulted in limited statistical power to address, for example, differences between male and female offenders or filicide offenders and filicide-suicide cases. Further, some cases of filicide during the inclusion period could remain undetected due to an acquitted perpetrator.

Regarding prior offending, conviction data undoubtedly underestimate absolute crime rates; for example, data on undetected child victimization are lacking. Further, since

prior violent convictions hold no information on victim identity, assault of children is not separated from assault against adult victims. Data on inpatient psychiatric morbidity and previous attempted suicide capture only severe or complicated cases. However, unless there were systematic reporting differences prior to the filicide between cases and controls, this underrepresentation should not have been different across groups. Hence, relative risk magnitudes were not affected, only the precision of risk estimates.

Information on educational level was only complete during the period 1990–2008. However, due to perpetrators being matched on birth year, the coverage is equally correct in cases and controls.

Generalizability should be considered given Sweden's long history of public tax-funded prenatal and perinatal care to all pregnant women. This practice is likely to affect filicide rates, especially neonaticide, for which limited access to or compliance with prenatal care is a possible risk factor.[12]

We concur that there appears to be no "magic" filicide risk factor in need of discovery.[34] Rather, our data suggest different predictors with varying robustness that together contribute to filicide. Identifying people at risk is highly challenging for low-prevalence behaviors, and, although this study provides some direction, the predictive precision for filicide will most likely remain low. However, prior suicidal behavior, violent crime, and major psychiatric disorder, but not substance misuse, might need clinical consideration and further testing as offender-related filicide risk factors. The same holds for an indicator of parenting stress, such as multiple birth, but not for the less specific characteristics low socioeconomic position and suboptimal pregnancy.

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Potential conflicts of interest: **Dr Runeson** has received honoraria for lecturing from Lundbeck and AstraZeneca. **Drs Lysell, Lichtenstein**, and **Långström** report no competing interests.

Funding/support: The study was supported by grants from the Swedish Research Council—Medicine, the National Crime Compensation Authority, the National Prison and Probation Services, and Karolinska Institute faculty funds for partial financing of doctoral students.

Role of the sponsor: The sponsors had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript.

Supplementary material: Available at PSYCHIATRIST.COM.

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THE JOURNAL OF CLINICAL PSYCHIATRY

Supplementary Material

Article Title: Risk Factors for Filicide and Homicide: 36-Year National Matched Cohort Study

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DOI Number: 10.4088/JCP.13m08372

List of Supplementary Material for the article

1. eTable 1 — Potential risk factors among filicide perpetrators (n=151) compared to matched general population controls in Sweden 1973-2008 and stratified by gender

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Supplementary eTable 1. Potential risk factors among filicide perpetrators (n=151) compared to matched general population controls in Sweden 1973-2008 and stratified by gender.

	Filicide perpetrator gender			
	Male N=82		**Female N=69**	
Variable	**n (%)**	**OR (95% CI)**	**n (%)**	**OR (95% CI)**
Low education[a]	32 (39.0)	1.4 (0.9-2.3)	28 (40.6)	2.6 (1.5-4.4)
Immigrant status[b]	21 (25.6)	1.3 (0.7-2.2)	16 (23.2)	1.5 (0.8-2.7)
Any psychiatric disorder[c]	16 (19.5)	7.0 (3.4-14.2)	21 (30.4)	10.4 (5.4-20.1)
Major psychiatric disorder[d]	14 (17.1)	11.2 (5.0-25.1)	15 (21.7)	13.7 (6.1-30.7)
Psychotic disorder	3 (3.7)	5.1 (1.2-21.6)	10 (14.5)	25.2 (7.7-82.7)
Affective disorder	9 (11.0)	17.5 (5.7-54.0)	6 (8.7)	6.8 (2.3-20.0)
Personality disorder	3 (3.7)	4.7 (1.1-19.1)	2 (2.9)	5.1 (0.9-28.0)
Substance misuse	5 (6.1)	2.6 (0.9-7.4)	4 (5.8)	3.3 (1.0-10.5)
Any prior suicide attempt	11 (13.4)	16.0 (6.0-42.8)	10 (14.5)	16.3 (5.9-44.6)
Neurologic disorder[e]	4 (4.9)	1.9 (0.6-5.6)	1 (1.4)	0.8 (0.1-6.3)
Traumatic injury	19 (23.2)	2.2 (1.3-3.9)	10 (14.5)	2.2 (1.1-4.7)
Any prior crime	27 (32.9)	2.5 (1.5-4.2)	11 (15.9)	4.1 (1.9-8.8)
Any prior violent crime	15 (18.3)	5.6 (2.7-11.5)	5 (7.2)	14.8 (3.4-65.7)

Note: All risk factors were measured *before* the index killing among offenders and the corresponding time point in matched controls.

OR:s designate conditional odds ratios with 95% confidence intervals (CI:s).

a) Only compulsory school compared to higher education.

b) Born outside of Sweden.

c) Included the 3 specified psychiatric disorders below, substance misuse and also anxiety-, phobic-, obsessive-, eating-, and adjustment disorders.

d) Included psychotic-, affective-, and personality disorder.

e) Included traumatic brain injury, epilepsy and Huntington's disease.