ORIGINAL ARTICLE

Risk of Sudden Infant Death Syndrome With Parental Mental Illness

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Context: Sudden infant death syndrome is the leading cause of postneonatal death in developed countries. Little is known about risks linked with parental mental illness per se or how such risks are modified by specific psychiatric conditions and by maternal vs paternal psychopathological abnormalities.

Objective: To investigate cause-specific postneonatal death, including sudden infant death syndrome, in infants whose parents had been admitted as psychiatric inpatients.

Design: National cohort study.

Setting: The entire Danish population.

Patients: All of the singleton live births registered from January 1, 1973, to December 31, 1998. Linkage to the national psychiatric register enabled identification of all of the parental admissions from April 1, 1969, onward.

Main Outcome Measure: All of the cases of sudden infant death syndrome in the postneonatal period classified via national mortality registration between January 1, 1973, and December 31, 1998.

Results: Psychiatric admission history in either parent doubled the risk of sudden infant death syndrome, but there was no difference in risk whether infants were exposed to maternal or paternal admission. Risk was particularly high if both parents had been admitted for any psychiatric disorder (relative risk, 6.9; 95% confidence interval, 4.1-11.6). Among specific parental disorders, the greatest risk was associated with admission for alcohol- or drug-related disorders (mothers: relative risk, 5.0; 95% confidence interval, 3.4-7.5; fathers: relative risk, 2.5; 95% confidence interval, 1.7-3.8). Contrary to prior expectation, parental schizophrenia and related disorders did not confer higher risks than other parental disorders that resulted in admission.

Conclusions: Infants whose parents have been admitted for psychiatric treatment are at greater risk for sudden infant death syndrome. However, risks may be lower than previously thought with maternal schizophrenia and related disorders. Clinicians should be aware of particularly high risks if both parents have received any psychiatric inpatient treatment or if either parent (but the mother especially) was admitted with an alcohol- or drug-related disorder.

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SUDDEN INFANT DEATH SYNDROME (SIDS) is the most common cause of postneonatal death in developed countries.[1] In the United States there were more than 2000 such deaths in 2003, occurring at a rate of 0.5 per 1000 live births.[2] A SIDS case is recorded when a sudden unexpected death in infancy (SUDI) occurs but a thorough postmortem examination and scene-of-death inquiry are unable to determine a specific cause of death. In about two-thirds of SUDIs, a classification of SIDS is given. As such, it is a diagnosis of exclusion that may cover a range of different causes. Many risk factors for SIDS have been identified, one of which is maternal schizophrenia.[3] This and effects linked with other parental psychiatric illnesses represent an important public health concern because most people with mental illness now become parents.[4] The death of a child also has serious and long-term consequences for parental mental well-being.[5,6]

Calls for further investigation of the association between parental mental illness and SIDS have been made.[7] A Danish population-based study[3] reported a 5-fold higher risk in infants whose mothers have schizophrenia. Other studies[8,9]

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have found an increased risk of SIDS with postnatal depression. Little is known about how risks are influenced by a broader range of psychiatric conditions. However, our recent Danish population-based study[10] found that among parents with a variety of psychiatric diagnostic categories, the highest risk of death from all causes was in infants whose mothers had been admitted for an alcohol- or drug-related disorder.

In this study, we aimed to address the limitations of the current literature and extend the findings of our previous study. We examined whether there is a higher risk of SIDS linked with parental psychiatric admission history, whether any increased risk is specific to particular parental disorders, and whether an increased risk is specific to maternal vs paternal psychopathological abnormalities. We anticipated that the highest risks of SIDS would be observed among infants exposed to the following: (1) parental admission with schizophrenia and related disorders; (2) parental admission with an alcohol- or drug-related disorder; (3) maternal admission (as compared with paternal admission); and (4) having both parents (vs 1 parent only) admitted.

METHODS

STUDY COHORT

Using data from the national Civil Registration System,[11] we initially identified all of the births in Denmark to Danish-born mothers between January 1, 1973, and December 31, 1998. The study cohort was restricted to singleton births owing to statistical nonindependence of observations within multiple birth sets. All newly born infants are assigned a unique personal identification number. This is systematically recorded in each of the registers in the Civil Registration System; thus, virtually complete linkage between registers is achieved.[11] We linked the Central Population Register, which records the dates of birth, death, and emigration of each individual living in Denmark, to the Psychiatric Central Register, which records information on diagnoses for all inpatient admissions since April 1, 1969,[12] and to the national Causes of Death Register.[13] Parental diagnoses and causes of death were recorded using the *International Classification of Diseases* (*ICD*) system; the 8th revision was applied from January 1, 1973, to December 31, 1993,[14] with the 10th revision used from January 1, 1994, to December 31, 1998.[15]

MISSING PATERNAL IDENTITIES

Maternal identity was registered for every offspring subject in the birth cohort. Paternal identity data were 90.5% complete for postneonatal deaths (at ages 29 days to 1 year) but only 74.1% complete for neonatal deaths (first 28 days of life). We therefore restricted our analyses to the postneonatal period to enable likewise comparison between effects linked with maternal vs paternal psychiatric admission. In this study the registered father is not necessarily the biological father, as this information was not recorded in the registers.[11]

CLASSIFICATION OF EXPOSURE

Infants were classified as being exposed according to the date of the first maternal or paternal psychiatric admission for any reason (or within a specific diagnostic range). If the first parental admission occurred after an infant's death or first birthday, it was excluded from the exposed group. We classified exposure according to the first admission for a psychiatric diagnostic category or an alcohol- or drug-related disorder, regardless of whether this was assigned as a primary or secondary diagnosis. We thereby accounted for the fact that alcohol- and drug-related disorders are rarely assigned as the primary diagnosis. It was not possible to adequately examine dual diagnosis as a separate diagnostic group because no such code exists in either *ICD* revision. We did, however, address the issue of comorbidity by separately estimating relative risks (RRs) of SIDS and other causes of death in relation to maternal or paternal admission having excluded alcohol- and drug-related disorders from the exposed groups.

All of the parental admissions at age 16 years and older were identified from the psychiatric register. The *ICD* codes used to delineate specific diagnostic categories were as follows: schizophrenia and related disorders (ie, schizophrenia, schizophrenia-like disorders, schizoaffective disorders): *ICD-8*: 295, 296.8, 297, 298.39, 301.83; *ICD-10*: F20-F29; affective disorders (ie, bipolar disorder and other affective disorders): *ICD-8*: 296.09, 296.19, 296.29, 296.39, 296.99, 298.09, 298.19, 300.49, 301.19; *ICD-10*: F30-F39; and alcohol- or drug-related disorders: *ICD-8*: 291, 294.3, 303, 304, 980.09; *ICD-10*: F10-F16, F18-F19. The *ICD-8* codes for drug-related disorders were generic (ie, without reference to particular drug types); the *ICD-10* codes identified specific drug types: F11 (opioids), F12 (cannabinoids), F13 (sedatives or hypnotics), F14 (cocaine), F15 (other stimulants), F16 (hallucinogens), F18 (volatile solvents), and F19 (miscellaneous). All of the diagnostic categories were selected for reasons of clinical relevance and have been used in other Danish registry studies (eg, our earlier study[10]).

CLASSIFICATION OF POSTNEONATAL DEATH BY CAUSE

Postneonatal death was classified by cause as follows: SIDS: *ICD-8*: 795; *ICD-10*: R95; all natural causes (other than SIDS): *ICD-8*: 000-796; *ICD-10*: A00-R99 (excluding SIDS codes); and all unnatural causes (accident, assault, or open verdict): *ICD-8*: 800-999; *ICD-10*: V00-Y99.

More than 90% of all SIDS cases in the whole study period were classified before January 1, 1994, using *ICD-8*. Because of this numerical preponderance, any effect of the coding revision on our study results is likely to have been minor. All of the postneonatal deaths that occurred in Denmark during the study period were ascertained (n=3511); virtually all of them (3505 postneonatal deaths [99.8%]) had a cause of death recorded, and the level of missing cause of death was minimal in both the exposed and unexposed groups.

STATISTICAL ANALYSES

Statistical analyses were conducted using Stata version 9 statistical software (Stata Corp, College Station, Texas). The RR of death in infants exposed to parental admission compared with unexposed subjects was estimated using Poisson regression.[16] The reference groups in these models were infants whose mother or father had not been admitted with any psychiatric illness. The cohort was followed up from birth to the date of death, first birthday, emigration, or January 1, 1999, whichever came first. Having restricted the analyses to the postneonatal period, there were 1 439 982 infants eligible for at least 1 day of follow-up. Owing to right censoring, a small proportion (3.6%) of offspring subjects were not followed up completely through the whole postneonatal period. For example, an infant born at the end of November 1998 would contribute just a few days of follow-up. However, our Poisson models were analogous to sur-

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vival analysis in that they did not require an equal amount of follow-up per subject.

We created time-dependent categorical exposure variables[17] by stratifying the person-years at risk according to the date of the first parental admission. Thus, it was possible for infants to be placed initially in the unexposed group and then be subsequently transferred to an exposed category following the first parental admission. Despite using these complex time-dependent stratification procedures, the exposure variables simply classified offspring according to whether their parent(s) had been admitted. Owing to small numbers of events, they were not categorized according to the duration of or since exposure. The Poisson models estimated the RR by comparing the number of deaths in exposed infants (divided by the aggregated person-years at risk) with the same parameter for unexposed infants. To account for cohort effects and to achieve a good fit to the data, the models were adjusted for interactions between the calendar period (1973-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994, 1995-1998) and infant age in fine strata. From the regression models we also used Wald significance tests to determine whether the RRs were higher if only the mother or only the father (and if both parents vs only 1 of them) had been admitted. Our methods are explained in greater detail elsewhere.[10]

We further adjusted the RRs for maternal age at birth as well as infant birth order and sex. These additional adjustments produced RRs and confidence intervals that were very similar to those presented in this article. Therefore, we have not reported these extra results. A previous Danish registry study[3] found that variance estimation methods that adjusted for within-family correlation generated results almost identical to those from methods that did not take account of these effects. This is because multiple occurrences of SIDS within families are exceptionally rare. In our data set there were no multiple familial SIDS cases in the exposed group, and such cases constituted only 0.5% (6 of 1242) of the total number in the unexposed group. Therefore, we did not exclude multiple familial SIDS cases from our analyses or assess them as a separate subgroup. Also, we did not adjust for familial clustering, preferring the better small-sample properties of the standard approach for low-frequency events.

RESULTS

RISKS ASSOCIATED WITH ANY PARENTAL PSYCHIATRIC ADMISSION

Table 1 shows the RRs of cause-specific postneonatal death associated with any maternal or paternal history of psychiatric admission. We found greater than 2-fold higher risks of SIDS and death from any unnatural cause among infants exposed to any maternal admission. Among the 60 SIDS cases exposed to any maternal psychiatric admission, only 3 mothers were first admitted between the birth and death of the infant. The other 57 mothers had their first admission before the infant's birth, most of which occurred prior to the index pregnancy. A greater than 2-fold higher risk of SIDS was also observed in infants exposed to any paternal admission. There was also a trend toward higher risk of death from unnatural causes with history of paternal admission, but owing to the small number of exposed cases (n=5), this estimate of elevated risk was not statistically significant ($P=.28$). There was an approximate 30% higher risk of death from any natural cause other than SIDS in relation to any maternal or paternal admission history.

Table 1. Relative Risks of Cause-Specific Postneonatal Death in Infants With Parental Admission for Any Psychiatric Illness

Maternal vs Paternal Effects by Offspring Cause of Death	Deaths, Rate/10 000 Person-y (No.)		RR (95% CI)
	Admitted	Not Admitted	
Maternal effects			
SIDS	22.6 (60)	9.7 (1242)	2.3 (1.8-3.0)
All other natural causes	19.6 (52)	15.4 (1970)	1.3 (1.0-1.7)
All unnatural causes	3.4 (9)	1.3 (172)	2.6 (1.4-5.2)
Paternal effects			
SIDS	21.1 (54)	8.6 (1086)	2.3 (1.8-3.1)
All other natural causes	18.4 (47)	14.4 (1821)	1.3 (1.0-1.8)
All unnatural causes	2.0 (5)	1.2 (158)	1.6 (0.7-4.0)

Abbreviations: CI, confidence interval; RR, relative risk; SIDS, sudden infant death syndrome.

We also estimated the population attributable fraction on the risk of SIDS linked with a history of psychiatric admission in at least 1 parent. Our estimate was modest (population attributable fraction, 5.0%; 95% confidence interval, 3.4%-6.5%), but the population impact could be considerably higher if a broader group of parents with mental illness were included in the exposure group, such as those treated in the community or as outpatients.

RISKS ASSOCIATED WITH SPECIFIC PARENTAL DIAGNOSTIC CATEGORIES

Table 2 presents RRs of SIDS (and other causes of postneonatal death) associated with maternal or paternal psychiatric admission history within specific diagnostic categories. We found a trend toward higher SIDS risks in infants whose mothers or fathers had been admitted for schizophrenia and related disorders compared with the general population. However, these estimates were based on small numbers and had wide confidence intervals. There was a significant 2-fold elevation in the risk of SIDS among infants whose fathers were admitted with affective disorders, and we observed a trend toward higher risk with maternal admission for affective disorder.

The highest risks of SIDS (and also of death due to all other causes) were associated with maternal admission for alcohol- or drug-related disorders. We found a 5-fold higher risk of SIDS in these infants, although the risk associated with paternal admission in this diagnostic category was around half that for maternal alcohol- or drug-related admissions. **Table 3** shows the RRs of SIDS associated with parental psychiatric admission other than for alcohol- or drug-related disorders. Excluding these disorders attenuated the effect size linked with any maternal admission from an RR of 2.3 (admissions for alcohol- and drug-related disorders included) (Table 1) to an RR of 1.5 (admissions for alcohol- and drug-related disorders in either parent excluded) (Table 3). Excluding any parental alcohol- or drug-related admission also attenuated the effect sizes linked with all of the paternal psychiatric admissions but to a lesser degree.

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Table 2. Relative Risks of Sudden Infant Death Syndrome by Specific Parental Psychiatric Diagnostic Category

Maternal vs Paternal Effects by Offspring Cause of Death	Not Admitted	Schizophrenia and Related Disorders		Affective Disorders		Alcohol- and Drug-Related Disorders	
	Deaths, Rate/10 000 Person-y (No.)	Deaths, Rate/10 000 Person-y (No.)	RR (95% CI)	Deaths, Rate/10 000 Person-y (No.)	RR (95% CI)	Deaths, Rate/10 000 Person-y (No.)	RR (95% CI)
Maternal effects							
SIDS	9.7 (1242)	19.8 (5)	2.0 (0.8-4.7)	15.3 (9)	1.7 (0.9-3.2)	52.3 (24)	5.0 (3.4-7.5)
All other causes	16.8 (2142)	18.9 (5)	1.2 (0.5-3.0)	18.8 (11)	1.1 (0.6-2.0)	34.9 (16)	2.1 (1.3-3.4)
Paternal effects							
SIDS	8.6 (1086)	16.4 (4)	1.8 (0.7-4.9)	18.7 (8)	2.1 (1.1-4.3)	23.4 (24)	2.5 (1.7-3.8)
All other causes	15.6 (1979)	12.3 (3)	0.8 (0.3-2.6)	25.6 (11)	1.6 (0.9-3.0)	18.4 (19)	1.2 (0.8-1.9)

Abbreviations: CI, confidence interval; RR, relative risk; SIDS, sudden infant death syndrome.

Table 3. Relative Risks of Sudden Infant Death Syndrome in Relation to Any Parental Admission, With Alcohol- and Drug-Related Admissions Excluded

Maternal vs Paternal Effects by Offspring Cause of Death	Deaths, Rate/10 000 Person-y (No.)		
	Admitted	Not Admitted	RR (95% CI)
Exclusion criterion 1[a]			
Maternal effects			
SIDS	15.2 (31)	9.5 (1201)	1.7 (1.2-2.4)
All other causes	18.2 (37)	16.7 (2105)	1.2 (0.8-1.6)
Paternal effects			
SIDS	17.6 (24)	8.4 (1046)	2.0 (1.3-3.0)
All other causes	18.4 (25)	15.6 (1940)	1.2 (0.8-1.8)
Exclusion criterion 2[b]			
Maternal effects			
SIDS	13.6 (26)	9.3 (1152)	1.5 (1.0-2.2)
All other causes	18.8 (36)	16.6 (2045)	1.2 (0.9-1.7)
Paternal effects			
SIDS	15.9 (21)	8.3 (1015)	1.9 (1.2-2.9)
All other causes	18.2 (24)	15.5 (1898)	1.2 (0.8-1.9)

Abbreviations: CI, confidence interval; RR, relative risk; SIDS, sudden infant death syndrome.
[a] Maternal or paternal admissions for alcohol- or drug-related disorders were excluded from the maternal or paternal exposure group, respectively.
[b] Alcohol- or drug-related admissions of either parent were excluded from both exposure groups.

Table 4. Relative Risks of Sudden Infant Death Syndrome Specific to Mother-Only vs Father-Only Admission and to Number of Parents Admitted

Maternal vs Paternal Effects	Deaths in Exposed Group, Rate/10 000 Person-y (No.)[a]	RR (95% CI)[b]	Wald *z* Test Statistic (*P* Value)[c]
Any psychiatric admission			
Mother-only admission	15.0 (35)	1.8 (1.3-2.5)	–0.37 (.71)
Father-only admission	17.3 (40)	1.9 (1.4-2.7)	
1 Parent admitted	16.2 (75)	1.9 (1.5-2.4)	4.49 (<.001)
Both parents admitted	56.8 (14)	6.9 (4.1-11.6)	
Alcohol- or drug-related disorder			
Mother-only admission	30.4 (11)	3.3 (1.8-6.0)	1.35 (.18)
Father-only admission	17.7 (16)	2.0 (1.2-3.2)	
1 Parent admitted	21.4 (27)	2.4 (1.6-3.4)	2.84 (.004)
Both parents admitted	83.7 (5)	9.4 (3.9-22.6)	

Abbreviations: CI, confidence interval; RR, relative risk; SIDS, sudden infant death syndrome.
[a] The unexposed group consisted of infants with neither parent admitted.
[b] A common reference category (neither parent admitted) was used to calculate each RR; there were 1051 SIDS cases in the unexposed group (8.5 per 10 000 person-years).
[c] Tests for linear combination of regression coefficients in the Poisson model (ie, mother-only vs father-only admission; 2 parents vs 1 parent admitted).

MATERNAL-ONLY VS PATERNAL-ONLY ADMISSION AND NUMBER OF ADMITTED PARENTS

The RRs of SIDS in relation to the specific exposure groups of maternal-only and paternal-only admissions as well as the number of parents admitted are shown in **Table 4**. For effects linked with all parental psychiatric admissions or with alcohol- or drug-related disorder admissions, we found no evidence of higher risk for maternal-only admission as compared with paternal-only admission. However, admission of both parents increased the risk of SIDS almost 7-fold compared with infants in the general population. The risk was even higher if both parents were admitted with alcohol- or drug-related disorders, although there were only a small number of cases in this subgroup (n=5).

COMMENT

KEY FINDINGS

Having a parent with any psychiatric inpatient history more than doubles the risk of SIDS compared with general population rates. In particular, we found a nearly 7-fold higher risk when both parents had been admitted. Overall, there was no evidence of a difference in risk among infants exposed to maternal-only vs paternal-only admission. However, among the specific diagnostic categories investigated, we found that the greatest risk of SIDS occurred if a parent (and especially the mother)

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had been admitted with an alcohol- or drug-related disorder. The risk of SIDS was no greater in relation to schizophrenia and related disorders than with other parental disorders that led to admission. There was a weak trend for a higher risk of SIDS in relation to this parental diagnostic category, but failure to find significant effects may have been due to low statistical power.

Our findings are generally consistent with previous studies reporting higher rates of postneonatal death, and SIDS in particular, linked with parental psychiatric disorder. However, we observed only half the risk of SIDS in infants exposed to maternal admission with schizophrenia and related disorders than has previously been reported in Denmark,[3] a difference that could be due to reverse causality bias. In that study, infants were classified to the exposed group even if the first maternal admission occurred after the infant had died (and death of one's child is a strong predictor of parental admission for schizophrenia and other disorders).[5]

POSSIBLE CAUSAL MECHANISMS

Infants whose mothers or fathers were admitted for alcohol- or drug-related disorders were at higher risk of SIDS compared with both the general population and infants exposed to other parental illnesses. Evidence for an association between in utero exposure to alcohol and SIDS risk is unclear. Thus, the Nordic Epidemiological SIDS Study[18] reported no link with maternal use of alcohol during pregnancy after adjustment for socioeconomic status and smoking. A further Danish study[19] has confirmed these negative findings in relation to moderate alcohol intake in pregnancy. By contrast, recent data in Native Americans show a relationship between maternal binge drinking and SIDS, especially so with exposure during the periconceptual period and first trimester.[20] Our literature search found no direct evidence of a link with fetal alcohol syndrome, although siblings of these infants have been shown to have a 10-fold higher risk of SIDS.[21] Exposure to maternal hard drug use during pregnancy has also been linked with increased risks of all-cause infant mortality[22] and SIDS,[23] although the risks are even higher if exposure continues during infancy.[24] While maternal substance misuse may directly affect the baby both before and after birth, the ill effects of exposure to paternal alcohol or drug use are restricted to the latter period. However, the reduced but still significant elevated risk with paternal admission for these disorders could be caused by coincident maternal use during pregnancy without psychiatric admission. Another possible explanation for the especially high risk linked with alcohol- and drug-related disorders is chaotic lifestyle and consequent neglect of care among some of these parents.

Infants with 2 parents affected by severe mental illness or alcohol- or drug-related disorders are particularly vulnerable to SIDS. An explanation for this phenomenon could not be derived from our data. This is likely to be a highly selected group of parents with assortative mating, downward social drift, and extremely poor psychosocial circumstances. Interaction between genetic and environmental risk factors[25] may partially explain such a high RR. Also, if both parents are intoxicated while caring for their infant, there may be periods when their levels of vigilance and capacity to provide adequate care are particularly lacking.

It is not clear that a causal relationship exists between parental psychiatric admission history and SIDS. Our findings may merely reflect associations that arise owing to shared risk factors. Smoking,[26,27] which is known to be more common with psychiatric illness,[28] may be a particularly important unmeasured confounder in our study. The Nordic Epidemiological SIDS Study[27] reported that maternal smoking during pregnancy was an independent risk factor. These effects may be particularly strong in our study owing to the exceptionally high prevalence of smoking among Danish women,[29,30] as 30% to 40% of them smoked during pregnancy throughout the 1990s[27,31,32] and half of all of their children were exposed to passive smoking in the home.[33]

Other modifiable risk factors for SIDS in the general population include sleeping in the prone position,[34] loose bedding and a soft sleeping surface,[35] overheating,[36] and sharing a bed with parents who smoke or drink alcohol.[37,38] It is unclear whether these risk factors are more prevalent among parents with mental illness than in the population at large. A lack of awareness of risk factors may contribute to higher rates of SIDS in infants with parents with mental illness. Evidence suggests that SIDS cases are becoming increasingly concentrated in disadvantaged groups that are difficult to reach via national risk-reduction campaigns.[39,40] A Danish national campaign with particular focus on avoiding the prone sleeping position was launched in 1991; as in other countries, this led to a marked decline in the national SIDS rate.[40] It could be that levels of compliance with the campaign were particularly poor among parents with mental illness. We undertook additional analyses of SIDS risks during the 1990s (vs the 1970s and 1980s), which showed no support for this notion. The risk fell at a similar rate in infants with and without a history of parental mental illness, and the RRs were approximately 2 in both periods.

Across all of the diagnostic groups and in relation to maternal and paternal admission, the RRs of SIDS were consistently greater than they were for other causes of death (except for unnatural causes). This could be partly explained by socioeconomic status effects,[41] which also predict higher risk of both all-cause infant mortality and SIDS. The RR estimates may have been attenuated if we had adjusted for low socioeconomic status. However, controlling for these factors could represent overadjustment if mental illness is associated with downward social mobility.[42] Furthermore, some of the observed effect sizes were large (eg, RR of 5 with maternal admission for alcohol- or drug-related disorders; RR of 7 with admission of both parents). Relative risks of this order of magnitude are less likely to be wholly explained by confounding factors.[43] International comparisons of inequalities in general health status indicate that trends are more favorable in the Nordic countries than elsewhere in Europe.[44] Nonetheless, social class gradients in infant mortality still exist in Scandinavia.[45] Thus, socioeconomic status factors are probably an important confounder in Denmark, but perhaps to a lesser degree

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than in the United Kingdom or the United States, for example.

STRENGTHS AND LIMITATIONS OF THE STUDY

The main strengths of our study were that we used whole population data during a 26-year period with complete linkage between national registers. Exposure data were collected prospectively using objective, routinely collected items, and follow-up was complete for both exposed and unexposed cohorts. The size of the cohort allowed us to examine links with a range of parental mental illnesses as well as to compare the effects of maternal vs paternal disorder and having 2 parents vs 1 parent admitted. However, the study had several limitations. We had no information about socioeconomic status, parental smoking, prescribed medication, usual or last sleeping position, or actual levels of alcohol or drug use during pregnancy or post partum. For example, if a causal relationship truly exists between maternal psychiatric history and SIDS, it may be related to the use of psychotropic medication during pregnancy; however, the study registers lacked any medication data. The comparison between effects linked with maternal vs paternal admission history is also somewhat limited owing to a lack of adjustment for single parenthood.

We examined only psychiatric illness of sufficient severity to result in inpatient admission; therefore, the results cannot be generalized to less severe forms of parental psychopathological abnormalities. The register records information on all psychiatric admissions nationally since April 1, 1969. All psychiatric outpatient contacts have also been recorded since January 1, 1995, but at the time of constructing the study cohort we could not examine these effects owing to low statistical power. Previous studies have shown a higher risk of SIDS with postnatal depression with or without psychiatric admission.[8,9] Likewise, our only measure of alcohol consumption was history of admission with an alcohol-related disorder assigned as a primary or secondary diagnosis. It seems likely that effects would be weaker in relation to alcohol misuse without admission. In future years, it may be possible to use the Danish registers to compare SIDS risks by parental illness severity as indicated by inpatient vs outpatient treatment. As in other countries, rates of psychiatric hospitalization in Denmark fell sharply during the study period,[46] but we found no evidence of RRs increasing during this time.

We were unable to ascertain whether parents were mentally ill during infants' lives or whether infants were living with their parent(s) at the time of their death. The latter could lead to bias if parents with mental illness are more frequently separated from their infants owing to intervention by the social services. We were unable to assess this potential bias because adopted infants are relinked to their new legal parents and all previous linkages to biological parents are expunged from the registers.[11] However, rates of maternal-infant separation are rare in the Danish general population; between January 1, 1982, and December 31, 1998, 0.1% of infants (83/61 000 live births/year) were placed outside their own home.[47] Although separation rates may be higher with severe parental mental illness, any exposure misclassification from adoption is likely to have attenuated our effect sizes by misplacing exposed subjects in the unexposed group.

There were minimal levels of missing cause-of-death data, although effect estimates specific to paternal psychiatric admission history may have been biased owing to missing registered paternity in 9.5% of all postneonatal deaths and 12.4% of SIDS cases. The prevalence of prior maternal admission was higher in infants without (6.2%) than with (2.0%) registered fathers. This suggests possible higher prevalence of paternal admission among the unregistered fathers. However, such exposure misclassification would again most likely attenuate the effect sizes.

Perhaps the most important limitation concerns the accuracy of cause-of-death classification, which was taken from the underlying cause assigned in the death certificate. Since its first use in 1969, the diagnosis of SIDS has attracted controversy and subsequent revision[48]; therefore, assessing diagnostic validity and consistency over time is difficult. Thus, a national registry study should perhaps be best viewed as a study of SUDI, especially when the original records could not be revisited to determine the likelihood of any given death being a genuine SIDS case. However, analyses from Denmark and Norway (which have higher rates than other Nordic countries) suggest that their national SIDS statistics are relatively accurate and reliable.[49] Danish law requires an autopsy in cases of SUDI, so autopsy rates for these deaths are higher (70%-90%) than in many other European countries.[50] Forensic inquiry in Denmark also includes a death scene investigation and interviews with the family doctor, parents, and other relatives. Neither the marked rise in national SIDS rates during the 1980s nor the sharp fall in the 1990s could be attributed to changes in classification or diagnostic practice.[49]

We found a significantly higher risk of death from all unnatural causes with exposure to any maternal psychiatric admission, with 5 of the 9 deaths in this group classified as homicides. It is believed that an unknown proportion of SIDS cases are disguised homicides.[51] We can only speculate as to whether offspring of parents with mental illness would be more or less likely to be assigned a diagnosis of SIDS vs homicide. Throughout the study period, Danish SIDS diagnoses were generally made by forensic pathologists following standardized criteria.[49,50] Therefore, death from unnatural causes may have been considered more frequently and rigorously than in other countries and the likelihood of significant misclassification may be lower.

CONCLUSIONS

Clinicians should be aware that the association between parental schizophrenia and SIDS risk is much weaker than previously reported. When treating severe adult psychiatric illnesses, it is important to identify patients who already have or will soon have infants in their care. To help raise parental awareness of modifiable risk factors, these especially vulnerable infants may be better protected if infants' pediatricians are informed of parents' mental illnesses. Particularly high levels of vigilance are indi-

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cated if both parents have a history of severe mental illness.

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