Suicide Methods and Specific Types of Accidental Death and Fatal Poisoning Among Discharged Psychiatric Patients: A National Cohort Study

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ABSTRACT

Objective: Persons discharged from inpatient psychiatric units are at greatly elevated risk of dying unnaturally. We conducted a comprehensive examination of specific causes of unnatural death post-discharge in a national register-based cohort.

Method: A cohort of 1,683,645 Danish residents born 1967–1996 was followed from their 15th birthday until death, emigration, or December 31, 2011, whichever came first. Survival analysis techniques were used to estimate incidence rate ratios (IRRs) comparing risk for persons with and without psychiatric admission history in relation to (*a*) suicide method, (*b*) accidental death type, (*c*) fatal poisoning type, and (*d*) homicide.

Results: More than half (52.5%, n = 711) of all unnatural deaths post-discharge were fatal poisonings, compared with less than a fifth (17.0%, n = 1,012) among persons in the general population not admitted. Just 6.8% (n = 92) of all unnatural deaths post-discharge were due to transport accidents—the most common unnatural death type in the general population (53.4%, n = 3,184). Suicide risk was 32 times higher among discharged patients (IRR 32.3; 95% CI, 29.2–35.8) and was even higher during the first year post-discharge (IRR 70.4; 95% CI, 59.7–83.0). Among the suicide methods examined, relative risk values were significantly larger for intentional self-poisoning (IRR 40.8; 95% CI, 33.9–49.1) than for "violent" suicide methods (IRR 29.4; 95% CI, 26.1–33.2). The greatest relative risk observed was for fatal poisoning (irrespective of intent) by psychotropic medication (IRR 93.7; 95% CI, 62.5–140.5). The highest post-discharge mortality rate was for accidental self-poisoning among persons diagnosed with a psychoactive substance abuse disorder: 290.1 per 100,000 person-years.

Conclusions: Closer liaison between inpatient services and community care, more effective early treatment for comorbid substance abuse, enhanced psychosocial assessment following self-harm, and tighter medication surveillance could decrease risk of unnatural death post-discharge.

J Clin Psychiatry 2018;79(6):17m11809

To cite: Walter F, Carr MJ, Mok PLH, et al. Suicide methods and specific types of accidental death and fatal poisoning among discharged psychiatric patients: a national cohort study. *J Clin Psychiatry*. 2018;79(6):17m11809.

To share: https://doi.org/10.4088/JCP.17m11809

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Mental illness is associated with premature mortality,[1–3] and persons with a history of inpatient psychiatric treatment are at especially elevated risk.[4–8] Relative risk of dying unnaturally in this population, compared to that for persons not admitted for psychiatric treatment, is much higher than that of dying naturally.[8] However, no published studies have comprehensively examined specific causes of unnatural death in a single cohort, thereby enabling direct comparison of risks. Whereas a substantial body of literature is available on mental illness and suicide risk,[9–12] far fewer studies have reported on other unnatural causes of death such as accidents in this population.[13,14]

We conducted a national register-based cohort study to examine the following causes of unnatural death among persons after first discharge from inpatient psychiatric services: (1) suicide method, (2) accidental death type, (3) fatal poisoning type, and (4) homicide. Most previous studies have examined suicide methods[15–18] or types of accidental death[13] separately. Thus, as only a limited literature[19,20] reports on multiple causes of unnatural death in the same population, an especially novel feature of this study is assessment of different suicide methods and specific types of accidental death and fatal poisoning, including the poisoning agent used, all in 1 national cohort. We hypothesized that risk would be markedly elevated for each cause of death examined versus persons not admitted for inpatient psychiatric treatment and that relative risk for intentional self-poisoning would be greater than for "violent" suicide methods.[17]

METHODS

Data Sources

The study was approved by the Danish Data Protection Agency, the State Serum Institute, and Statistics Denmark. In accordance with the Act on Processing of Personal Data, anonymity and confidentiality were strictly maintained by replacing identification numbers with randomly generated personal identifiers. We analyzed data extracted from the Civil Registration System (CRS), which has captured vital status information on all Danish residents since 1968. This register can be linked with other national registers via a personal identification number.[21] We linked information from the CRS with information from the Psychiatric

Clinical Points

- More than half of all unnatural deaths among persons after a first discharge from inpatient psychiatric care were poisonings, whereas 1 in 6 of all unnatural deaths were poisonings among comparator cohort members in the general population.
- A diverse range of effective preventive measures will be required to achieve a significant reduction in risk of dying from unnatural causes post-discharge.
- Specifically, closer liaison between inpatient services and community care, more effective early treatment for comorbid substance abuse, enhanced psychosocial assessment following self-harm, and tighter medication surveillance could decrease risk of unnatural death.

Central Research Register[22] and the Register of Causes of Death.[23]

Study Cohort

We examined all persons born in Denmark during 1967–1996, inclusive, who were residing in the country at their 15th birthday (N = 1,683,645). To eliminate potential confounding due to elevated psychopathology risk among immigrants,[24] we restricted the cohort to persons with both parents born in Denmark. We also excluded individuals discharged from inpatient psychiatric care at least once before their 15th birthday (n = 5,529). Follow-up commenced on cohort members' 15th birthdays and was terminated at death, emigration, or end of follow-up, whichever came first. During the follow-up period, January 1, 1982, to December 31, 2011, we compared persons who experienced their first discharge from an inpatient psychiatric unit, or a psychiatric ward in a general hospital, after their 15th birthday to persons without history of psychiatric inpatient treatment (ie, the reference group). Depending on whether cohort members' 15th birthdays occurred adjacent to the beginning or end of the study's 30-year observation period, the minimum age in years when their follow-up ceased was 15 and the maximum was 44, which was also the age range at first discharge from inpatient psychiatric care. The amount of person-time at risk that each cohort member could possibly contribute to the denominator ranged from 1 day to 30 years.

Outcomes and Covariates

We extracted information from the Register of Causes of Death to classify underlying causes of death based on the *International Classification of Diseases*, 8th revision (*ICD-8*)[25] and 10th revision (*ICD-10*)[26]; *ICD-9* was never introduced in Denmark. Supplementary Table 1 lists the *ICD-8* and *ICD-10* codes used for these classifications. Deaths by self-poisoning with psychotropic medication and self-poisoning with narcotics and hallucinogens were restricted to *ICD-10*–coded deaths that occurred from January 1, 1994, onward, due to inconsistency between *ICD* 8th and 10th revisions. We obtained clinical information, including first discharge date and psychiatric diagnosis at first inpatient episode, from the Psychiatric Central Research Register. We utilized primary and secondary diagnostic codes and applied a hierarchical approach[8,27] to classifying them to ensure mutual exclusivity between groups (Supplementary Table 2).

Statistical Analyses

Risks of dying from specific causes were compared between persons discharged from their first inpatient psychiatric episode versus individuals without history of psychiatric admission. The registry data available did not distinguish between deaths that occurred in the community on discharge date versus those that happened during the inpatient episode, with those cases categorized as inpatient deaths. We calculated incidence rates and estimated incidence rate ratios (IRRs) and their 95% confidence intervals (CIs) using Poisson regression with person-time denominators. The Poisson models were adjusted for age and calendar year, both categorized into 5-year bands, and gender, to account for these potential confounding influences at first discharge and throughout post-discharge follow-up.

RESULTS

Cohort Characteristics

Among the 1,683,645 cohort members, 47,077 (2.8%) were discharged at least once from inpatient psychiatric care on or after their 15th birthday. Supplementary Table 3 profiles their sociodemographic and clinical features. There was a slight female predominance (51.1%), and 55.4% were below 25 years of age at first discharge, with more than a quarter (26.9%) being in their mid-late teens at this event. Thus, cohort members were studied mostly at young adult age, but their maximum age during follow-up was 44 years. Among the psychiatric diagnostic categories examined, neurotic, stress-related, and somatoform disorders (25.8%) were the most common, followed by psychoactive substance abuse (22.3%). Most discharged patients (94.0%) were admitted voluntarily at their first inpatient episode, and most of them had a length of stay of 30 days or less (71.5%). Among discharged persons, 19.4% had harmed themselves before their first inpatient treatment episode.

Incidence Rates and Distribution of Deaths by Specific Cause

The incidence rate was higher for suicide than for accidental death among the discharged patients, whereas, among persons not admitted, accidental death occurred more frequently than suicide (Table 1). For both groups, the incidence rate for violent suicide methods was higher than for intentional self-poisoning, with hanging, strangulation, or suffocation being the most common method in both. This method, combined with intentional self-poisoning, accounted for approximately two-thirds of all suicides among discharged individuals (67.8%, n = 436) and among the comparator cohort members (63.7%, n = 812). Among discharged patients who died accidentally, far more persons died of accidental self-poisoning than from transport accidents or accidental falls. This contrasted with individuals

Table 1. Numbers of Deaths and Incidence Rates for Specific Causes of Unnatural Death

	Discharged Patients (N = 47,077)		Persons Not Admitted (N = 1,636,568)	
Cause of Death	No. of Deaths	Incidence per 100,000 Person Years	No. of Deaths	Incidence per 100,000 Person Years
Any unnatural death	1,353	361.3	5,959	24.9
Suicide				
Any suicide method	643	171.7	1,274	5.3
Intentional self-poisoning	214	57.1	311	1.3
Prescribed or illicit drug	164	43.8	132	0.6
Other poisoning agent	50	13.4	179	0.7
"Violent" method	429	114.6	963	4.0
Hanging, strangulation, suffocation	222	59.3	501	2.1
Drowning	20	5.3	39	0.2
Firearm or explosive	37	9.9	230	1.0
Sharp instrument	16	4.3	13	0.1
Jumping from a height	52	13.9	45	0.2
All other violent methods	82	21.9	135	0.6
Accidental death				
Any accidental death	494	131.9	4,208	17.6
Accidental self-poisoning	332	88.7	523	2.2
Prescribed or illicit drug	323	86.2	482	2.0
Other poisoning agent	9	2.4	41	0.2
Transport accident	92	24.6	3,184	13.3
Accidental fall	14	3.7	92	0.4
All other accidental deaths	56	15.0	409	1.7
Fatal poisoning[a]				
Any fatal poisoning	711	189.9	1,012	4.2
Intentional	214	57.1	311	1.3
Accidental	332	88.7	523	2.2
Undetermined intent	165	44.1	178	0.7
Prescribed or illicit drug	644	172.0	784	3.3
Other poisoning agent	67	17.9	228	1.0
Psychotropic medication[b]	96	25.6	45	0.2
Narcotic or hallucinogen[b]	314	83.8	457	1.9
Homicide	21	5.6	186	0.8

[a]Includes intentional self-poisoning (suicide), accidental self-poisoning, and self-poisoning of undetermined intent.
[b]Includes only *ICD-10* coded deaths that occurred January 1, 1994, onward; does not include *ICD-8* coded deaths that occurred prior to January 1, 1994.

without psychiatric admission history, who had higher incidence rates for dying from transport accidents than by accidental self-poisoning. More than half (52.5%, n = 711) of all unnatural deaths in the discharged group were fatal poisonings, compared with less than a fifth (17.0%, n = 1,012) among persons not admitted; just 6.8% (n = 92) of all unnatural deaths in the discharged group were due to transport accidents, compared with more than half (53.4%, n = 3,184) among those not admitted. From 1994, the year from when we could examine this particular *ICD-10* category, approximately half of all the fatal poisonings involved a narcotic or hallucinogenic drug among both discharged cohort members (47.0%, n = 314) and those without psychiatric hospitalization history (51.7%, n = 457). In Supplementary Tables 4 and 5, incidence rates for specific causes of death are reported by diagnostic category. For intentional self-poisoning, accidental self-poisoning, and all other accidental deaths, the highest incidence rates were among persons discharged with a psychoactive substance abuse disorder diagnosis. In this diagnostic category, the incidence rate for accidental self-poisoning (290.1 per 100,000 person-years) was almost 4 times higher than for intentional self-poisoning (77.9 per 100,000).

Incidence Rate Ratios

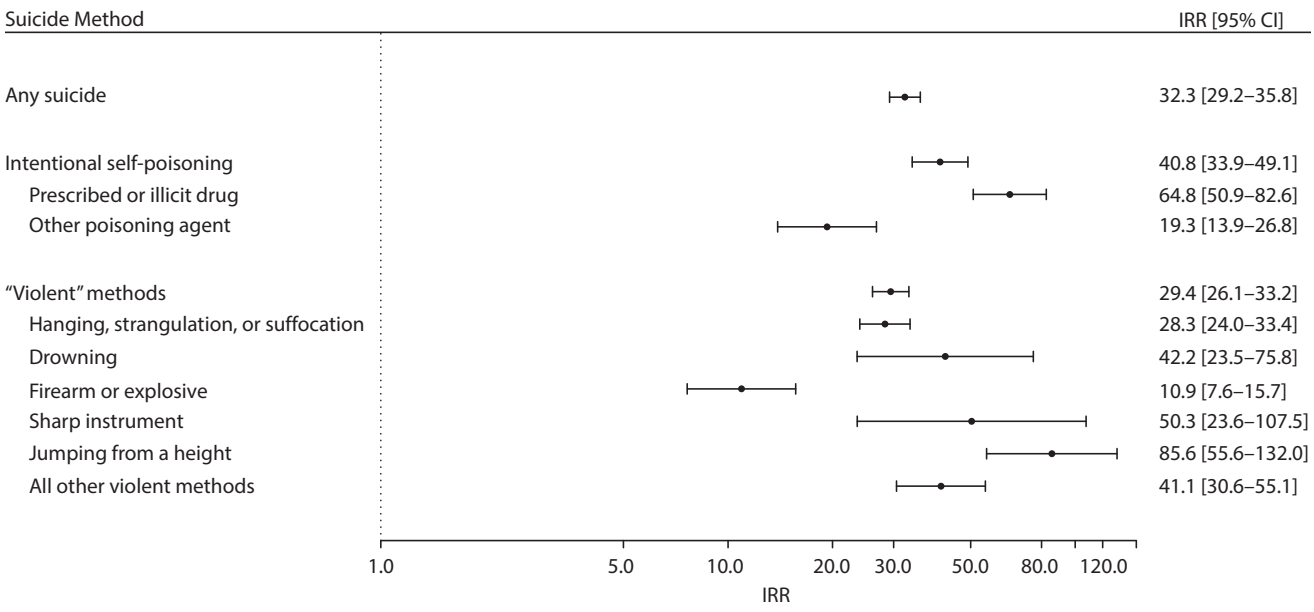
Suicide. Persons discharged from inpatient psychiatric services had a markedly elevated suicide risk compared to those without psychiatric admission (Figure 1). Although incidence of suicide by any violent method was higher than for intentional self-poisoning, relative risk was significantly higher for intentional self-poisoning (IRR 40.8; 95% CI, 33.9–49.1 vs IRR 29.4; 95% CI, 26.1–33.2) and was also significantly higher for intentional self-poisoning specifically with prescribed or illicit drugs (IRR 64.8; 95% CI, 50.9–82.6) than for all other poisoning agents combined (IRR 19.3; 95% CI, 13.9–26.8). Among violent methods, the largest relative risk value observed was for jumping from a height (IRR 85.6; 95% CI, 55.6–132.0). It is, however, important to emphasize the imprecision of this estimate and also that this specific method accounted for only 8.1% of all suicide cases and 3.8% of all unnatural deaths post-discharge. Persons diagnosed with schizophrenia and related disorders, mood disorders, and personality disorders had particularly elevated suicide risks, as shown in Supplementary Table 4.

Accidental death. The relative risk for accidental death (Figure 2) was more than 3 times lower than that for suicide. Compared to persons not admitted for psychiatric treatment, discharged patients were at much greater elevated risk for accidental poisoning (IRR 32.5; 95% CI, 28.2–37.5) than for other accidental death types. As was observed for intentional self-poisoning, the IRR was significantly higher for accidental self-poisoning from prescribed and illicit drugs (IRR 33.8; 95% CI, 29.2–39.2) than for all other poisoning agents combined (IRR 13.2; 95% CI, 6.2–28.2). Compared to other types of accidental death, the risk of fatal transport accidents was only modestly elevated among discharged patients compared to those without psychiatric admission. Nonetheless, discharged patients were at least twice as likely to die from this cause as individuals without inpatient psychiatric history (IRR 2.7; 95% CI, 2.2–3.4). As presented in Supplementary Table 5, among the diagnostic categories examined, psychoactive substance abuse conferred the greatest risk of dying accidentally (IRR 21.4; 95% CI, 19.0–24.1), with a particularly marked risk elevation observed for accidental self-poisoning among persons in this diagnostic group (IRR 78.3; 95% CI, 66.5–92.1).

Homicide. This outcome occurred exceptionally rarely even among persons discharged, although elevated risk (IRR 7.4; 95% CI, 4.7–11.7) was observed versus individuals not admitted.

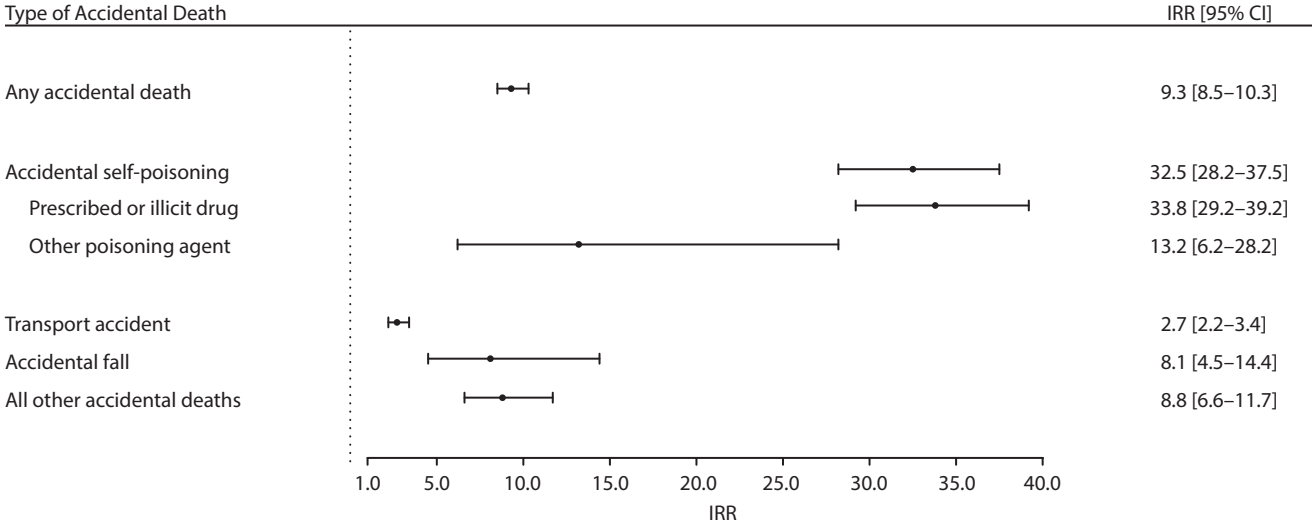
Fatal poisoning. The observed IRRs did not vary markedly when comparing intentional, accidental, and self-poisoning of undetermined intent, with accidental self-poisoning having a slightly lower IRR value compared with the other 2 fatal self-poisoning categories (Figure 3). For all fatal poisonings

Figure 1. Incidence Rate Ratios (IRRs) for Suicide by Specific Method After First Inpatient Discharge Compared to Persons Not Admitted[a]



[a]Estimated IRRs were adjusted for gender, age, and calendar year.

Figure 2. Incidence Rate Ratios (IRRs) for Specific Types of Accidental Death After First Inpatient Discharge Compared to Persons Not Admitted[a]



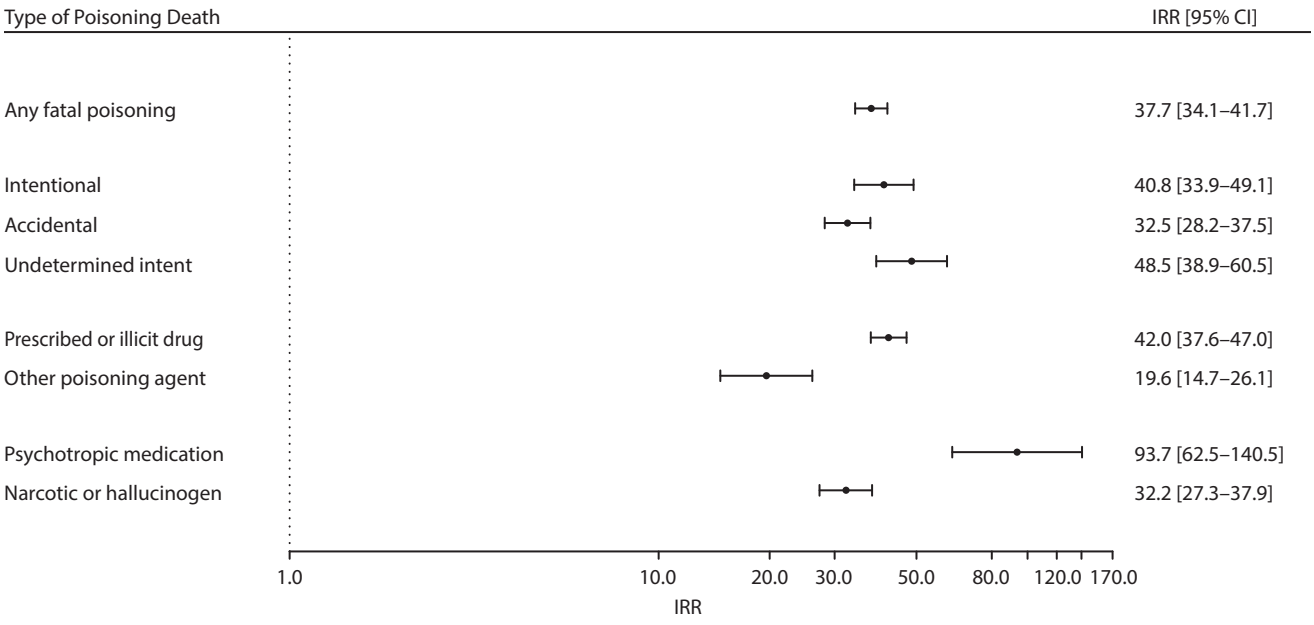
[a]Estimated IRRs were adjusted for gender, age, and calendar year.

(irrespective of intent), the relative risk was significantly higher for poisoning with prescribed or illicit drugs (IRR 42.0; 95% CI, 37.6–47.0) than for all other poisoning agents combined (IRR 19.6; 95% CI, 14.7–26.1). The highest IRR value among the cause-specific mortality outcomes examined was for poisoning by psychotropic medication, with discharged patients having approximately a 90 times elevated risk compared to persons not admitted (IRR 93.7; 95% CI, 62.5–140.5).

Gender-Specific IRRs

Compared to men, discharged women had significantly greater relative risks for suicide by any method, intentional self-poisoning, suicide by any violent method, and any fatal poisoning (Table 2); $P < .001$ for each of these 4 categories. There was no significant difference between the gender-specific IRRs in relation to accidental death ($P = .10$). Although the IRRs were consistently greater for women, the incidence rate was higher for men in both the discharged

Figure 3. Incidence Rate Ratios (IRRs) for Specific Types of Fatal Poisoning After First Inpatient Discharge Compared to Persons Not Admitted[a]



[a]Estimated IRRs were adjusted for gender, age, and calendar year. Estimated IRRs for poisoning death include intentional self-poisoning (suicide), accidental self-poisoning, and self-poisoning of undetermined intent. Estimated IRRs for "psychotropic medication" and "narcotic or hallucinogen" include only *ICD-10* coded deaths that occurred from January 1, 1994, onward; do not include *ICD-8*–coded deaths that occurred prior to January 1, 1994.

Table 2. Gender-Specific Incidence Rate Ratios (IRRs) for Specific Unnatural Causes of Death Following First Inpatient Discharge Compared to Persons Not Admitted

Cause of Death	No. of Deaths	Incidence per 100,000	IRR[a]	95% CI
Any suicide[b]				
Males	452	246.3	26.4	23.5–29.7
Females	191	100.0	68.9	55.3–85.8
Intentional self-poisoning[b]				
Males	127	69.2	30.5	24.3–38.2
Females	87	45.5	80.4	57.0–113.4
"Violent" suicide method[b]				
Males	325	177.1	25.1	22.0–28.8
Females	104	54.4	61.8	46.4–82.4
Any accidental death[c]				
Males	382	208.2	8.9	8.0–9.9
Females	112	58.6	11.4	9.3–14.0
Any fatal poisoning[b,d]				
Males	504	274.7	31.9	28.4–35.7
Females	207	108.4	70.2	56.5–87.3

[a]Estimated incidence rate ratios were adjusted for age and calendar year.
[b]Significant interaction was observed between outcome and gender ($P < .001$).
[c]No significant gender interaction observed ($P = .10$).
[d]Includes intentional self-poisoning (suicide), accidental self-poisoning, and self-poisoning of undetermined intent.

and comparison groups for each of these 5 cause-specific categories.

IRRs Within a Year of First Discharge

Within 1 year post-discharge, suicide risk among former inpatients was 70 times higher versus persons not admitted (n = 161; IRR 70.4; 95% CI, 59.7–83.0). Similarly, relative risks for intentional self-poisoning (n = 46; IRR 82.6; 95% CI, 60.5–112.8), for suicide by any violent method (n = 115; IRR 66.6; 95% CI, 54.8–80.9), and for fatal poisoning (irrespective of intent) (n = 108; IRR 55.6; 95% CI, 45.6–67.8) were greatly elevated during the first year post-discharge.

DISCUSSION

Main Findings

This national cohort study comprehensively investigated cause-specific unnatural death among persons discharged from their first episode of inpatient psychiatric care. These persons discharged were at elevated risk for each specific cause of unnatural death examined compared to persons without inpatient psychiatric history. The relative risk for suicide was approximately 3–4 times higher than that for dying accidentally or by homicide. Among patients who died by suicide, relative risk was greater for any fatal self-poisoning than for any violent suicide method. Among accidental deaths in the discharged group, self-poisoning occurred more frequently than all other types of fatal accident, with transport accident deaths having the smallest risk increase among discharged patients versus those without admission history. For fatal self-poisoning, the relative risk was greater for poisoning with prescribed or illicit drugs than for all other poisoning agents combined. The highest IRR observed across the causes of death examined was for fatal poisoning with psychotropic medication (irrespective of intent). Females had consistently greater IRRs than males, even though male incidence rates were higher for each cause of death examined, among persons discharged and also those

without inpatient psychiatric history. For most outcomes, risk was greatly elevated within 1 year post-discharge compared to the unrestricted follow-up. Persons discharged and diagnosed with schizophrenia and related disorders, mood disorders, and personality disorders had especially elevated suicide risks. Individuals diagnosed with psychiatric substance abuse disorders were particularly prone to dying by accidental self-poisoning, and incidence of accidental fatal overdose with a narcotic or hallucinogenic drug was especially raised for this diagnostic category post-discharge.

Comparison With Existing Evidence

Our findings are consistent with the published literature reporting on unnatural causes of death among persons diagnosed with mental illnesses. Several studies have shown that persons with histories of inpatient psychiatric care are at elevated suicide risk,[8,9,12,17,20,28] and a smaller number of investigations have also indicated raised accidental death risk.[1,13] Our findings concur with those reported by Black et al,[20] who examined suicide and accidental death in a cohort of discharged psychiatric patients and who reported a higher standardized mortality ratio (SMR) for death by suicide compared to accidental death. In contrast to our results, these authors found a difference between males and females in relation to fatal accidents, with females having a higher relative risk than males. In terms of suicide methods among former psychiatric inpatients, the published literature is inconclusive.[15–17] A large registry study from Sweden[17] examined persons diagnosed with personality disorders and showed, as in our study, that discharged patients were at particularly heightened risk for intentional self-poisoning compared to persons without psychiatric admission history. These authors reported that the lowest SMR was for death by firearms, irrespective of gender, as was also shown in our study; however, the highest SMRs that they observed were for jumping from height among men and hanging among women. Due to the small number of cases for some outcomes, we did not estimate gender-specific incidence rate ratios across the full array of unnatural causes of death. Several reasons can explain between-study variability in findings, including underlying differences between study populations such as country and psychiatric diagnoses, as well as inadequate statistical power for investigating rare cause-specific mortality outcomes. Our study cohort mostly comprised young adults, which could also be an important contributory factor in explaining these differences.

The most comprehensive study of accidental death to date has been carried out by Crump et al[13] using Swedish national registry data. When the relative risks for several types of accidents between persons with history of inpatient or outpatient psychiatric care and the general population were compared, the risk of accidental death by poisoning was reported to be markedly elevated, followed by fatal accidental falls and transport accidents. The same rank order of relative risks was observed in our Danish study, although our relative risk estimates were slightly higher than the ones presented by Crump et al for each cause of death examined. Comorbid substance abuse explained a sizeable amount of the excess risk for accidental death observed in the Swedish study,[13] although other factors, such as sleeping problems[29,30] or chronic fatigue,[31] could place discharged patients at elevated risk for accidental death. Heightened homicide victimization risk, as reported from other studies,[32–34] may be partially explained by comorbid substance abuse.[32] Other factors involved in this risk elevation include reduced awareness of hazardous situations among persons with mental illnesses[33,34] and that psychiatric patients more often live in deprived areas with higher violent criminality rates.[35]

The preponderance of fatal poisonings involving a narcotic or hallucinogenic drug was likely due specifically to overdoses of methadone and heroin/morphine, which together accounted for 84% of all cases among fatally intoxicated drug addicts in an investigation conducted across 3 forensic medicine institutes in Denmark during 2007.[36] Despite strict regulations regarding heroin substitution and surveillance of methadone use, in Denmark the majority (60%) of opiate-related deaths are caused by methadone overdose (versus 34% by heroin), with methadone involved in a disproportionately high number of these fatal overdoses compared to other European countries like Sweden, Finland, Ireland, and Estonia.[37]

Strengths and Limitations

The study's main strength is its novel comprehensive examination across the full spectrum of cause-specific unnatural death among persons discharged in a large national cohort. The cohort's size and the high-quality administrative registry data,[21] which cover every Danish resident, enabled assessment of exceptionally rare cause-specific mortality outcomes with ample statistical power and precision. We examined specific suicide methods as well as types of accidental death and fatal poisoning. We assessed all psychiatric diagnoses in contrast to restricting our cohort to a certain diagnosis, as in previous studies.[14,17]

The study was, however, limited in certain ways. As is true for registry studies generally, the availability of relevant covariates was restricted by the data being collected routinely for administrative rather than for research purposes.[38] For example, type of psychiatric unit or whether a person discharged themselves against medical advice[28] could not be assessed. Despite the cohort's huge size, event counts were low for certain causes of death, especially homicide; therefore, we could not stratify the rarest outcomes by gender. We could not distinguish between deaths that occurred immediately after discharge on the same day versus those that happened during inpatient episodes. Also, the *ICD* coding did not enable examination of fatal poisoning by prescribed medication versus an illicit drug as discrete causes of death. Classification of accidental versus intentional poisoning is particularly challenging in relation to fatal drug overdoses.[39] We could not, however, infer the degree to which such misclassification attenuated the relative risk estimates observed, and therefore we also reported "any fatal poisoning" as a coalesced outcome category, as

well as accidental, intentional, and undetermined fatal poisonings separately. Also, cause of death determination procedures in Denmark may ascertain a greater proportion of equivocal suicide cases than in some other Western European countries such as England.[40] A final limitation concerns generalizability. In a study cohort of persons discharged for the first time from inpatient psychiatric care predominantly at younger adult age, most were diagnosed with nonpsychotic disorders, and almost all were admitted voluntarily. As equivalent data are unavailable elsewhere, we do not know the degree to which study cohorts delineated similarly in other countries would be comparable clinically.

CONCLUSION

This national cohort study has revealed markedly elevated risks across the array of unnatural causes of death examined. Therefore, an eclectic set of effective preventive measures is indicated if the incidence of unnatural death is to be reduced in this patient population with multiple vulnerabilities. Individuals discharged from inpatient psychiatric services for the first time are at greatly elevated risk of fatally poisoning themselves, irrespective of their intent, and particularly using prescribed or illicit drugs. Clinicians should strive to reduce risk of fatal poisoning with prescribed drugs by enhancing post-discharge care and introducing more vigilant monitoring of medication among discharged patients. Mental health services can enhance the safety of their patients by distributing drugs in smaller quantities at each prescription, although some patients may still hoard medication to acquire a quantity sufficient to end their life. Strategies that successfully enhance compliance in taking psychiatric medication[41] could therefore be beneficial given the low adherence rates in this population.[42,43] To reduce risk of suicide by violent suicide methods, it is crucial to act on thoughts about using those methods disclosed by former inpatients, to ensure their safety by enhanced liaison between inpatient services and post-discharge community care. This is particularly relevant for individuals known to have attempted suicide using violent methods. Therefore, it is crucial for clinicians to inquire about suicidal ideation, detailed plans of self-harm, and previous thwarted suicide attempts. The markedly elevated risk of unnatural death, accidental poisoning in particular, among persons discharged with psychoactive substance abuse disorders indicates a need for interventions targeting dependency issues early in treatment. Effective therapy and other support services post-discharge should be provided to individuals known to abuse substances, including alcohol, and enhanced psychosocial assessment and monitoring following self-harm episodes could also reduce risk of premature unnatural death in this population.

Submitted: July 17, 2017; accepted April 5, 2018.

Published online: October 2, 2018.

Potential conflicts of interest: None.

Funding/support: This study was funded by a Medical Research Council Doctoral Training Partnership PhD studentship awarded to Mr Walter and by a European Research Council grant (ref. 335905) awarded to Prof Webb.

Role of the sponsor: The supporters had no role in the design, analysis, interpretation, or publication of this study.

Acknowledgments: The authors thank Prof Søren Dalsgaard, National Centre for Register-based Research (NCRR), Aarhus University, Aarhus, Denmark, for his advice on Danish drug prescribing policies. He has no conflicts of interest to disclose.

Supplementary material: Available at PSYCHIATRIST.COM.

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Editor's Note: We encourage authors to submit papers for consideration as a part of our Focus on Suicide section. Please contact Philippe Courtet, MD, PhD, at pcourtet@psychiatrist.com.

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THE JOURNAL OF CLINICAL PSYCHIATRY
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Supplementary Material

Article Title: Suicide Methods and Specific Types of Accidental Death and Fatal Poisoning Among Discharged Psychiatric Patients: A National Cohort Study

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DOI Number: 10.4088/JCP.17m11809

List of Supplementary Material for the article

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This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

Supplementary Table 1: ICD-8 and ICD-10 coding ranges for all unnatural causes of death examined

Cause of death	ICD-8	ICD-10
Any suicide	E950-E959	X60- X84
Intentional self-poisoning	E950-E952	X60-X69
Prescribed or illicit drug	E950.0-E950.3	X60-X64
Self-poisoning by other agent	E950.4-E950.9; E951-E952	X65-X69
'Violent' method	E953-E958	X70-X84
Hanging, strangulation, suffocation	E953	X70
Drowning	E954	X71
Firearm & explosive	E955	X72-X75
Sharp instrument	E956	X78
Jumping from a height	E957	X80
All other 'violent' methods	E958	X76; X77; X79; X81-X84
Any accidental death	E800-E929, E940 - E942, E944-E946	V01- X59
Accidental self-poisoning	E850-E877; E942	X40-X49
Prescribed or illicit drug	E850-E859	X40-X44
Other poisoning agent	E860-E877	X45-X49
Transport accident	E800-E845; E927; E940; E941	V01-V99
Accidental fall	E880-E887; E943	W00-W19
All other types of accident	E890-E926; E928; E929; E944; E945; E946	W20-W99; X00-X39; X50-X59
Any fatal poisoning	E850-E877; E942; E950-E952; E980-E982	X40-X49; X60-X69; Y10-Y19
Intentional	E950-E952	X60-X69
Accidental	E850-E877; E942	X40-X49
Undetermined intent	E980-E982	Y10-Y19
Prescribed or illicit drug	E850-E859; E950.0-E950.3; E980.0-E980.3	X40-X44; X60-X64; Y10-Y14

Other poisoning agent	E950.4-E950.9; E951-E952; E860-E877; E980.4-E980.9; E981-E982	X45-X49; X65-X69; Y15-Y19
Psychotropic medication	-	X41; X61; Y11
Narcotic or hallucinogen	-	X42; X62; Y12
Homicide	E960-E978	X85-Y09

Supplementary Table 2: Classification of psychiatric diagnostic categories at first inpatient episode according to ICD-10 and equivalent ICD-8 codes

Diagnostic category	ICD-10 codes	ICD-8 codes
Mental and behavioral disorders due to psychoactive substance abuse	F10-F19	291.x9, 294.39, 303.x9, 303.20, 303.28, 303.90, 304.x9
Schizophrenia and related disorders	F20-F29	295.x9, 296.89, 297.x9, 298.29-298.99, 299.04, 299.05, 299.09, 301.83
Mood disorders	F30-F39	296.x9 (excluding 296.89), 298.09, 298.19, 300.49, 301.19
Neurotic, stress-related, and somatoform disorders	F40-F48	300.x9 (excluding 300.49), 305.x9, 305.68, 307.99
Personality disorders	F60	301.x9 (excluding 301.19), 301.80, 301.81, 301.82, 301.84
All other disorders combined	F00-F09	290.09, 290.10, 290.11, 290.18, 290.19, 292.x9, 293.x9, 294.x9, 309.x9
	F50	305.60, 306.50, 306.58, 306.59,
	F70-F79	311.xx, 312.xx, 313.xx, 314.xx, 315.xx
	F84	299.00, 299.01, 299.02, 299.03
	F90-F98	306.x9, 308.0x

Supplementary Table 3: Sociodemographic and clinical characteristics of the 47,077 individuals at first discharge from inpatient psychiatric care

Characteristic	n	% of Total (N=47,077)
Gender:		
Male	23,042	49.0
Female	24,035	51.1
Age at first discharge (in years):		
15-19	12,677	26.9
20-24	13,393	28.4
25-29	9353	19.9
30-34	6538	13.9
35-39	3869	8.2
40 and over	1247	2.6
Psychiatric diagnostic category:		
Psychoactive substance abuse	10,488	22.3
Schizophrenia and related disorders	7018	14.9
Mood disorders	10,145	21.5
Neurotic, stress-related, and somatoform disorders	12,148	25.8
Personality disorders	3405	7.2
All other disorders combined	3873	8.2
Type of admission:[a]		
Voluntary	44,270	94.0
Involuntary	2792	5.9
Length of stay:		
Up to 7 days	22,334	47.4
8-30 days	11,340	24.1
31 days to 6 months	11,805	25.1
More than 6 months	1598	3.4
History of self-harm before first discharge[b]	9139	19.4

[a] Admission type was not recorded for 15 persons, who were omitted from the denominator for this prevalence estimate

[b] Cases of self-harm were delineated using a previously applied algorithm[42] using data extracted from the Psychiatric Central Research Register and the National Patient Register

Supplementary Table 4: Incidence rate ratios (IRRs) for suicide methods according to psychiatric diagnoses

Outcome and psychiatric diagnosis	Discharged patients: N=47,077 Number of deaths	Incidence rate per 100,000 person years	IRR [a]	95% CI	
Any suicide method					
Psychoactive substance abuse	186	233.6	31.4	26.8	36.8
Schizophrenia and related disorders	168	245.8	40.4	34.3	47.6
Mood disorders	100	160.2	38.0	30.8	46.9
Neurotic, stress-related, and somatoform disorders	96	102.8	21.9	17.8	27.1
Personality disorders	62	183.8	38.1	29.5	49.3
All other disorders combined	31	83.85	18.9	13.2	27.1
Intentional self-poisoning					
Psychoactive substance abuse	62	77.9	42.6	32.0	56.6
Schizophrenia and related disorders	38	55.6	35.7	25.3	50.3
Mood disorders	43	68.9	61.6	44.0	86.1
Neurotic, stress-related, and somatoform disorders	31	33.2	26.8	18.4	39.1
Personality disorders	25	74.1	57.4	38.0	86.6
All other disorders combined	15	40.6	34.5	20.5	58.1
'Violent' method					
Psychoactive substance abuse	124	155.7	27.8	23.0	33.8
Schizophrenia and related disorders	130	190.2	42.1	34.9	50.8
Mood disorders	57	91.3	29.6	22.5	38.9
Neurotic, stress-related, and somatoform disorders	65	69.6	20.2	15.7	26.1
Personality disorders	37	109.7	31.2	22.4	43.4
All other disorders combined	16	43.3	13.3	8.1	21.9

[a] Estimated IRRs were adjusted for gender, age- and calendar year

Supplementary Table 5: Incidence rate ratios (IRRs) for types of accidental death according to psychiatric diagnoses

Outcome and psychiatric diagnosis	Discharged patients: N=47,077				
	Number of deaths	Incidence rate per 100,000 person years	IRR [a]	95% CI	
Any accidental death					
Psychoactive substance abuse	312	391.9	21.4	19.0	24.1
Schizophrenia and related disorders	51	74.6	4.8	3.6	6.3
Mood disorders	23	36.9	3.6	2.4	5.4
Neurotic, stress-related, and somatoform disorders	57	61.0	5.1	3.9	6.6
Personality disorders	26	77.1	6.0	4.1	8.9
All other disorders combined	25	67.6	5.4	3.6	8.0
Accidental self-poisoning					
Psychoactive substance abuse	231	290.1	78.3	66.5	92.1
Schizophrenia and related disorders	31	45.4	14.9	10.3	21.4
Mood disorders	6	9.6	4.2	1.9	9.5
Neurotic, stress-related, and somatoform disorders	33	35.3	14.6	10.2	20.9
Personality disorders	14	41.5	18.0	10.6	30.6
All other disorders combined	17	46.0	22.2	13.7	36.0
All other accidental deaths					
Psychoactive substance abuse	81	101.7	7.1	5.7	8.8
Schizophrenia and related disorders	20	29.3	2.3	1.5	3.6
Mood disorders	17	27.2	3.4	2.1	5.4
Neurotic, stress-related, and somatoform disorders	24	25.7	2.7	1.8	4.0
Personality disorders	12	35.6	3.4	1.9	6.0
All other disorders combined	8	21.6	2.1	1.0	4.1

[a] Estimated IRRs were adjusted for gender, age- and calendar year