Incidence and Predictors of Suicide Attempts and Suicide Deaths Among Individuals Recently Hospitalized for a Mental Disorder: A Population-Based Study

Jessica S. Enns, MD[a,*]; Natalie P. Mota, PhD[b]; James M. Bolton, MD[a]; Okechukwu Ekuma, MSc[c]; Dan Chateau, PhD[d]; Michelle M. Paluszek, MA[e]; Jitender Sareen, MD[a]; and Laurence Y. Katz, MD[a]

ABSTRACT

Objective: To examine the incidence and predictors of suicide attempts and deaths in the year after psychiatric hospitalization.

Methods: A population-based dataset was used to develop a cohort of individuals 18 years or older admitted with a mental disorder (defined by *ICD-10* codes) from 2005 to 2016 (n = 26,975) in Manitoba, Canada. Using Cox regression, hazard ratios were calculated for each covariate among those who attempted and died by suicide in the year following hospitalization, while adjusting for confounders.

Results: In the year following hospitalization for a mental disorder, 0.7% of the individuals died by suicide and 3.5% attempted suicide. Statistically significant risk factors for suicide in the year after discharge from psychiatric hospitalization included male sex (hazard ratio [HR], 1.47; 95% confidence interval [CI], 1.10–1.97) and urban location (HR, 1.37; 95% CI, 1.02–1.85) and for attempting suicide included female sex (HR, 0.63; 95% CI, 0.55–0.72), living rurally (HR, 0.66; 95% CI, 0.58–0.75), a previous mental disorder (HR, 1.63; 95% CI, 1.38–1.92), justice involvement (HR, 1.48; 95% CI, 1.28–1.70), and being on income assistance (HR, 1.17; 95% CI, 1.01–1.35) ($P < .05$ for all). Age (HR, 0.99; 95% CI, 0.99–0.99) ($P < .05$) was associated with a reduced rate of suicide attempts.

Conclusions: Further research into interventions to address the identified risk factors for suicide in the recently discharged population is critical to improve management.

J Clin Psychiatry 2022;83(4):21m14055

To cite: Enns JS, Mota NP, Bolton JM, et al. Incidence and predictors of suicide attempts and suicide deaths among individuals recently hospitalized for a mental disorder: a population-based study. *J Clin Psychiatry.* 2022;83(4):21m14055.

To share: https://doi.org/10.4088/JCP.21m14055

[a]Department of Psychiatry, University of Manitoba, Winnipeg, Manitoba, Canada

[b]Department of Clinical Health Psychology, Max Rady College of Medicine, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada

[c]Manitoba Centre for Health Policy, Max Rady College of Medicine, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada

[d]Research School of Population Health, College of Health and Medicine, Australian National University, Canberra, ACT, Australia, and Manitoba Centre for Health Policy Department of Community Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada

[e]Department of Psychology, University of Regina, Regina, Saskatchewan, Canada

**Corresponding author:* Jessica S. Enns, MD, 204-470-1213, 771 Bannatyne Ave, Winnipeg, Manitoba, Canada, R3E 3N4 (umenns93@myumanitoba.ca).

The World Health Organization recognizes suicide as a public health priority, with close to 800,000 people dying by suicide annually and a suicide attempt rate approximately 20 times higher.[1] Although hospitalization is an important clinical intervention for managing acute suicide risk,[2] there is a known increased risk of suicide among individuals recently discharged from hospitalization for mental disorders.[3] A meta-analysis found a pooled rate of suicide after discharge of 484/100,000 person-years.[4] This compares to an approximate population suicide rate in Canada of 11/100,000 people in 2019.[5]

Identification of risk factors for suicide among the high-risk group of individuals recently discharged from psychiatric hospitalization is crucial to guide clinical management; however, current evidence is limited by incomplete availability of sample characteristics. A meta-analysis examining suicide deaths after discharge from psychiatric facilities found that suicide rates were higher among those who were previously admitted and those admitted for suicidal behavior.[4] This meta-analysis was limited by a high degree of heterogeneity and did not examine suicide attempts after discharge. Risk factors for suicide after psychiatric hospitalization in a case-control study included a history of self-harm, affective disorders, recent last contact with services, expressing clinical symptoms at last contact with staff, initiating one's own discharge, and missing one's last appointment with services. Those who were detained for compulsory treatment at the last admission or had enhanced levels of aftercare were less likely to die by suicide.[6] Another case-control study found that risk factors for suicide after psychiatric hospitalization included a history of suicidal behavior or threats, depressive symptoms at the time of admission and discharge, disordered thought content at admission, a change from one ward to another, a discharge initiated by the patient, not discharging into institutional care, and not having a fixed appointment with a general practitioner.[7] That study was unable to examine suicide attempts. A machine learning study found that for men, prescriptions for anxiolytics and drugs used in addictive disorders interacted with other characteristics in the risk profiles (eg, alcohol-related disorders, hypnotics, and sedatives) that led to higher risk of post-discharge suicide, and in women there was interaction between recurrent major depression and other characteristics (eg, poisoning and low income) that led to increased risk of suicide.[8] Alcohol-related disorders and nicotine dependence in men and poisoning in women were identified as important suicide predictors. None of these studies were able to examine important social factors such as justice involvement and income assistance. A systematic

Clinical Points

- Individuals recently discharged from psychiatric hospitalization are at an increased risk of suicide attempts and deaths, and current evidence examining predictors of suicide attempts and deaths is limited by incomplete availability of sample characteristics.
- Identification of risk factors for suicide among those recently discharged from psychiatric hospitalization is critical in order to better treat and manage this population.

review[9] found that male sex, a history of self-harm, a history of suicide attempts, admission with suicidal ideation or suicidal behavior, and hopelessness were associated with suicide after discharge, and lithium was protective against suicide after discharge. This study included criminal history; however, it included a heterogenous population and was not able to examine suicide attempts following psychiatric hospitalization.

The existing studies examining predictors of suicide after hospitalization were limited by incomplete availability of sample characteristics (including important social measures such as justice involvement, past child and family services involvement, and use of income assistance). The current study addressed gaps in the literature by using a population-based dataset that contained a range of important demographic variables to assess for predictors of suicide and suicide attempts after psychiatric admission. To our knowledge, this was the first Canadian study to examine predictors of suicide attempts and deaths specifically after psychiatric hospitalization. There are differences in health care systems in Canada compared to other countries; therefore, it is important to examine risk factors for suicide and suicide attempts in different populations to identify similarities and differences that may impact clinical care. The objective of this study was to examine the incidence and predictors of suicide attempts and suicide deaths in the year following psychiatric hospitalization using a population-based dataset.

METHODS

Data Sources

This study used the Manitoba Population Research Data Repository (MPRDR) housed at the Manitoba Center for Health Policy (MCHP), an internationally recognized administrative data repository housing over 90 deidentified health and social datasets linked together using scrambled Personal Health Identification Numbers (PHIN) for all registered Manitobans.[10] All Manitobans have a unique PHIN that tracks health service utilization, *International Classification of Diseases* (*ICD*) codes for physical and mental disorders, vital statistics including causes of death (eg, suicide), and sociodemographic data (including age, sex, location of residence, and use of income assistance). The MCHP is located at 408–727 McDermot Avenue, Winnipeg, Manitoba, R3E 3P5. Access to MCHP data is carefully controlled for protection of privacy, and only the MCHP analyst who is assigned to each project works with the raw data.

Deaths by suicide were identified using the Vital Statistics Mortality Registry, and suicide attempts that resulted in hospitalization in the year after hospital discharge were derived from the hospital discharge abstract database. The following datasets in the MPRDR were used to identify important potential confounding variables and predictors in our analyses: Hospital Discharge Abstract Database and Outpatient Physician Billing Claims (mental and physical disorders), Employment/Income Assistance, Child and Family Services (involvement with Child and Family Services and child apprehension), Census data (area-level socioeconomic measures), Health Registry data (age, sex, area of residence), and Prosecution Information and Scheduling Management (criminal charges, being a victim of a crime, or witnessing a crime).

Approval was obtained from the Health Information Protection Committee and the University of Manitoba Health Research Ethics Board. We acknowledge the MCHP for use of data contained in the Population Health Research Data Repository. The results and conclusions are those of the authors, and no official endorsement by the Manitoba Centre for Health Policy, Manitoba Health, or other data providers is intended or should be inferred.

Cohort Formation

All individuals in the population admitted to hospital for a mental disorder between April 1, 2005, and December 31, 2016, formed the cohort of interest. Using the Discharge Abstract Database, 26,975 individuals 18 years or older with a mental disorder as the most responsible diagnosis admitted between April 1, 2005, and December 31, 2016, were identified using *ICD* codes. These *ICD* code definitions came from previously validated work using the MCHP database.[11] The following *ICD* codes were included: Mood and Anxiety Disorders (depressive disorder, affective psychosis, neurotic depression, adjustment reaction, bipolar disorder, an anxiety state, phobic disorders, or obsessive compulsive disorders) (*ICD-10-CA* codes F30, F31, F32, F33, F34, F38, F40, F41.0, F 41.1, F 41.2, F41.3, F41.8, F41.9, F42, F43, F53.0), Substance Use Disorders (alcohol or drug psychoses, alcohol or drug dependence, or nondependent abuse of drugs) (*ICD-10-CA* codes F10–F19, F55, Z50.2, Z50.3), Psychotic Disorders (*ICD-10-CA* codes F11.5, F12.5, F13.5, F14.5, F15.5, F16.5, F18.5, F19.5, F20, F22, F23, F24, F25, F28, F29), Personality Disorders (*ICD-10-CA* codes F21, F60, F61, F62, F69), and Suicide Attempts (*ICD-10-CA* codes X60–X84, Y10–Y34, T39, T40, T42.3, T42.4, T42.7, T43, T50.9, T58, X44, X46, X47).

Those with a diagnosis of dementia were excluded from the study as these individuals were more likely admitted to medical units rather than psychiatric units.

Outcome Measures

The primary outcome of the study was death by suicide. A suicide attempt that resulted in hospitalization was the

secondary outcome of interest. This study examined time to the first suicide attempt or death in the year after first mental health hospitalization, and if an individual had more than 1 admission, the repeat admissions were not included in this study.

Suicide deaths. Suicide deaths were examined in the year following psychiatric hospitalization.[12–14] The following codes were used to identify deaths by suicide within the Vital Statistics database: Accidental Poisoning: *ICD-10-CA* codes X40–X42, X46, X47; Self-inflicted Poisoning: *ICD-10-CA* codes X60–X69; Self-inflicted Injury: *ICD-10-CA* codes X70–X84; and Late Effects of Self-inflicted Injury: *ICD-10-CA* codes Y10-Y12, Y16, Y17, and Y87.0. The definition of suicide deaths using *ICD* codes has been previously validated.[15] Accidental overdoses were included within the definition of suicide deaths, as 50% of coroner verdicts of accidental overdoses were actually determined by experienced suicide researchers to be suicide deaths[16]; therefore, we have included accidental overdoses in our suicide death outcome to increase sensitivity.

Suicide attempts. Suicide attempts were examined in the year following psychiatric hospitalization. Attempts were operationalized as 1 or more hospitalizations with a diagnosis for self-inflicted injury or poisoning (*ICD-10-CA* codes X60–X84) or 1 or more hospitalizations with a diagnosis for poisoning of undetermined intent, injury of undetermined intent, or accidental poisoning if there was a mental disorder code during the hospital stay (*ICD-10-CA* codes Y10–Y34, T39, T40, T42.3, T42.4, T42.7, T43, T50.9, T58, X44, X46, X47).[17]

Covariates

Sociodemographic factors. Age (18–25, 26–34, 35–54, or 55+ years), sex (male, female), and geographical region of residence (urban, rural) were derived from the population registry. The urban region included the 2 largest urban centers of Manitoba (Winnipeg and Brandon), and the rest of the population was considered rural dwelling. Whether individuals had been on income assistance in the year preceding their hospitalization was also examined.

Previous mental disorder. The following criteria were used to identify those diagnosed with a mental disorder in the year prior to hospital admission to be used as a covariate in the analysis: 1 or more hospitalizations or physician visits with any of the following mental disorders in the year preceding hospital admission: Substance Use Disorders, Psychotic Disorders, Personality Disorders, and Suicide Attempts, or 1 or more hospitalizations or 2 or more physician visits for mood and anxiety disorders. For each of these mental disorders, please refer to *ICD* codes listed above.

Physical health conditions. *ICD-10* codes were used to identify a range of diagnosed physical health conditions in the 12 months preceding the hospitalization. Charlson Comorbidity Index scores were created for each individual using *ICD* codes by assigning weights to different disorder categories based on their adjusted mortality risk and then summing the relevant weights for each individual into a single score.[18,19]

Table 1. Demographics of Individuals Hospitalized for Mental Disorders, 2005–2016 (N = 26,975)

Variable	N (%)
Sex	
Male	13,554 (50.3)
Female	13,421 (49.8)
Location of residence	
Urban	15,679 (58.1)
Rural	11,296 (41.9)
Previous mental disorder	
Yes	19,848 (73.6)
No	7,127 (26.4)
Justice involvement	
Yes	12,190 (45.2)
No	14,785 (54.8)
Income assistance	
Yes	7,325 (27.2)
No	19,650 (72.9)
Child and family services care	
In care	1,521 (5.6)
Not in care	25,454 (94.4)
Physical illness	
Charlson Index of 0	25,492 (94.5)
Charlson Index of 1	1,057 (3.9)
Charlson Index ≥ 2	426 (1.6)
Age, mean (range), y	44.4 (18–103)

Child and family services involvement. History of foster care involvement was derived from the Child and Family Services data (which contain information from 1992 and onward). Individuals with a history of being in care are at higher risk of engaging in suicidal behavior.[20–23]

Justice involvement. The Prosecution Information and Scheduling Management database (which contains information from 2002 and onward) was used to identify whether individuals had ever been charged with a criminal offense or been the victim of or witnessed a crime, another psychosocial risk factor for suicidality.[24–27] Different forms of justice involvement were included as 1 variable, as previous analyses have shown overlap between these groups.[28]

Statistical Analysis

The incidence of suicide deaths and attempts in the year following discharge from hospital was examined. Using Cox regression, hazard ratios (HRs) were calculated for each covariate among the group that died by suicide in the year following hospitalization for a mental disorder (compared to those who did not die by suicide) and the group that attempted suicide (compared to those who did not attempt suicide), while adjusting for all other covariates examined. The proportional hazard assumption was tested by the interaction of the covariates and log of the survival time. Statistical analysis was done in Statistical Analysis Software (SAS) V9.4.

RESULTS

There were 26,975 individuals who were hospitalized for a mental disorder between April 1, 2005, and December 31, 2016 (Table 1). Among individuals who were hospitalized for

Table 2. Risk Factors for Suicide in the Year After Mental Disorder Hospitalization

Variable	Suicide deaths in year after hospitalization (N = 198), N (%)	Did not die by suicide in the year after hospitalization (N = 26,777), N (%)	Hazard ratio (95% confidence interval)
Sex, male (ref = female)	118 (59.6)	13,436 (50.2)	**1.47 (1.10–1.97)***
Location, urban (ref = rural)	131 (66.2)	15,548 (58.1)	**1.37 (1.02–1.85)***
Previous mental disorder	157 (79.3)	19,691 (73.5)	1.37 (0.96–1.94)
Justice involvement	97 (49.0)	12,093 (45.2)	1.18 (0.87–1.59)
Income assistance	56 (28.3)	7,269 (27.2)	0.96 (0.69–1.33)
In care of child and family services	9 (4.6)	1,512 (5.7)	0.84 (0.42–1.68)
Physical illness			
Charlson Index of 0 (ref)	184 (92.9)	25,308 (94.5)	
Charlson Index of 1	9 (4.6)	1,048 (3.9)	1.33 (0.77–2.29)
Age			1.00 (0.99–1.01)

*P value < .05.

Table 3. Risk Factors for Attempted Suicide in the Year After Mental Disorder Hospitalization

Variable	Suicide attempts in year after hospitalization (N = 946), N (%)	Did not attempt suicide in year after hospitalization (N = 26,029), N (%)	Hazard ratio (95% confidence interval)
Sex, male (ref = female)	374 (39.5)	13,180 (50.6)	**0.63 (0.55–0.72)***
Location, urban (ref = rural)	470 (49.7)	15,209 (58.4)	**0.66 (0.58–0.75)***
Previous mental disorder	773 (81.7)	19,075 (73.3)	**1.63 (1.38–1.92)**
Justice involvement	542 (57.3)	11,648 (44.8)	**1.48 (1.28–1.70)***
Income assistance	318 (33.6)	7,007 (26.9)	**1.17 (1.01–1.35)***
In care of child and family services	72 (7.6)	1,449 (5.6)	0.90 (0.70–1.16)
Physical illness			
Charlson Index of 0 (ref)	899 (95.0)	24,593 (94.5)	
Charlson Index of 1	35 (3.7)	1,022 (3.9)	1.03 (0.74–1.45)
Charlson Index ≥ 2	12 (1.3)	414 (1.6)	1.09 (0.62–1.93)
Age			**0.99 (0.99–0.99)***

*P value < .05.

a mental disorder in this study, 0.7% died by suicide and 3.5% attempted suicide in the year following hospitalization.

There was a subgroup of 198 people who died by suicide in the year after psychiatric hospitalization (Table 2). Statistically significant risk factors for completing suicide in the year after discharge from psychiatric hospitalization included male sex (hazard ratio [HR], 1.47; 95% confidence interval [CI], 1.10–1.97) and urban location (HR, 1.37; 95% CI, 1.02–1.85) (P < .05 for all).

There were 946 suicide attempts in the year after discharge from psychiatric hospitalization (Table 3). Statistically significant risk factors for attempting suicide in the year after discharge from psychiatric hospitalization included female sex (HR, 0.63; 95% CI, 0.55–0.72), living rurally (HR, 0.66; 95% CI, 0.58–0.75), a previous mental disorder (HR, 1.63; 95% CI, 1.38–1.92), justice involvement (HR, 1.48; 95% CI, 1.28–1.70), and being on income assistance (HR, 1.17; 95% CI, 1.01–1.35) (P < .05 for all). Age (HR, 0.99; 95% CI, 0.99–0.99) (P < .05) was associated with a reduced rate of suicide attempts.

DISCUSSION

Among the 26,975 individuals who were admitted to hospital for a mental disorder, 3.5% attempted suicide and 0.7% died by suicide in the year following hospitalization. Although not directly comparable, a population-based study in France found that a comparable proportion of 0.89% of individuals died by suicide in the year after hospitalization for non-fatal self-harm.[29]

This study found that the risk factors for those who attempt and complete suicide in the year after psychiatric hospitalization differ. Previous studies have shown that those who died by suicide (compared to those who attempt suicide) were more likely to be male, be older, and have comorbid alcohol use disorder or medical illnesses.[30–33] The current study supported the finding that male sex was a risk factor for suicide deaths; however, it also highlighted urban location as a risk factor for suicide, whereas rural location was risk factor for suicide attempts. A previous case-control study also found that urbanicity was a risk factor for suicide and that the risk was largely eliminated when adjusted for marital status, income, and ethnicity.[34] Those who attempt suicide may be a distinct group compared to those who die by suicide,[35,36] and it is possible that features of urban living such as more robust crisis services and other supports may reduce the risk of suicide attempts but not deaths.

A mental disorder diagnosis in the year preceding hospitalization was a risk factor for suicide attempts. This finding is in keeping with existing literature that there is an elevated risk of suicide attempts with all mental disorders.[37] This study did not find previous mental disorders to be a statistically significant risk factor for suicide deaths; however, this may be related to limitations in sample size, as there was a trend toward significance (HR, 1.37; 95% CI, 0.96–1.94).

Justice involvement[24–27] and low socioeconomic status[38] are well described risk factors for suicide, and this study supports that both justice involvement and being on income assistance (a measure of low socioeconomic status) are risk factors for suicide attempts in the year following psychiatric hospitalization even after adjusting for confounders. Recent literature examining individuals diagnosed with mental disorders has shown that criminal accusations and victimization were most prevalent among individuals with a history of suicide.[28] Future studies to further explore the increased risk of suicide attempts among those with a history of justice involvement after psychiatric hospitalization would be imperative.

Comorbid physical health conditions are also well described risk factors for suicide.[39,40] Although our study did not find physical health conditions to be a statistically significant risk

factor for suicide, there was an important trend noted (HR, 1.33; 95% CI, 0.77–2.29), and this would warrant further consideration and analysis in future studies.

Although age was a statistically significant risk factor for suicide attempts in the year following hospitalization, clinically, a hazard ratio of almost 1 would not be significant.

The results of this study should be interpreted within the context of the following limitations. The mental disorder diagnoses came from physician billing claims and were dependent on health care seeking. The current study examined only suicide attempts that resulted in hospitalization and did not include those who did not seek care or presented to the emergency department and were subsequently discharged. This restriction likely underestimates the prevalence of suicide attempts. As a result of using *ICD* codes to identify mental disorders, some mental disorders could not be validly identified from MCHP data (eg, eating disorders). In addition, mental disorder diagnoses could not be broken down into individual disorders in this study, and therefore they were examined as 1 aggregate covariate ("previous mental disorder"). There were some confounding variables that were not captured in this study due to reliance on electronic health data such as family history, ethnicity, and educational attainment. Finally, despite lack of statistical significance, some covariates in our study may still demonstrate important associations with suicide attempts and deaths after psychiatric hospitalization.[41] This study's inability to demonstrate statistical significance for certain covariates may be related to limitations in sample size.

This study also had some important strengths. The use of a population-based dataset allowed for a representative analysis of suicide outcomes after hospitalization in the Manitoba population. These study findings are likely to be generalizable to other provinces in Canada, and the similarity to the results of other previous studies suggests generalizability beyond that. The availability of many covariates in the dataset that had been rarely examined previously was also an asset, as it allowed for analysis of many different predictors of suicide attempts and deaths. Further research to expand our knowledge and develop interventions to address the risk factors for suicide in the recently discharged population, including the potential inherent risk of suicide with hospitalization itself, would be critical to better treat and manage this population.

Submitted: April 22, 2021; accepted November 22, 2021.

Published online: June 13, 2022.

Relevant financial relationships: **Dr Bolton** received funding from the Brain and Behavior Research Foundation. **Drs Enns**, **Mota**, **Chateau**, **Sareen**, and **Katz**; **Mr Ekuma**; and **Ms Paluszek** have no conflicts to disclose.

Funding/support: Funding was obtained from a Health Sciences Centre Foundation Operating Grant (Winnipeg, Manitoba, Canada).

Role of the sponsor: The funding source was not involved with the conduct or publication of this study.

Previous presentation: Enns J, Chahal HS, Mota N, et al. Incidence and predictors of suicide attempts and deaths in a recently hospitalized population for a mental health concern. Poster presented at Canadian Academy of Psychiatric Epidemiology (CAPE) Virtual Conference, October 21, 2020.

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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.