

**Suicide, unintentional poisoning mortality, and nonfatal suicide attempts after
involuntary psychiatric hospitalization**

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Abstract

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Little is known about the incidence of adverse outcomes after involuntary psychiatric hospitalization (IPH) in the United States. The objectives of this study were to use nonparametric competing risks analysis to estimate the incidences of suicide mortality, unintentional poisoning mortality, and nonfatal suicide attempt following discharge from IPH; to determine the most common methods of suicide death after IPH; and to use Cox proportional hazards modeling to investigate the association of sociodemographic and clinical factors with the risk of each outcome. People with a discharge from IPH in King County, Washington from 2016 – 2022 (N=22,019) were included. The cohort median age was 37 years (IQR: 27,53) with a median hospitalization length of 14 days (IQR: 7,25.5) for the most recent IPH. The 1-year rates of suicide and unintentional poisoning death were 598 per 100,000 person-years (95% CI: 497,714) and 931 per 100,000 person-years (95% CI: 804,1073), while the average rates over 7 years were 185 per 100,000 person-years (95% CI: 157, 219) and 429 per 100,000 person-years (95% CI: 367,497). The 90-day rate of first nonfatal suicide attempt was 3407 per 100,000 person-years (95% CI: 2758,4177) and the average rate over 2.75 years was 880 per 100,000 person-years (95% CI: 742,1036). The most common method of suicide was suffocation or hanging (37.1%). A Danger-to-Self detainment order for the most recent IPH was associated with risk of both suicide and unintentional poisoning death. These results indicate a substantial risk of fatal suicide, nonfatal attempt, and unintentional poisoning death following discharge from IPH, with a critical period of risk in the first year. Further research into strategies for post-discharge care and mortality prevention after IPH is profoundly needed.

Background

Involuntary psychiatric hospitalization (IPH) is a treatment method intended to prevent suicide death, risk of harm to others, and other adverse outcomes for people experiencing acute psychiatric distress or inability to maintain self-care.¹ Both short-term and long-term IPHs (termed “emergency holds” and “civil commitment”, respectively) are legally permitted in all 50 U.S. states, with substantial state-to-state variation in procedures.^{1,2} The annual number of IPHs occurring in the U.S. is unknown but is estimated to be approximately 1 million.³ Poor data availability related to IPHs in the United States⁴ has led to few U.S. studies that examine crucial questions such as rates of adverse events after discharge and factors associated with post-discharge adverse outcomes, despite evidence suggesting this group faces substantial risk of such outcomes. People who have experienced IPH have substantially shorter life expectancy than the general population and have elevated short-term suicide risk after discharge compared to voluntarily hospitalized controls.⁵⁻⁷ A separate study investigating suicide mortality among people evaluated for IPH – approximately one-third of whom ultimately experienced an IPH – identified the first year after evaluation as a critical period for suicide risk.⁸ The study also found roughly 4.2% of people who died by suicide in Washington from 2000 – 2011 experienced at least one IPH.

There is an urgent need to study involuntary psychiatric treatment in the United States, including describing the risks of adverse outcomes following discharge and factors associated with these risks. A closer lens on the practice is warranted given most medical treatment is premised on consent, and patients who undergo IPH have some fundamental legal rights suspended. Qualitative research suggests psychiatric patients recognize both benefits of involuntary treatment as well as significant harms, including lasting impacts to mental health and future avoidance of disclosing of future suicidal feelings.^{9,10} A deeper understanding of mortality after IPH is crucial to developing and implementing more effective treatments for this at-risk population. Suicide mortality is a key outcome to estimate because suicidality is a common indication for IPH, and suicide risk is dramatically elevated after discharge from voluntary psychiatric hospitalization.¹¹ Characterizing the method of suicide death is important to aid the development of prevention strategies. Related outcomes, such as nonfatal suicide attempt and mortality from unintentional poisoning, are salient due to their connection with suicide, as nonfatal attempts are a common antecedent to suicide mortality, and intentional poisoning deaths are often misclassified as unintentional.¹²⁻¹⁴ Nonfatal attempts are also associated with significant long-term psychological distress and poor health outcomes,^{15,16} which may be reducible or preventable with focused intervention. Investigating factors associated with adverse outcomes can indicate which groups are at highest risk and greatest need among those who experience IPH.

Leveraging a linked administrative database of death outcomes and service utilization in King County, Washington, our objectives were to estimate the incidences of suicide mortality, unintentional poisoning mortality, and nonfatal suicide attempt following discharge from IPH, to determine the most common methods of suicide death after IPH, and to investigate the association of sociodemographic and clinical factors with the risk of each outcome. These factors included

age, sex/gender, race, ethnicity, a history of homelessness service use, jail stays, number of recorded IPHs, and characteristics of the most recent IPH.

Methods

Study Design and Participants

This retrospective cohort study utilized data from the New Opportunities for Health and Resilience Measures for Suicide Prevention (NO HARMS) database, which links death certificate records in Washington State with administrative records from agencies and programs operating in the state's largest county, King County. Records were linked at the person-level using a machine learning algorithm. All individuals discharged from IPH in King County between January 1, 2016, and December 30, 2022, were included in the analysis (N=22,019).

Outcomes

The main outcomes of interest were suicide mortality, unintentional poisoning mortality, and nonfatal suicide attempts. Death outcomes were sourced from state death certificates from January 1, 2016, to December 31, 2022. Cause of death was determined from International Classification of Disease 10 Clinical Modification (ICD-10-CM) codes included with death certificate records. Unintentional poisoning excluded poisoning death by homicide and included both unintentional overdose and poisoning by substances that were unintentionally used. Nonfatal suicide attempts were sourced from the Rapid Health Information Network (RHINO), a statewide surveillance system that collects data on emergency department (ED) presentations for health conditions of interest, including suicidal ideation and suicide attempt. Only RHINO data originating in King County from April 1, 2020, to December 30, 2022, were included. The analysis of nonfatal attempts was restricted to all those with an IPH during this time period.

Exposures

Data on IPHs originated from the King County Behavioral Health and Recovery Division (BHRD). The start and end date of each IPH and the type of detention order (i.e., Danger to Self, Danger to Others, Danger to Property, or Gravely Disabled) were extracted. Date of birth, sex/gender, race, and ethnicity were determined from all data sources in NO HARMS, including sources not used in the present study. Some sources record gender identity while others record sex assigned at birth, and as such this variable will be described as "sex/gender". Observations with implausibly advanced ages (>100) were removed from the analysis (n=3). A history of homelessness services was defined as having used any homelessness services recorded in the King County Homeless Management Information System (HMIS), a record system for people experiencing homelessness who receive housing services, or the Health Care for the Homeless Network (HCHN), a program providing medical, dental, and case management services for people experiencing homelessness. Records from county-operated jails and municipal jails within the county were used to determine history of within-county jail stays. Homelessness service use and jail stays were recorded during the IPH observation period (January 1, 2016, to December 30, 2022).

Statistical Analysis

Descriptive characteristics of the overall cohort were summarized along with the characteristics of subgroups defined by their mortality outcome of interest (suicide, unintentional poisoning, and censored or died of other causes). Subgroup characteristics were compared with nonparametric Kruskal-Wallis tests for continuous variables due to violations of normality, and Chi-square or Fisher's exact tests for categorical variables. Cause-specific cumulative incidence functions were estimated with nonparametric time-to-event methods accounting for competing risks.^{17,18} Competing risk methods estimate the marginal probabilities of competing events, without assuming independence of events, by accounting for the probability of overall survival until time $t-1$ when estimating the cause-specific survival at time t . The index date for each participant was their most recent IPH discharge recorded in the database. For fatal outcomes, death by all other causes was considered a competing risk, and participants with no recorded death outcome were censored at the end of the observation period. In the analysis of nonfatal suicide attempts, time to first ED presentation for suicide attempt was measured, and mortality by any cause was considered a competing risk. Method-specific cumulative incidences were estimated for suicide deaths, accounting for the competing risks of death by unintentional poisoning and other causes. Suicide methods were categorized as firearm (ICD-10-CM codes X72, X73, X74), poisoning (X60 – X65, X67, X69), suffocation or hanging (X70), jumping/falling or being hit by a moving object including car crash (X80, X81, X82), and all other methods (X76, X78).

Cause-specific Cox proportional hazards models were used to estimate univariate associations between each factor of interest and cause-specific hazard rates for each outcome.¹⁹ Cox modeling is preferred for etiologic questions compared to the subdistribution hazards approach (i.e., Fine-Gray model), and the two approaches produce similar results when the event rate is low.²⁰ A series of three multivariable models were fit to estimate adjusted associations. Variables were selected for each model *a priori* based on their conceptual proximity to risk of the outcome (Figure 1). The first model included demographic variables: age, sex/gender, race, Hispanic/Latino ethnicity. Age was entered with restricted cubic splines ($k=4$, reflecting distributional quantiles). Due to low sample size among minoritized (non-White) racial classifications, race was coded as a binary for modeling (White alone or minoritized race). The second model added characteristics of the period prior to most recent IPH, beginning in January 2016, including homelessness service use (binary: yes, no), jail stay before most recent IPH (binary: yes, no), and the number of IPHs prior to the most recent (coded as categorical: 1, 2, and 3 or more IPHs). For nonfatal suicide attempts, two additional variables were included in the model because they were available for the nonfatal suicide attempt observation period (April 2020 – December 2022): emergency department (ED) presentation for suicide attempt prior to IPH (binary: yes, no), ED presentation for nonfatal suicide behavior (binary: yes, no). Lastly, characteristics of the most recent IPH were entered in the third model, including the type of detention order and the length of stay for the most recent IPH in days. Length of stay was entered with restricted cubic splines ($k=4$, reflecting distributional quantiles). Length of stay values in the 99.9th percentile of the distribution (>528 days) were removed from models due to the significant influence of large values ($n=22$). The proportional hazards assumption was tested for each covariate in all models with the correlation of

scaled Schoenfeld residuals and log-time. No proportionality violations were identified. Missingness was addressed by coding missing values as a separate category. The observations with at least one missing value (n=7513, 34.1%) were less likely to die of suicide or unintentional poisoning ($p<0.001$), and had lower prevalence of >1 IPH, homelessness service use, jail stays, and nonfatal suicide behaviors (all $p<0.001$; Table S1, Appendix I). A sensitivity analysis was conducted with complete cases. Data were analyzed with R v4.3.2. The study was approved by the Washington State Institutional Review Board.

Results

Descriptive Statistics

The full cohort (N=22,019) had a median age of 37 years (Interquartile Range [IQR] = 27, 53) at their last occurring IPH (Table 1) with a mean of 2.48 years of follow-up (IQR: 0.94,4.41) per person and 61,363 combined person-years of follow-up. A total of 194 people died by suicide (0.88%), and 355 died of unintentional poisoning (1.61%). There were statistically significant differences between groups in terms of several sociodemographic factors including sex/gender, racial and ethnic classifications, jail stays, and homelessness service use (all $p<0.01$). There were more men among those who died by suicide and unintentional poisoning (62.9% and 70.7%, respectively) than among those who were censored or died of other causes (52.7%). Those who died by suicide or unintentional poisoning had a greater proportion of people classified with more than one race (39.7% and 44.8%, respectively) than people who were censored or died of other causes (13.3%). More than half of those who died of unintentional poisoning had a history of homelessness service use (51.0%) or had a recorded jail stay (53.2%) compared to 20.3% and 26.7%, respectively, in the group who were censored or died of other causes. Those who died of unintentional poisoning were more likely to have 3 or more recorded IPHs (27.9%) than those who died by suicide (12.4%) or who were censored or died of other causes (15.0%; $p<0.001$). Half of those who died by suicide (50.0%) and roughly one-third of people who died by unintentional poisoning (33.8%) had a Danger to Self detention order for their last recorded IPH, compared to 29.3% of those who were censored or died of other causes. The most common method of suicide was suffocation/hanging (n=72, 37.1%), followed by poisoning (n=36, 17.1%), jumping, falling or being hit by a moving object (n=33, 17.0%), and firearms (n=29, 14.9%).

Mortality Outcomes

The 7-year cumulative incidence of suicide was 1.30% (95% Confidence Interval [CI]: 1.10%,1.53%), a rate of 185 per 100,000 person-years (95% CI: 157, 219), while the 7-year cumulative incidence of unintentional poisoning was 3.00% (95% CI: 2.57%,3.48%), a rate of 429 per 100,000 person-years (95% CI: 367, 497) (Figure 3A). The 1-year cumulative incidences were 0.60% (95% CI: 0.50%,0.71%) for suicide, a rate of 598 per 100,000 person-years (95% CI: 497,714), and 0.93% (95% CI: 0.80%, 1.07%) for unintentional poisoning, a rate of 931 per 100,000 person years (95% CI: 804,1073). For suicide, 46.2% of the total cumulative incidence occurred during the first year. The rate in the first year was more than three times the average rate across 7 years of follow-up. Suicides in the study sample accounted for approximately 2.3% of suicide deaths in

Washington State over the study observation period,²¹ while unintentional poisoning deaths in the study population accounted for 3.3% of such deaths in the state during the study period.²¹

When examining methods of suicide, the cumulative incidence of suicide by suffocation or hanging was consistently greater than suicides by firearm, poisoning, jumping/falling, or being hit by a moving object (Figure 3B). The rate of suicide by suffocation or hanging was 383 per 100,000 person-years (95% CI: 279,519) in the first 6 months after discharge and 66 per 100,000 (95% CI: 49,87) over the entire observation period, indicating a critical period of heightened risk.

In univariate and multivariable regression models of suicide risk, minoritized racial classification, homelessness service use prior to last IPH, and having a Danger to Self detention order for the last IPH were associated with risk (all $p < 0.01$; Figure 2A, Table S2). In the final multivariable model, minoritized racial classification was associated with roughly 1.5 times greater risk of suicide (adjusted hazard ratio [aHR]=1.48, 95% CI: 1.11,1.97) and a Danger to Self order was associated with more than two times greater risk of suicide compared to a Danger to Others order (aHR=2.34, 95% CI: 1.51,3.61). Utilizing homelessness services prior to the last recorded IPH was associated with decreased risk of suicide in all models (fully adjusted model: aHR=0.52, 95% CI: 0.34,0.79).

For unintentional poisoning, male sex/gender, minoritized racial classification, Hispanic/Latino ethnicity, homelessness service use, a jail stay before last IPH, and having 3 or more IPHs were each associated with the cause-specific risk in univariate analysis and all multivariable models (all $p < 0.01$; Figure 2B, Table S3). In the final multivariable model, each of these variables had adjusted hazard ratios for their association with unintentional poisoning between 1.34 and 1.68, except for homelessness service use (aHR=2.16, 95% CI: 1.71, 2.75). In unadjusted analyses these variables showed strong associations with unintentional poisoning mortality. For example, the 7-year cumulative incidence of unintentional poisoning for those with a history of homelessness service use was 8.68% (95% CI: 6.73%,10.92%) compared to 1.97% for those without such a history (95% CI: 1.58%, 2.43%; HR=4.96, 95% CI: 4.03, 6.12). A Danger to Self order and a Gravely Disabled, Health and Safety order were associated with the cause-specific hazard of unintentional poisoning in the final multivariable model (Danger to Self aHR=1.49, 95% CI: 1.09, 2.03; Gravely Disabled, Health and Safety aHR=1.43, 95% CI: 1.06, 1.95) but not in univariate analysis.

Nonfatal Suicide Attempt

The analysis of nonfatal suicide attempts was conducted with a subset of the full cohort for which linked data on emergency department presentations for suicide attempts were available ($n=10,700$; Table S4). This group had a median of 1.05 years follow-up (IQR: 0.44,1.84) and 12,473 combined person-years of follow-up. A total of 178 people had a suicide attempt after their last recorded IPH (1.7%), while 766 (7.1%) had a suicide attempt at some time prior to their last IPH, and 2759 (25.8%) had an ED presentation for other suicide behavior prior to last IPH, including suicide ideation and non-suicidal self-harm. The 2.75-year cumulative incidence of suicide attempt after last IPH was 2.42% (95% CI: 2.04%,2.85%; Figure 4A), a rate of 880 per 100,000 person-years

(95% CI: 742,1036). The 90-day cumulative incidence was 0.84% (95% CI: 0.68,1.03), a rate of 3407 per 100,000 person-years (95% CI: 2758,4177). The events in the first 90 days accounted for 34.7% of the total observed cumulative incidence.

Several variables were significantly associated with the risk of suicide attempt in univariate analysis and all subsequent multivariable models: minoritized racial classification, a suicide attempt before last IPH, and other suicide behavior before last IPH (all $p < 0.05$; Figure 4B; Table S4). Previous ED presentation for suicide attempt showed a strong unadjusted association (HR=8.94, 95% CI: 6.57,12.16) as did previous ED presentation for suicide behavior (HR=7.07, 95% CI: 5.15,9.71). The 2.75-year cumulative incidence of suicide attempt for those with a previous ED presentation for attempt was 13.8% (95% CI: 10.2,18.0) compared to 1.73% (95% CI: 1.40, 2.13) for those without a previous ED presentation for attempt (HR=8.94, 95% CI: 6.57, 12.16). Homelessness service use, a previous jail admission, and having 3 or more IPHs were significant in univariate analyses ($p < 0.05$) but not in multivariable models.

Discussion

In this analysis of suicide, unintentional poisoning death, and nonfatal suicide attempt after involuntary psychiatric hospitalization, we found rates of suicide, unintentional poisoning mortality, and nonfatal suicide attempt to be substantially greater than rates in the general population, and comparable to or exceeding rates in similar populations from published literature. The most common methods of fatal suicide differed from those seen in the general population, and several sociodemographic factors were associated with the risk of the outcomes.

The observed suicide incidence was comparable to reports in the literature of suicide after psychiatric hospitalization, including a pooled estimate from 41 published studies, but differences in study populations, follow-up time, and statistical methodology prevent precise comparisons and clear explanations for observed differences.²² A study from Taiwan found a greater incidence rate of suicide after IPH discharge over 7 years among people with schizophrenia (365 per 100,000 person-years) compared to our results among all people with IPH (185 per 100,000).⁵ Among adult Medicaid patients with a diagnosed mental disorder, the 90-day post-discharge incidence rate was 178 per 100,000 person-years¹¹ compared to the rate we found of 892 per 100,000 person-years.¹¹ This study did not distinguish voluntary from involuntary stays, which may at least partially explain this substantial difference. However, the rate we found is less than the rate of 1108 per 100,000 person-years from a study of over 700,000 psychiatric inpatients – both voluntary and involuntary – in Taiwan.²³ In alignment with many published studies,^{11,22-25} our analysis found the first year after discharge was a critical period of suicide risk, with a substantial proportion of mortality occurring within this period. Facilitating post-discharge follow-up and continuity of care is challenging in the context of voluntary psychiatric hospitalizations²⁶ and is likely to be more difficult in the involuntary context. Evidence is mixed as to the effectiveness of prompt follow-up after discharge, but a lack of care continuity is associated with increased suicide risk.^{26,27} Safety planning has been shown to reduce suicide risk after brief acute contact,²⁸ such as in the ED, but further study is needed to evaluate safety planning and other post-discharge planning for psychiatric hospitalization.

Randomized controlled trials are needed to identify effective interventions during this high-risk period.

Our findings suggest an association of social determinants of health and suicide risk after IPH. In this study, people with minoritized racial classifications experienced greater suicide risk after IPH than people classified as White alone. In the general population, people classified as American Indian or Alaska Native have greater suicide rates than White people, but other racial groups have lower suicide rates.²⁹ Among people experiencing IPH, social determinants of health related to racial classification may exert a greater detrimental influence on mental health and suicide risk than in the general population, operating through multiple distinct pathways, such as reduced access to effective treatment and increased experience of social stigmatization and criminalization. Homelessness service use was associated with lower suicide risk, an unexpected result given that the suicide rate among people experiencing homelessness is greater than in the general population.^{30,31} This finding could reflect a protective effect of homelessness service use in suicide prevention among this specific population of people who have undergone IPH. However, given the significantly greater risk we identified of unintentional poisoning among those with a history of homelessness service use, the “protective” effect for suicide may be an artifact of misclassification.¹⁴ People experiencing homelessness who die of poisoning could be less likely to have their death posthumously classified as a suicide, thereby systematically decreasing their estimated suicide risk and increasing their estimated unintentional poisoning risk.

The most common method of suicide death was suffocation or hanging, which differs from the U.S. general population and the general population of King County, for whom firearms are the most common method.³²⁻³⁴ However, this result is consistent with published literature suggesting that firearms are a less common method of suicide among people with psychiatric disorders.^{35,36} The substantial rate of suicide by suffocation or hanging in the first 6 months after discharge from most recent IPH suggests a potential intervention target, though prevention efforts related to access to means for suffocation or hanging are not feasible.^{37,38} Poisoning represents another potential target given it was the second most common method of suicide, and if some proportion of unintentional poisoning deaths were in fact misclassified suicides, the estimated incidence of poisoning suicide would be greater. Means-restriction is considered more effective for poisoning^{39,40} but needs further study, especially specific to psychiatric hospitalization and IPH.

The rate of unintentional poisoning mortality in the first year after discharge was greater than the average rate across 7 years. However, the 1-year rate for unintentional poisoning was 2.2 times greater than the overall average rate, compared to 3.2 times for suicide, reflecting less relative reduction in the rate over time for unintentional poisoning. The finding that people with minoritized racial or ethnic classification were at elevated risk of unintentional poisoning corresponds with recent literature finding increasing rates of overdose for minoritized races relative to the rate for White people, including among American Indian and Alaska Native people, who already showed higher rates.⁴¹ However, given the crude classification of race in this study, a more detailed analysis of risk among different racial groups is needed for developing focused prevention efforts. Homelessness service use, jail, and 3 or more IPHs were all associated with mortality risk

suggesting these institutional touchpoints could be utilized for intervention. Developing interventions for individuals engaged in homelessness services, detained in jail, or repeatedly utilizing psychiatric crisis services may be more efficient than approaches for the entire population of people undergoing IPH, though both strategies have important merits. The association of a Danger to Self order for the most recent IPH with risk of unintentional poisoning after discharge suggests suicidality may be associated with unintentional poisoning death, which comports with previous work identifying substantial overlap among suicide ideation, suicide attempt, and nonfatal overdose.⁴² The lack of unadjusted association with unintentional poisoning and a Danger to Self order while the adjusted association was significant could indicate that confounding within the sample attenuated the univariate association. If people at lower risk of unintentional poisoning had greater representation in the Danger to Self group, the univariate association could be null while the adjusted association is significant. For example, having a jail stay prior to most recent IPH was strongly associated with unintentional poisoning (univariate HR=3.74), and people with a jail stay prior to most recent IPH were underrepresented among those with a Danger to Self order, composing 27% of the overall sample but only 18% of those with a Danger to Self order. Controlling for jail history may have corrected this imbalance to uncover an association after adjustment.

Similar to results for suicide and unintentional poisoning, the risk of nonfatal suicide attempt was greater in the early period after discharge. During the first 90 days of follow-up, the attempt rate was 3.9 times greater than the overall rate. In multivariable models, the profile of factors associated with nonfatal suicide attempt was similar the profile for fatal suicide. However, the analysis of nonfatal attempts was able to account for previous emergency department visits for suicide attempt and other suicide behaviors, identifying them as strongly associated with later risk of nonfatal attempt. These results align with previous work identifying suicide attempt as a significantly associated with later attempt and suicide death.^{13,43} Understanding patients' histories of suicidal behavior is crucial to identifying who is at greatest risk of suicide behavior post-discharge.

Strengths and Limitations

To our knowledge, this is the first U.S.-based investigation into suicide and unintentional poisoning mortality, and nonfatal suicide attempt after involuntary hospitalization. This study is strengthened by its use of a large longitudinal database of identity-linked records covering a wide temporal window and including diverse data sources that are not often linked. These administrative sources provide a comprehensive population-level view of IPHs, death outcomes, jail stays, and other relevant service events and institutional contacts. Accounting for the competing risk of death by other causes when estimating cumulative incidence reduces bias compared to traditional Kaplan-Meier methods,⁴⁴ which are more common in the suicide literature.

The data sources for this study also present several limitations that must be noted. This analysis does not support counterfactual causal claims about the effectiveness of IPH for suicide prevention due to the lack of a clear comparator group to those who received IPH. A significant proportion of the sample was missing data on key sociodemographic variables, limiting the conclusions that can be drawn about these factors' associations with the outcomes. Furthermore,

the crude classification of race limits the specificity of inferences about how race is associated with outcomes after IPH discharge. Other factors relevant to the objectives of the study, such as the psychiatric or substance use diagnoses of participants, were not available. The factors that were available, such as jail stays prior to IPH, were only measured during the study observation period. As such, those who entered the study earlier in the observation period had less opportunity to be recorded with an instance of one of the relevant factors prior to most recent IPH. Due to temporal differences in data availability, information on past suicide attempt could not be used for the regression analysis of mortality outcomes, but its inclusion could alter the regression results. Only deaths within the state and nonfatal suicide attempts within the county were available, so the true rate of these outcomes is likely higher than estimated. Additionally, nonfatal suicide attempts that did not result in presentation to an emergency department were not captured in the data. The results of this study may unevenly generalize to other locations given the substantial variation in IPH policies and practices at the state- and even county-level, along with differences in population-level characteristics that are associated with mortality risk.

Conclusion

The rates of suicide, unintentional poisoning mortality, and nonfatal suicide attempt estimated in this study suggest an opportunity for improving post-discharge care for people who undergo IPH. People with an IPH in King County represented a substantial proportion of statewide suicides and unintentional poisoning deaths. Given the limited academic study on U.S. involuntary psychiatric hospitalization, further research is merited to investigate the causal effects of IPH, as well as important related questions such as factors associated with undergoing IPH and how policies and healthcare practices impact risk of mortality and other adverse events after IPH.

Tables and Figures

See following pages

Table 1. Descriptive Statistics for People Discharged from Involuntary Psychiatric Hospitalization in King County, Washington from 2016 – 2022

	Total ^a (N=22019)	Censored or Died of Other Causes (n=21470)	Suicide (n=194)	Unintentional Poisoning (n=355)	p-value ^a
Age (years)^b	37.0 [27.0, 53.0]	37.0 [27.0, 53.0]	36.0 [26.3, 47.8]	37.0 [30.0, 48.5]	0.18
Sex/Gender					<0.001
Female/Woman	8427 (38.3)	8251 (38.4)	71 (36.6)	104 (29.3)	
Male/Man	11680 (53.0)	11307 (52.7)	122 (62.9)	251 (70.7)	
Missing	1907 (8.7)	*	*	0 (0)	
Race					0.004
White	9538 (43.3)	9269 (43.2)	97 (50.0)	172 (48.5)	
Black	2494 (11.3)	*	*	20 (5.6)	
Native Hawaiian or Pacific Islander	131 (0.6)	131 (0.6)	0 (0)	0 (0)	
Asian	1244 (5.6)	*	11 (5.7)	*	
American Indian or Alaska Native	210 (1.0)	*	0 (0)	*	
More than one race	3093 (14.0)	2857 (13.3)	77 (39.7)	159 (44.8)	
Missing	5309 (24.1)	5309 (24.7)	0 (0)	0 (0)	
Hispanic/Latino	1970 (8.9)	1894 (8.8)	23 (11.9)	53 (14.9)	<0.001
Missing	1725 (7.8)	*	*	13 (3.7)	
Homelessness Services^c	4573 (20.8)	4360 (20.3)	32 (16.5)	181 (51.0)	<0.001
Jail Stay^c	5962 (27.1)	5722 (26.7)	51 (26.3)	189 (53.2)	<0.001
Length of Stay (days)^b	14.0 [7.00, 25.5]	14.0 [7.00, 26.0]	14.5 [6.25, 25.0]	14.0 [6.00, 24.0]	0.93
Number of IPHs					<0.001
1 IPH	15441 (70.1)	15100 (70.3)	142 (73.2)	199 (56.1)	
2 IPHs	3233 (14.7)	3148 (14.7)	28 (14.4)	57 (16.1)	
3+ IPHs	3345 (15.2)	3222 (15.0)	24 (12.4)	99 (27.9)	
Type of Detention Order^b					<0.001
Danger to Others	4164 (18.9)	4072 (19.0)	26 (13.4)	66 (18.6)	
Danger to Self	6507 (29.6)	6290 (29.3)	97 (50.0)	120 (33.8)	
Danger to Property	435 (2.0)	424 (2.0)	*	*	
Grave Disabled Health & Safety	8293 (37.7)	8116 (37.8)	53 (27.3)	124 (34.9)	
Grave Disabled Cognitive Volitional	1306 (5.9)	*	*	10 (2.8)	
Missing	1314 (6.0)	*	*	27 (7.6)	
Suicide Method					
Firearm	–	–	29 (14.9%)	–	
Jump/Fall or Moving Object	–	–	33 (17.0%)	–	
Poisoning	–	–	36 (18.6%)	–	
Suffocation/Hanging	–	–	72 (37.1%)	–	
Other Methods	–	–	17 (8.8%)	–	
Missing	–	–	–	–	

^a Continuous variables are summarized with median [interquartile range] and compared with Kruskal-Wallis nonparametric test of means. Categorical variables are summarized with count (percent) and compared with Chi-squared tests or Fisher's exact test for expected cell counts<5.

^b At last recorded IPH
^c Occurring prior to the last recorded IPH
* Data suppressed to protect confidentiality

Figure 1. Conceptual Model for Regression Analyses

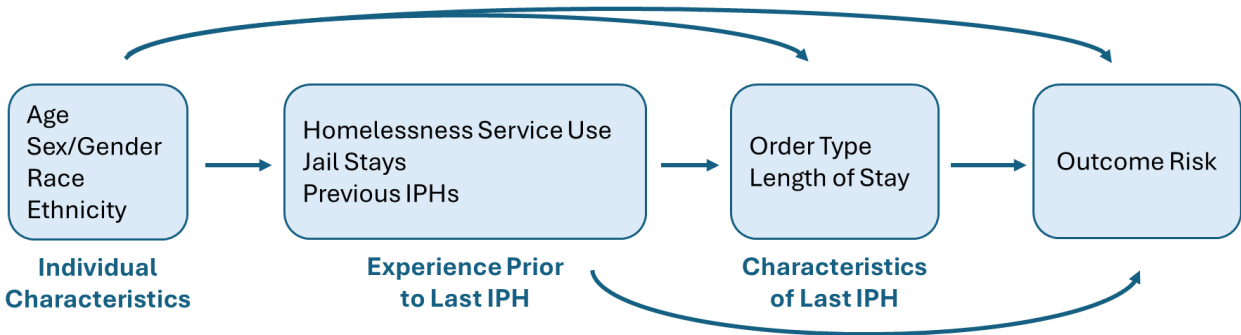
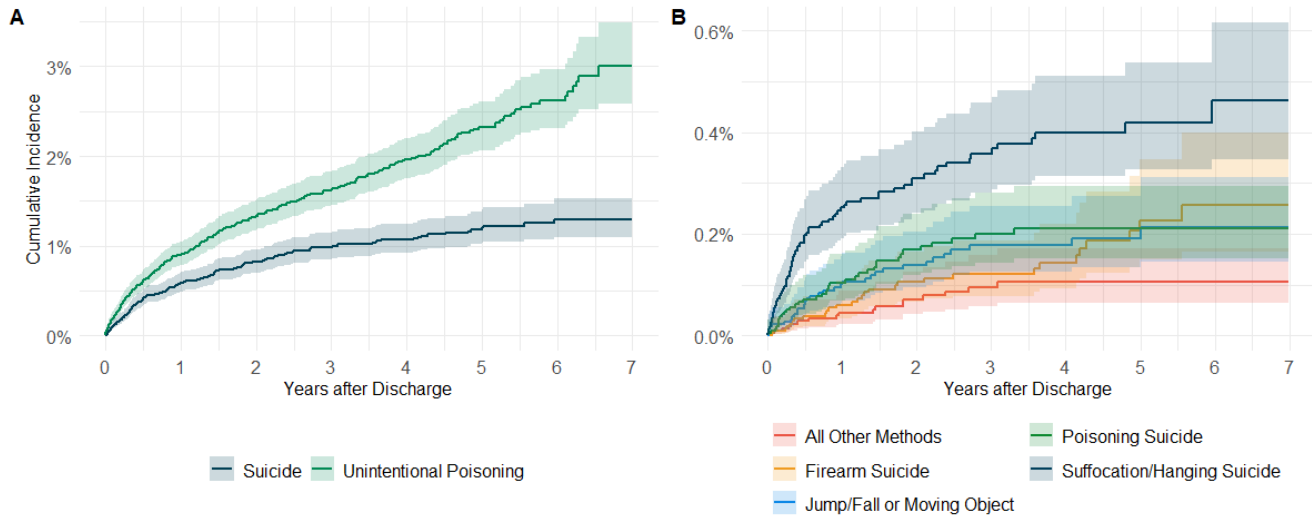
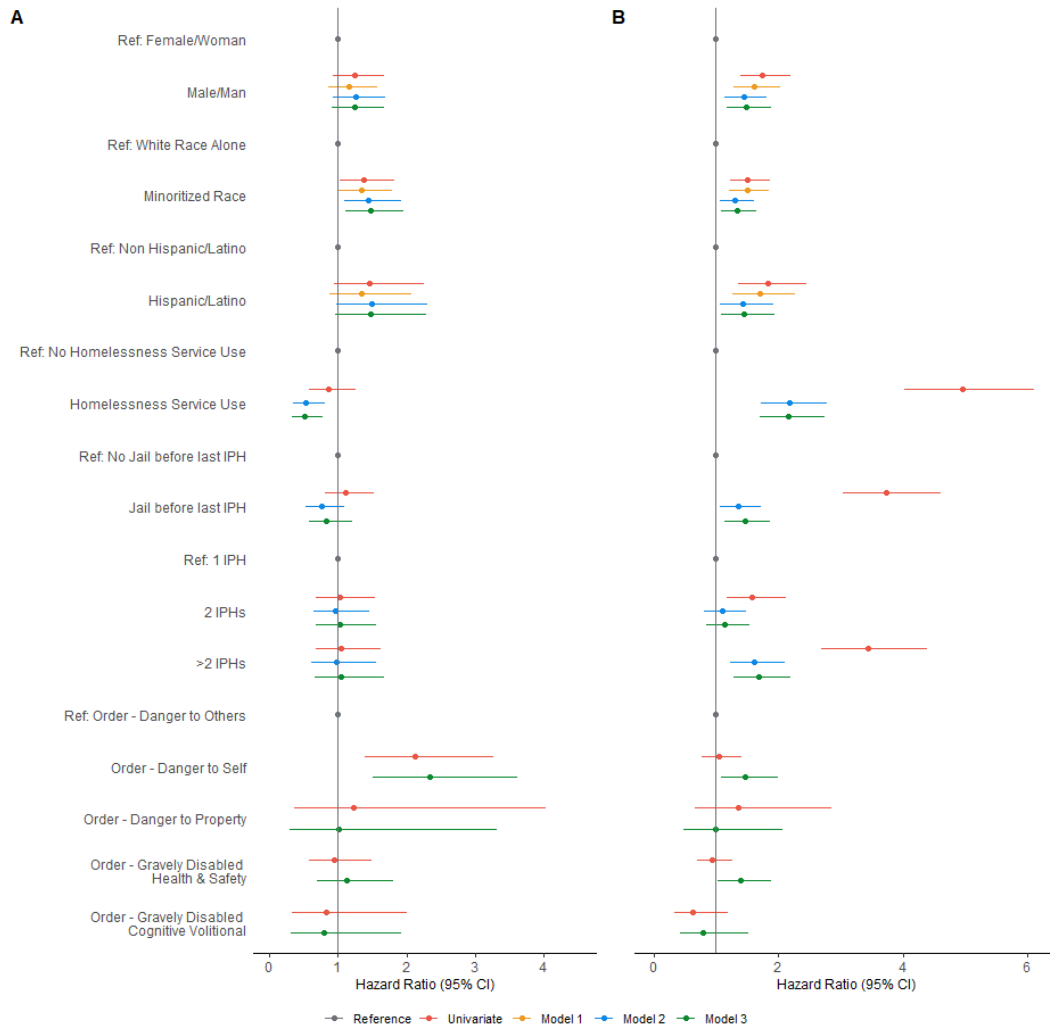


Figure 2. Cumulative Incidences of Suicide by Different Methods and Unintentional Poisoning after Most Recent Involuntary Psychiatric Hospitalization



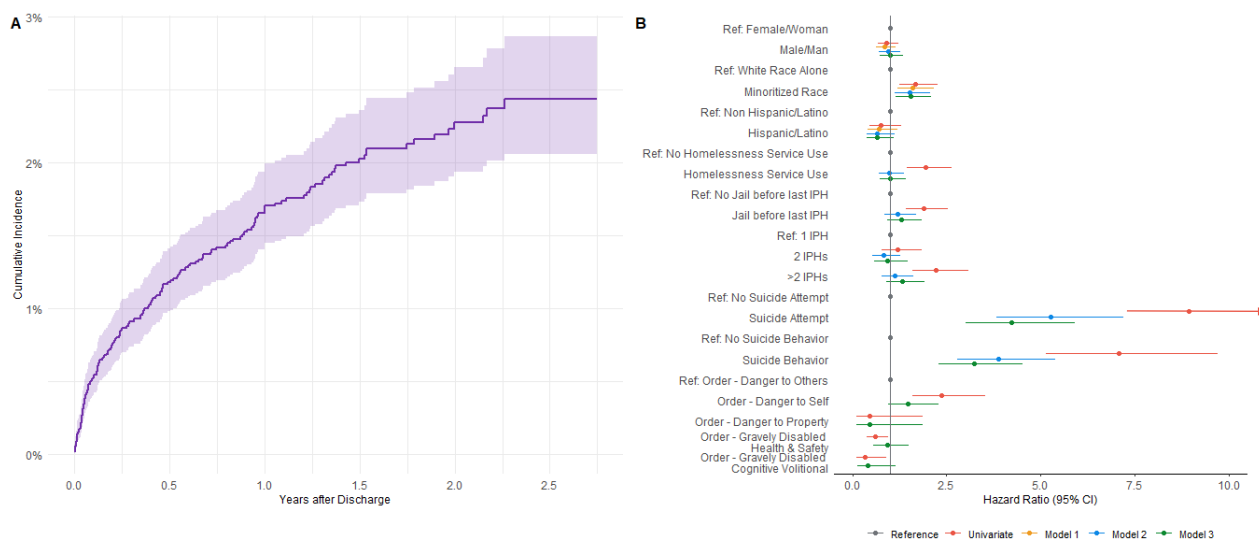
A. Cumulative incidences of suicide and unintentional poisoning, accounting for the competing risk of death by other causes. **B.** Cumulative incidences of suicide by different methods of suicide death, accounting for the competing risks of death by other causes, including unintentional poisoning.

Figure 3. Univariate and Multivariable Cox Proportional Hazards Model Results for Suicide and Unintentional Poisoning Mortality



Forest plot of hazard ratios and 95% confidence intervals for associations with **(A)** suicide mortality and **(B)** unintentional poisoning in univariate analysis and three stepwise multivariable models. Reference categories for each variable shown with gray dots. Hazard ratios for age (Models 1, 2, and 3) and length of stay (Model 3) spline knots and for missing categories for race, ethnicity, sex/gender, and order type are not shown.

Figure 4. Cumulative Incidence of Nonfatal Suicide Attempt and Cox Proportional Hazards Results



A. Cumulative incidence of nonfatal suicide attempt after most recent IPH, accounting for the competing risk of death by all causes. **B.** Forest plot of hazard ratios and 95% confidence intervals for associations with hazard of nonfatal suicide attempt in univariate analysis and three stepwise multivariable models. Reference categories for each variable shown with gray dots. Hazard ratios for age (Models 1, 2, and 3) and length of stay (Model 3) spline knots and for missing categories for race, ethnicity, sex/gender, and order type are not shown.

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Appendix I: Supplemental Information

Table S1. Comparison of Observations with Missing Values to Observations with No Missing Values

	Total (N=22019)	No Missing (n=14506)	Missing (n=7513)
Age (years)	37.0 [27.0, 53.0]	37.0 [27.0, 54.0]	37.0 [27.0, 52.0]
Sex/Gender			
Female/Woman	8427 (38.3%)	6178 (42.6%)	2249 (29.9%)
Male/Man	11693 (53.1%)	8328 (57.4%)	3365 (44.8%)
Missing	1899 (8.6%)	0 (0%)	1899 (25.3%)
Race			
White	9727 (44.2%)	8445 (58.2%)	1282 (17.1%)
Black	2531 (11.5%)	2057 (14.2%)	474 (6.3%)
Native Hawaiian or Pacific Islander	116 (0.5%)	97 (0.7%)	19 (0.3%)
Asian	1244 (5.6%)	1050 (7.2%)	194 (2.6%)
American Indian or Alaska Native	200 (0.9%)	166 (1.1%)	34 (0.5%)
More than one race	3118 (14.2%)	2691 (18.6%)	427 (5.7%)
Missing	5083 (23.1%)	0 (0%)	5083 (67.7%)
Hispanic/Latino	1972 (9.0%)	1444 (10.0%)	528 (7.0%)
Missing	1718 (7.8%)	0 (0%)	1718 (22.9%)
Homelessness Services^c	4587 (20.8%)	3868 (26.7%)	719 (9.6%)
Jail Stay^c	5978 (27.1%)	4592 (31.7%)	1386 (18.4%)
Length of Stay (days)^b	14.0 [7.00, 26.0]	14.0 [7.00, 25.0]	15.0 [7.00, 27.0]
Number of IPHs			
1 IPH	15439 (70.1%)	9657 (66.6%)	5782 (77.0%)
2 IPHs	3231 (14.7%)	2257 (15.6%)	974 (13.0%)
3+ IPHs	3349 (15.2%)	2592 (17.9%)	757 (10.1%)
Type of Detention Order			
Danger to Others	4170 (18.9%)	3172 (21.9%)	998 (13.3%)
Danger to Self	6504 (29.5%)	4452 (30.7%)	2052 (27.3%)
Danger to Property	435 (2.0%)	366 (2.5%)	69 (0.9%)
Grave Disabled Health & Safety	8297 (37.7%)	5499 (37.9%)	2798 (37.2%)
Grave Disabled Cognitive Volitional	1305 (5.9%)	1017 (7.0%)	288 (3.8%)
Missing	1308 (5.9%)	0 (0%)	1308 (17.4%)
Suicide Method			
Firearm	29 (0.1%)	28 (0.2%)	1 (0.0%)
Jump/Fall or Moving Object	33 (0.1%)	32 (0.2%)	1 (0.0%)
Other Methods	17 (0.1%)	14 (0.1%)	3 (0.0%)
Poisoning	36 (0.2%)	30 (0.2%)	6 (0.1%)

Suffocation/Hanging	72 (0.3%)	65 (0.4%)	7 (0.1%)
Mortality Outcome			
Censor or Died of Other Causes	21468 (97.5%)	14010 (96.6%)	7458 (99.3%)
Suicide	194 (0.9%)	176 (1.2%)	18 (0.2%)
Unintentional Poisoning	357 (1.6%)	320 (2.2%)	37 (0.5%)

^a Continuous variables are summarized with median [interquartile range] and compared with Kruskal-Wallis nonparametric test of means. Categorical variables are summarized with count (percent) and compared with Chi-squared tests or Fisher's exact test for expected cell counts<5.

^b At last recorded IPH

^c Occurring prior to the last recorded IPH

* Data suppressed to protect confidentiality

Table S2. Regression Results for Suicide Mortality

Characteristic	Univariate			Model 1			Model 2			Model 3		
	HR ¹	95% CI ¹	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p
Sex/Gender												
Female/Woman				—	—		—	—		—	—	
Male/Man	1.25	0.93, 1.68	0.13	1.17	0.87, 1.57	0.3	1.26	0.93, 1.69	0.13	1.24	0.92, 1.68	0.2
Race												
White Alone				—	—		—	—		—	—	
Minoritized Race	1.37	1.04, 1.82	0.03	1.35	1.02, 1.79	0.04	1.45	1.09, 1.93	0.01	1.48	1.11, 1.97	0.007
Hispanic/Latino	1.47	0.96, 2.25	0.08	1.35	0.88, 2.07	0.2	1.50	0.97, 2.31	0.07	1.48	0.96, 2.28	0.076
Homelessness Service Use	0.86	0.59, 1.27	0.46				0.54	0.36, 0.82	0.004	0.52	0.34, 0.79	0.002
Jail	1.11	0.81, 1.53	0.51				0.76	0.53, 1.09	0.14	0.83	0.58, 1.20	0.30
Number of IPHs												
1 IPH							—	—		—	—	
2 IPHs	1.03	0.69, 1.55	0.88				0.97	0.64, 1.46	0.9	1.03	0.68, 1.56	0.90
>2 IPHs	1.05	0.68, 1.62	0.83				0.98	0.62, 1.56	1	1.05	0.66, 1.68	0.80
Detention Order Type												
Danger to Others										—	—	
Danger to Self	2.13	1.39, 3.26	<0.01							2.34	1.51, 3.61	<0.001
Danger to Property	1.22	0.37, 4.03	0.74							1.01	0.30, 3.32	1.0
Grave Disabled: Health & Safety	0.94	0.59, 1.5	0.80							1.13	0.70, 1.80	0.6
Gravely Disabled: Cog-Volitional	0.83	0.34, 2.01	0.68							0.79	0.33, 1.92	0.6

¹ HR = Hazard Ratio, CI = Confidence Interval. Estimates are not shown for age and length-of-stay splines nor for missing categories (Sex/Gender, Race, Hispanic/Latino ethnicity, Detention Order Type)

Table S3. Model Results for Unintentional Poisoning Mortality

Characteristic	Univariate			Model 1			Model 2			Model 3		
	HR ¹	95% CI ¹	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p-value
Sex/Gender												
Female/Woman	—	—		—	—		—	—		—	—	
Male/Man	1.75	1.39, 2.20	<0.001	1.62	1.29, 2.03	<0.001	1.44	1.15, 1.82	0.002	1.50	1.18, 1.89	<0.001
Race												
White Alone	—	—		—	—		—	—		—	—	
Minoritized Race	1.51	1.23, 1.86	<0.001	1.50	1.22, 1.85	<0.001	1.31	1.06, 1.62	0.012	1.34	1.08, 1.65	0.007
Hispanic/Latino	1.83	1.37, 2.45	<0.001	1.70	1.27, 2.28	<0.001	1.44	1.07, 1.93	0.016	1.45	1.08, 1.95	0.014
Homelessness	4.96	4.03, 6.12	<0.001				2.19	1.73, 2.78	<0.001	2.16	1.71, 2.75	<0.001
Service Use							1.36	1.07, 1.73	0.013	1.47	1.15, 1.88	0.002
Jail	3.74	3.04, 4.61	<0.001									
Number of IPHs												
1 IPH	—	—					—	—		—	—	
2 IPHs	1.59	1.18, 2.12	0.002				1.11	0.82, 1.49	0.50	1.15	0.85, 1.55	0.40
>2 IPHs	3.44	2.70, 4.39	<0.001				1.62	1.24, 2.11	<0.001	1.68	1.29, 2.20	<0.001
Detention Order Type												
Danger to Others	—	—								—	—	
Danger to Self	1.05	0.78, 1.41	0.757							1.47	1.08, 2.00	0.013
Danger to Property	1.37	0.66, 2.85	0.402							1.00	0.48, 2.08	1.0
Grave Disabled: Health & Safety	0.94	0.70, 1.26	0.677							1.40	1.04, 1.89	0.028
Gravely Disabled: Cog-Volitional	0.63	0.33, 1.20	0.161							0.80	0.42, 1.52	0.50

¹ HR = Hazard Ratio, CI = Confidence Interval. Estimates are not shown for age and length-of-stay splines nor for missing categories (Sex/Gender, Race, Hispanic/Latino ethnicity, Detention Order Type)

Table S4. Descriptive Statistics for People Discharged from Involuntary Psychiatric Hospitalization in King County, Washington from 2020 – 2022

	Total (N=10700)	Censored or Died (n=10522)	Suicide Attempt (n=178)
Age (years) ^a	37.0 [28.0, 51.0]	37.0 [28.0, 51.0]	36.0 [27.3, 45.8]
Sex/Gender			
Female/Woman	4155 (38.8%)	4076 (38.7%)	79 (44.4%)
Male/Man	5807 (54.3%)	5708 (54.2%)	99 (55.6%)
Missing	738 (6.9%)	738 (7.0%)	0 (0%)
Race			
White	4604 (43.0%)	4530 (43.1%)	74 (41.6%)
Black	1389 (13.0%)	1368 (13.0%)	21 (11.8%)
NHPI	57 (0.5%)	57 (0.5%)	0 (0%)
Asian	623 (5.8%)	*	*
AIAN	101 (0.9%)	101 (1.0%)	0 (0%)
More than one race	1792 (16.7%)	1717 (16.3%)	75 (42.1%)
Missing	2134 (19.9%)	2134 (20.3%)	0 (0%)
Hispanic/Latino	1096 (10.2%)	1081 (10.3%)	15 (8.4%)
Missing	1031 (9.6%)	*	*
Homelessness Service Use ^b	2859 (26.7%)	2789 (26.5%)	70 (39.3%)
Jail	3664 (34.2%)	3579 (34.0%)	85 (47.8%)
Suicide Attempt	762 (7.1%)	698 (6.6%)	64 (36.0%)
Other Nonfatal Suicide^b Behaviors	2767 (25.9%)	2645 (25.1%)	122 (68.5%)
Length of Stay (days)	14.0 [7.00, 26.0]	14.0 [7.00, 26.0]	11.0 [6.00, 20.8]
Number of IPHs ^b			
1 IPH	6624 (61.9%)	6533 (62.1%)	91 (51.1%)
2 IPHs	1694 (15.8%)	1668 (15.9%)	26 (14.6%)
>2 IPHs	2335 (21.8%)	2274 (21.6%)	61 (34.3%)
Detention Order Type ^a			
Danger to Others	2053 (19.2%)	2022 (19.2%)	31 (17.4%)
Danger to Self	2808 (26.2%)	2705 (25.7%)	103 (57.9%)
Danger to Property	298 (2.8%)	*	*
Grave Disabled: Health & Safety	4011 (37.5%)	3974 (37.8%)	37 (20.8%)
Gravely Disabled: Cog- Volitional	867 (8.1%)	*	*
Missing	663 (6.2%)	*	*

^a At last recorded IPH

^b Occurring prior to the last recorded IPH

* Data suppressed to protect confidentiality

Table S5. Model Results for Nonfatal Suicide Attempt

Characteristic	Univariate			Model 1			Model 2			Model 3		
	HR ¹	95% CI ¹	p-value	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p
Sex/Gender												
Female/Woman	—	—	—	—	—	—	—	—	—	—	—	—
Male/Man	0.90	0.67, 1.22	0.506	0.86	0.64, 1.16	0.30	0.94	0.70, 1.28	0.70	0.99	0.73, 1.35	1.0
Race												
White Alone	—	—	—	—	—	—	—	—	—	—	—	—
Minoritized Race	1.68	1.24, 2.26	0.001	1.60	1.19, 2.17	0.002	1.52	1.13, 2.06	0.006	1.56	1.15, 2.10	0.004
Hispanic/Latino	0.76	0.45, 1.29	0.313	0.70	0.41, 1.19	0.20	0.66	0.39, 1.13	0.13	0.65	0.38, 1.11	0.12
Homelessness Service Use	1.95	1.44, 2.64	<0.001				0.98	0.69, 1.38	0.90	1.01	0.72, 1.42	1.0
Jail	1.90	1.41, 2.55	<0.001				1.19	0.84, 1.68	0.30	1.31	0.92, 1.85	0.13
Number of IPHs												
1 IPH	—	—	—				—	—	—	—	—	—
2 IPHs	1.19	0.77, 1.84	0.435				0.82	0.52, 1.28	0.40	0.93	0.59, 1.46	0.7
>2 IPHs	2.22	1.61, 3.08	<0.001				1.12	0.77, 1.62	0.50	1.32	0.90, 1.93	0.2
Suicide Attempt	8.94	6.57, 12.16	<0.001				5.26	3.84, 7.21	<0.001	4.22	3.01, 5.91	<0.001
Other Nonfatal Suicide Behaviors	7.07	5.15, 9.71	<0.001				3.88	2.80, 5.39	<0.001	3.22	2.29, 4.52	<0.001
Detention Order Type												
Danger to Others	—	—	—							—	—	—
Danger to Self	2.37	1.58, 3.54	<0.001							1.48	0.95, 2.30	0.082
Danger to Property	0.45	0.11, 1.87	0.271							0.44	0.11, 1.86	0.30
Grave Disabled: Health & Safety	0.59	0.37, 0.96	0.032							0.92	0.56, 1.50	0.70
Gravely Disabled: Cog-Volitional	0.32	0.11, 0.91	0.033							0.40	0.14, 1.14	0.086

¹ HR = Hazard Ratio, CI = Confidence Interval