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Has deinstitutionalization affected inpatient suicide? Psychiatric inpatient suicide rates between 1990 and 2013 in Israel

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ABSTRACT

Objective: To examine variations in rates of inpatient suicide and clinical risk factors for this phenomenon.
Method: The National Israeli Psychiatric Hospitalization Case Registry was used to study inpatient suicide. Clinical risk factors for inpatient suicide were examined in a nested case control design.
Results: Between 1990 and 2013 there were 326 inpatient suicides, at an average of one inpatient suicide per 1614 admissions. A significant decline in rates of suicide per admission over time ($p < 0.001$) was associated with a reduced number of beds ($p < 0.001$) and a decline in nationwide suicide rates ($p = 0.001$). Clinical risk factors for inpatient suicide were: affective disorders (OR = 5.95), schizoaffective disorder (OR = 5.27), schizophrenia (OR = 3.82), previous suicide attempts (OR = 2.59), involuntary hospitalization (OR = 1.67), and more previous hospitalizations (OR = 1.16,). A multivariate model with sensitivity of 27.3% and specificity of 95.3% for inpatient suicide, showed a positive predictive value of 0.4%.
Conclusions: The absolute number and rates of inpatient suicide per admission have decreased over time, probably due to the decreased number of beds lowering total time at risk. Patients with affective and psychotic disorders and with previous suicide attempts have the greatest risk of inpatient suicide. However, clinical characteristics do not enable identification of patients who are at risk for suicide.

1. Introduction

Suicide during psychiatric hospitalizations is a matter of major concern. In order to address this concern, primary research on inpatient suicide has focused either on the change in rate of inpatient suicide over time (Madsen and Nordentoft, 2013; Wolfersdorf et al., 1988) or on risk factors for inpatient suicide (Hunt et al., 2007; Madsen et al., 2012). With respect to suicide rates, a recent meta-analysis found that the rates of inpatient suicides per patient-years tended to be higher in more recent studies despite a shorter average length of hospital stay (Walsh et al., 2014).

Little is known of the factors that might be associated with changes in inpatient suicide rates over time. Given the world-wide trends over the past several decades to close down psychiatric hospitals and reduce the number of beds and the associated decreased length of stay, one might hypothesize that this trend would lead to increased rates of inpatient suicides (Walsh et al., 2014) as more acute and severely ill patients are hospitalized. Alternatively, one might hypothesize that less time spent in the hospital might be associated with a lower probability of suicide per admission, as patients have less time in the hospital to attempt suicide.

Clinical and demographic risk factors for inpatient suicide have been more widely studied, using cohort and case-control designs. However, inpatient suicide is a rare event and there are very few studies that have a sufficient sample size to meaningfully examine more than a handful of variables. To date only three controlled studies have included one hundred or more inpatient suicides (Hunt et al., 2007; Madsen et al., 2012; Modestin and Kopp, 1988) while smaller studies with less statistical power and higher risk of chance findings are much more common (Large et al., 2011).

1.1. Aims of the study

The first aim of this study was to determine changes in rates of inpatient suicide between 1990 and 2013. The second aim of the study was to analyze the associations between the change in number of beds and length of stay, and the change in rates of inpatient suicide. This analysis aims to test two conflicting hypotheses: either that as the number of

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beds per 1000 patients and mean length of stay decline, only the more acute and suicidal patients will be admitted, leading to an increase of inpatient suicide, or that the decreased rates of number of beds per 1000 patients will lead to lower rates of suicide perhaps because of decreased patient-years in the hospital and thus decreased time at risk. The third aim of this study was to identify clinical risk factors for suicide among Israeli psychiatric inpatients.

2. Material and methods

2.1. Study population

The study was approved by the Sheba Medical Center local IRB. Data from the Israeli Psychiatric Hospitalization Registry was used in order to examine both inpatient suicide rates and the clinical associations with inpatient suicide between 1990 and 2013. During the period of the study the Israeli Psychiatric Hospitalization Registry recorded annual information about the number of suicides, the number of psychiatric admissions, the average length of stay, and the rates of number of beds per 1000 persons (http://www.health.gov.il/Subjects/mental_health/Pages/publications.aspx) (Table1). The registry also contains diagnoses and demographics of admitted patients ascertained by board-certified psychiatrists at the time of each admission and discharge. The Israeli Psychiatric Hospitalization Registry defines suicide of inpatients according to international practice both as those occurring in hospital and while on approved leave. The hospitals from which the data were collected were both psychiatric hospitals and psychiatric wards in general hospitals. However, the data used for this study's analyses did not include a specification on type of hospital for each patient.

For the purpose of examining individual risk factors for inpatient suicide, we randomly selected four inpatient controls for each patient, who were admitted to the same hospital in the same year and did not die by suicide. The Israeli Psychiatric Hospitalization Registry records age, sex, date of admission and discharge, age at onset of psychiatric disorder, length of first admission, discharge ICD diagnosis, the presence of suicide attempts up to thirty days prior to hospitalization, number of previous hospitalizations, substance or alcohol abuse at the time of admission and legal classification of the patient (voluntary or involuntary hospitalization). The records also include data for forensically detained mentally ill offenders. All the available data was included in the analysis (Davidson et al., 1999).

2.2. Statistical analysis

2.2.1. National inpatient suicide rates

Suicide rates were calculated by examining: i) the number of suicides per admission (calculated by dividing the number of inpatient suicides by the number of admissions) and ii) the number of inpatient suicides per 100,000 inpatient years. The rate of suicides per admission was also reported as its inverse, with number of admissions per suicide, so that a larger number of admissions per suicide reflects a lower suicide rate. Bivariate linear regression was used to examine factors associated with the dependent variable of suicides per admission for each of the 24 study years. The independent variables analyzed were rates of beds per 1000 patients, suicide rates in the general Israeli population and the calendar year. Multicollinearity was tested using Pearson correlation and collinearity diagnostics provided by the multiple regression procedure, including variance inflation factor (VIF) and tolerance.

2.2.2. Patients' characteristics associated with suicide

Logistic regression was used to calculate odds ratios for each of the clinical factors associated with inpatient suicide. Variables that were significant at $p \leq 0.05$ were entered into a multivariate logistic regression model in order to calculate adjusted odds ratios and the sensitivity and specificity of a high-risk categorization. The positive predictive value was calculated based on the sensitivity and specificity of the multivariate logistic regression. Associations were classified as weak (OR between 1.5 and 2.5), moderate (OR between 2.5 and 4), strong (OR between 4 and 10) or very strong (OR greater than10) (Rosenthal, 1996). All regressions were performed with IBM SPSS software, version 22 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.).

3. Results

3.1. National inpatient suicide rates

During the study period, from 1990 to 2013, there were 436,930 admissions, of which 326 ended in a suicide, at a rate of 1340 admissions per suicide, at an overall suicide rate of 286 suicides per 100,000 inpatient years (Table 1). Suicides per admission were significantly lower in later years, starting from 0.0015 in 1990 and decreasing to 0.0005 in 2013. Bivariate analyses were performed with the dependent variable of suicides per admissions and the independent variables of number of beds per 1000 persons, nationwide suicide rate, and year of suicide. Each analysis showed a significant association between the independent variable and suicide per admission ($p \leq 0.05$) (Table 2). Pearson correlation indicated that higher number of beds per 1000 persons and higher national suicide rates were significantly associated with increased number of inpatient suicides (number of beds and calendar year: $r = -0.96$; number of beds and national suicide rates: $r = 0.83$; national suicide rates and calendar year: $r = -0.79$). Two of the VIF scores exceeded 10 (VIF of number of beds = 13.90; VIF of calendar year = 11.29) suggesting a problem of multicollinearity (Bowerman and O'Connell, 1990; Menard, 1995). Hence, multivariate regression models were not performed.

3.2. Patients' characteristics associated with suicide

Of the patients who died by suicide, 69.9% were male and 30.1% female. Mean age at time of suicide was 41 ± 15 years, and average time between first hospitalization and suicide was 7.6 ± 9.5 years. The overall percentage of patients who died by suicide while on approved leave throughout the 24 years of the study was 33%. There was no significant change in rates of patients who died by suicide while on approved leave throughout the years of the study ($p = 0.122$). Although we do not have data on the exact duration of approved periods of leave, these typically are not more than several days duration. This did not change during the period of time studied.

The multivariate logistic regression model suggested associations between risk for suicide and diagnosis of schizoaffective disorder (adjusted OR = 5.27, 95% CI 2.57–10.81), and affective disorders (adjusted OR = 5.95, 95% CI 3.45–10.25). Moderately strong associations were found between schizophrenia (adjusted OR = 3.82, 95% CI 2.33–6.27) and inpatient suicide, as well as previous suicide attempts (adjusted OR = 2.59, 95% CI 1.83–3.67) and inpatient suicide. Weaker but statistically significant associations were found between inpatient suicide and older age of onset (adjusted OR = 1.45, 95% CI 1.06–1.99), male sex (adjusted OR = 1.92, 95% CI 1.36–2.70), a greater number of admissions (5.86 ± 4.4 vs. 2.43 ± 4.3, adjusted OR = 1.16, 95% CI 1.10–1.23), and involuntary hospitalization (adjusted OR = 1.67, 95% CI 1.12–2.48). Substance abuse was not significantly associated with in-patient suicide (adjusted OR = 1.09, 95% CI 0.73–1.63) (Table 3).

A multivariate model that included schizoaffective disorder, affective disorder, schizophrenia, previous suicide attempt, older age of onset, male sex, more previous hospitalizations and involuntary status had a sensitivity of 27.3% and specificity of 95.3%. Using the base rate of 1 suicide per 1340 suicides, a positive predictive value of the multivariate model was estimated to be 0.4%, hence there was an extremely low ability to predict inpatient suicide.