

Suicide Rates After Discharge From Psychiatric Facilities

A Systematic Review and Meta-analysis

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IMPORTANCE High rates of suicide after psychiatric hospitalization are reported in many studies, yet the magnitude of the increases and the factors underlying them remain unclear.

OBJECTIVES To quantify the rates of suicide after discharge from psychiatric facilities and examine what moderates those rates.

DATA SOURCES English-language, peer-reviewed publications published from January 1, 1946, to May 1, 2016, were located using MEDLINE, PsychINFO, and EMBASE with the search terms ((suicid*).ti AND (hospital or discharg* OR inpatient or in-patient OR admit*).ab and ((mortality OR outcome* OR death*) AND (psych* OR mental*).ti AND (admit* OR admis* or hospital* OR inpatient* OR in-patient* OR discharg*).ab. Hand searching was also done.

STUDY SELECTION Studies reporting the number of suicides among patients discharged from psychiatric facilities and the number of exposed person-years and studies from which these data could be calculated.

DATA EXTRACTION AND SYNTHESIS The meta-analysis adhered to Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) and Meta-analysis of Observational Studies in Epidemiology (MOOSE) guidelines. A random-effects model was used to calculate a pooled estimate of postdischarge suicides per 100 000 person-years.

MAIN OUTCOMES AND MEASURES The suicide rate after discharge from psychiatric facilities was the main outcome, and the association between the duration of follow-up and the year of the sampling were the main a priori moderators.

RESULTS A total of 100 studies reported 183 patient samples (50 samples of females, 49 of males, and 84 of mixed sex; 129 of adults or unspecified patients, 20 of adolescents, 19 of older patients, and 15 from long-term or forensic discharge facilities), including a total of 17 857 suicides during 4 725 445 person-years. The pooled estimate postdischarge suicide rate was 484 suicides per 100 000 person-years (95% CI, 422-555 suicides per 100 000 person-years; prediction interval, 89-2641), with high between-sample heterogeneity ($I^2 = 98\%$). The suicide rate was highest within 3 months after discharge (1132; 95% CI, 874-1467) and among patients admitted with suicidal ideas or behaviors (2078; 95% CI, 1512-2856). Pooled suicide rates per 100 000 patients-years were 654 for studies with follow-up periods of 3 months to 1 year, 494 for studies with follow-up periods of 1 to 5 years, 366 for studies with follow-up periods of 5 to 10 years, and 277 for studies with follow-up periods longer than 10 years. Suicide rates were higher among samples collected in the periods 1995-2004 (656; 95% CI, 518-831) and 2005-2016 (672; 95% CI, 428-1055) than in earlier samples.

CONCLUSIONS AND RELEVANCE The immediate postdischarge period is a time of marked risk, but rates of suicide remain high for many years after discharge. Patients admitted because of suicidal ideas or behaviors and those in the first months after discharge should be a particular focus of concern. Previously admitted patients should be able to access long-term care and assistance.

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Suicide is among the top 20 causes of death worldwide. The World Health Organization estimates that the global age-standardized suicide rate was 11.4 per 100 000 person-years in 2012.¹ Most suicides occur in individuals with mental illness,² and virtually all mental disorders are associated with increased suicide-associated mortality.³ Mentally ill persons who have been discharged from psychiatric hospitals and wards seem to have a greater risk for suicide than other mentally ill persons.⁴

The rate of suicide after discharge from psychiatric hospitals and wards (referred to herein as postdischarge suicide) is very high. A recent US study⁵ reported a suicide rate of 178 per 100 000 person-years in the first 3 months after discharge, a figure that is approximately 15 times the US national suicide rate. Studies^{6–9} from the United Kingdom and Nordic countries with similar durations of follow-up after discharge have reported higher suicide rates. Currently, there are no accepted benchmarks for postdischarge suicide rates.

A synthesis of the existing literature about rates of postdischarge suicide would help quantify the extent of this issue and would complement an earlier meta-analysis¹⁰ of risk factors for postdischarge suicide by estimating expected base rates. A meta-analysis could help clarify the time course of postdischarge suicide risk and examine progress in reducing postdischarge suicide.

The first aim of this study was to calculate a pooled estimate and statistical dispersion (range, median, and interquartile range) of postdischarge suicide rates. The second aim was to explore whether the observed heterogeneity in postdischarge suicide rates was associated with the duration of follow-up after discharge and the year in which the samples were collected. We also explored potential associations between suicide rates and a predetermined set of moderator variables defined by demographic characteristics, clinical factors, and study methods.

Methods

We conducted a registered meta-analysis of rates of postdischarge suicides according to the Meta-analysis of Observational Studies in Epidemiology (MOOSE)¹¹ and Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA)¹² guidelines.

Search Strategy

Two of us (D.T.C. and M.M.L.) independently searched MEDLINE, PsychINFO, and EMBASE for relevant articles published in English from January 1, 1946, to May 1, 2016, with the search terms ((*suicid**).*ti* AND (*hospital* OR *discharg** OR *inpatient* OR *in-patient* OR *admit**).*ab* AND ((*mortality* OR *outcome** OR *death**) AND (*psych** OR *mental**)).*ti* AND (*admit** OR *admis** OR *hospital** OR *inpatient** OR *in-patient** OR *discharg**).*ab* (Figure 1). Electronic searches were supplemented by hand searches of the relevant review articles. Gray literature was not considered. Two of us (D.T.C., M.M.L.) independently winnowed titles, abstracts, and full-text publications.

Key Points

Questions What is the suicide rate after discharge from psychiatric facilities, and what factors influence it?

Findings In this meta-analysis of 100 studies of 183 patient samples, the postdischarge suicide rate was approximately 100 times the global suicide rate during the first 3 months after discharge and patients admitted with suicidal thoughts or behaviors had rates near 200 times the global rate. Even many years after discharge, previous psychiatric inpatients have suicide rates that are approximately 30 times higher than typical global rates.

Meaning Although recently discharged patients and those who were admitted because of suicidal ideas and behaviors are at particular risk of suicide, all discharged patients have an enduring high suicide rate and should have ongoing access to health care resources.

Inclusion and Exclusion Criteria

We included studies that reported the number of suicides among patients discharged from psychiatric hospitals or wards and the number of person-years in which the suicides occurred. We also included studies from which these data could be calculated using the reported suicide rate, the mean length of patient follow-up, or the duration of follow-up.

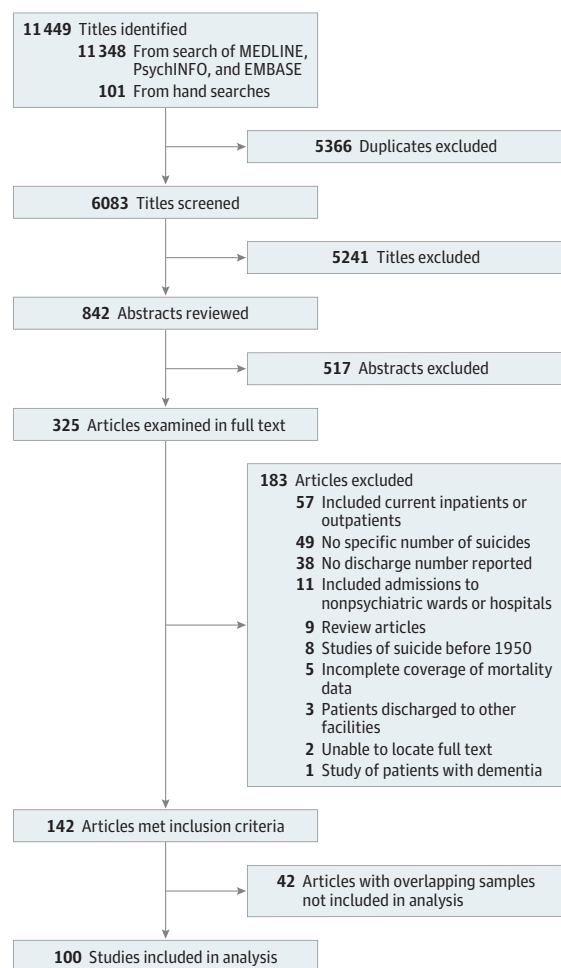
Studies of suicide attempts, community patients, and current inpatients; conducted before 1950; and with discharge from nonpsychiatric settings were excluded. Studies were excluded if the number of suicides and number of person-years were not reported, could not be calculated, or could not be obtained by email from the authors. When 2 studies reported completely overlapping samples (eg, when one study was conducted at a national level and another study was from a single hospital in that country in the same period), the study with fewer person-years was excluded. When 2 studies had partial overlap, both studies were included if less than 20% of the participants in the smaller study were included in the larger study.

Data Extraction

Two of us (D.T.C., M.M.L.) independently extracted the data. When studies reported multiple samples, nonoverlapping samples were selected according to a hierarchy of sex, age group (adolescents, adults, and those >65 years of age), duration of follow-up, year of the suicide, and diagnostic group, such that no participant in any single study was included more than once. In some publications, the number of person-years could be calculated using the number of suicides and reported suicide rate. In other publications, the number of person-years was estimated using the reported duration of follow-up.

A predetermined list of moderator variables was extracted for each sample: the duration of follow-up, the year or midyear of data collection, the country in which the study was conducted, sex (male, female, or mixed), age at discharge (adolescent, adult, unspecified by age, >65 years of age), whether the patients were discharged from long-term or forensic facilities, whether the patients were defined by an admission for suicidality (defined as an admission associated with a suicide

Figure 1. Flowchart of Searches for Studies Reporting Rates of Suicide Among Discharged Psychiatric Patients



attempt or suicidal ideation), whether the samples were of patients followed up after their first psychiatric admission (first-admission patients), and the psychiatric diagnosis (psychosis, affective disorder, or mixed and other diagnoses). The corresponding national suicide rate in the country during the year of the study was obtained using World Health Organization data for each sample.¹

Strength of Reporting Scale

The strength of reporting of each study was assessed using a 5-point scale derived from the Newcastle-Ottawa Scale for assessing the quality of nonrandomized studies.¹³ One point was awarded if the study identified suicides by using coroners' records or a national mortality database (rather than using hospital records), included all the postdischarge suicides in a defined geographic region (rather than suicides from a particular care setting), included open verdicts in suicide numbers, reported the number of individuals (rather than the number of discharges), or reported the number of person-years directly or the mean length of patient follow-up from which the number of person-years could be calculated directly. Studies that

included open verdicts were regarded as being of higher quality because of evidence that open-verdict cases are often regarded as suicides by researchers.^{14,15}

Statistical Analysis

The suicide rate per patient-year was the effect size measure. The pooled effect size was calculated using a random-effects model because we considered that the different patient groups in different countries during different periods were unlikely to have a common effect size. The studies were weighted according to their inverse variance, τ^2 was calculated using the Paule-Mandel method, and the suicide rates were log transformed and reported in rates per 100 000 person-years. The significance test of the pooled suicide rate was conducted with a null hypothesis of 11.4 events per 100 000 person-years. Between-study heterogeneity was assessed using the Cochran Q and I^2 statistics. Possible publication bias was tested by examination of the funnel plot and by an Egger regression.¹⁶ The analysis was conducted using R packages meta and metafor.¹⁷

Sources of between-sample heterogeneity were investigated using subgroup analysis with categorical moderators and meta-regression with continuous moderators. Continuous moderators examined by meta-regression and categorical moderators examined using subgroup analysis and Cochran Q that were significantly associated with heterogeneity in suicide rates ($\alpha < .05$) were entered into a mixed-effects multiple meta-regression model. The length of follow-up was dichotomized (≤ 12 months coded as 1, > 12 months coded as 0) for the purpose of the multiple meta-regression.

Results

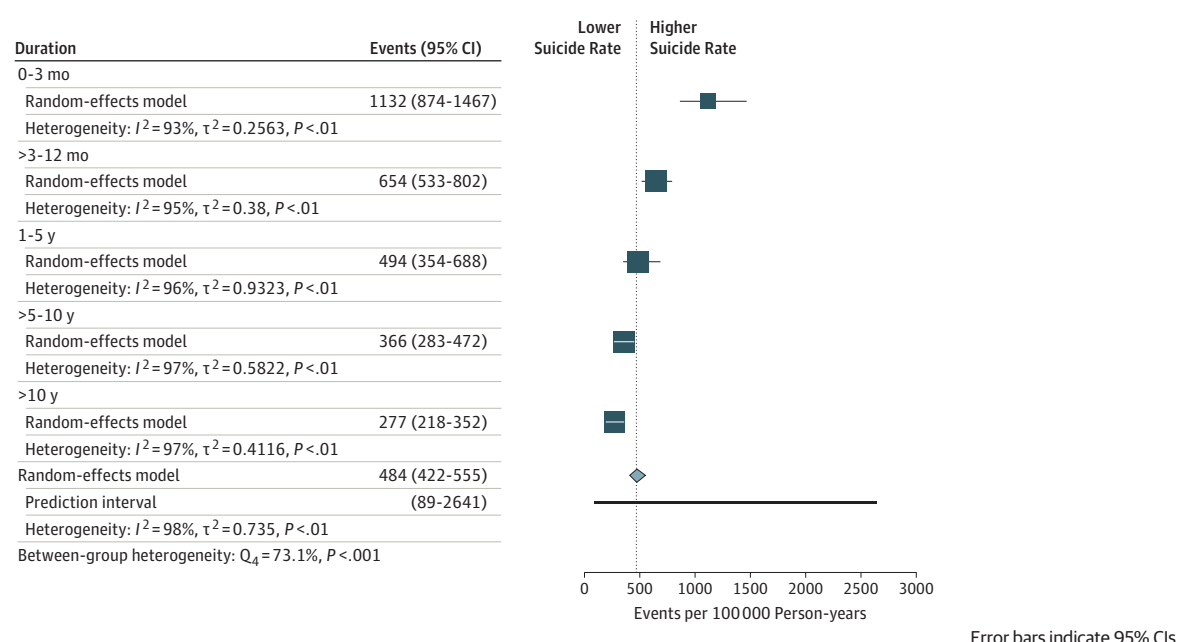
Searches and Data Extraction

A total of 142 full-text peer-reviewed publications met our inclusion criteria before being examined for possible overlapping participants (Figure 1). Two of us (D.T.C., M.M.L.) identified 113 of the 142 publications (79.6%). A total of 100 publications were included after the removal of overlapping studies (eTable 1 in the Supplement).^{6-9,18-113} These studies reported 183 separate samples of discharged patients. Forty-two publications were excluded because of overlap with larger publications (eTable 2 in the Supplement). Of the 183 patient samples, 50 were of females, 49 were of males, and 84 were of mixed sex (eTable 3 in the Supplement). A total of 129 samples were of adults or unspecified patients, 20 were of adolescents (≤ 18 years of age at the time of discharge), and 19 samples were of older patients (≥ 65 years of age at the time of discharge). Fifteen samples were of patients discharged from long-term or forensic facilities, and 23 samples were of first-admission patients. Nine samples were of patients who had been admitted with suicidality. There were disagreements about 40 of the 366 data points relating to effect size. All disagreements were resolved by a second examination of the data (D.T.C., M.M.L.).

Sample Characteristics

The 100 studies with 183 samples reported 17 857 suicides during 4 725 445 person-years. The mean (SD) number of

Figure 2. Suicide Rates According to Duration of Follow-up



suicides per sample was 97.6 (321.6) (median, 12; range, 0-2822), and the mean (SD) number of person-years per sample was 25 822 (111 914) (median, 3534; range, 17-1393 800). The median sample suicide rate was 461 per 100 000 person-years, with a range of 0 to 6259 per 100 000 person-years. The interquartile range was 207 to 919 per 100 000 person-years.

The median duration of follow-up was 60 months (range, 1-432 months; interquartile range, 12-112 months). The earliest study⁶⁸ reported a sample with a midpoint in 1967, the median year of the samples was 1992, and the most recent study⁹⁹ reported suicides that occurred in 2014.

Twenty-seven samples were from Asian countries, 10 samples were from Australasia, 30 from mainland Europe, 40 from Nordic countries, 32 from North America, and 42 from the United Kingdom or Ireland. There was 1 sample each from Israel and Brazil.

Meta-analysis

The pooled rate of suicide after discharge was 484 per 100 000 person-years (95% CI, 422-555 per 100 000 person-years; prediction interval, 89-2641; $P < .001$, assuming a null hypothesis of 11.4 per 100 000 person-years) with very high between-sample heterogeneity ($n = 183$, $Q_{182} = 9768$, $P < .001$, $I^2 = 98\%$, $\tau^2 = 0.86$). The pooled suicide rate among 18 samples with a follow-up of 3 months or less was 1132 per 100 000 person-years (95% CI, 874-1467 per 100 000 person-years; $I^2 = 93\%$) and decreased thereafter in studies with follow-up of 3 to 12 months (654 [95% CI, 533-802]; 43 samples; $I^2 = 95\%$), 1 to 5 years (494 [95% CI, 354-688]; 44 samples; $I^2 = 96\%$), 5 to 10 years (366 [95% CI, 283-472]; 44 samples; $I^2 = 97\%$), and greater than 10 years (277 [95% CI, 218-352]; 34 samples; $I^2 = 97\%$). The duration of follow-up was significantly associated with between-group heterogeneity ($Q_4 = 73.1$; $P < .001$) (Figure 2).

More recently conducted studies had higher rates of suicide per 100 000 person-years than older studies (2005-2016: 672 [95% CI, 428-1055]; 27 samples; $I^2 = 98\%$; 1995 to 2004: 656 [95% CI, 518-831]; 51 samples; $I^2 = 99\%$; 1985 to 1994: 404 [95% CI, 322-508]; 46 samples; $I^2 = 98\%$; 1975 to 1984: 373 [95% CI, 279-498]; 47 samples; $I^2 = 96\%$; before 1975: 423 [95% CI, 316-567]; 12 samples; $I^2 = 75\%$). The period of sample collection was significantly associated with between-sample heterogeneity ($Q_4 = 14.7$; $P = .005$).

Difference in postdischarge suicide rates according to geographic region were not statistically significant ($Q_6 = 10.6$; $P = .10$) (Asia: 632 [95% CI, 434-921]; 27 samples; $I^2 = 95\%$; Australasia: 423 [95% CI, 164-1090]; 10 samples; $I^2 = 96\%$; Mainland Europe: 502 [95% CI, 375-672]; 30 samples; $I^2 = 96\%$; Nordic countries: 562 [95% CI, 430-735]; 40 samples; $I^2 = 97\%$; North America: 308 [95% CI, 220-430]; 32 samples; $I^2 = 94\%$; United Kingdom and Ireland: 513 [95% CI, 410-642]; 42 samples; $I^2 = 98\%$; other: 261 [95% CI, 7-9940]; 2 samples; $I^2 = 98\%$).

The suicide rate was lower among cohorts of adolescents (158 per 100 000 person-years) compared with samples of adults (555 per 100 000 person-years), patients from long-term or forensic discharge facilities (487 per 100 000 person-years), and older patients (496 per 100 000 person-years) (Table 1). Samples of persons discharged after an admission for suicidality (2078 per 100 000 person-years) had more than 4 times the suicide rate of other samples (452 per 100 000 person-years) (Table 1). Rates of suicide were lower among first-admission patients (305 per 100 000 person-years) (Table 1). Samples of patients with psychosis (599 per 100 000 person-years), affective disorder (524 per 100 000 person-years), and mixed and other diagnoses (463 per 100 000 person-years) had similar suicide rates ($P = .40$). There was no significant

Table 1. Main Results and Analyses of Subgroups

Variable	No. of Samples	No. of Suicides	Total No. of Person-years	Estimated Suicide Rate per 100 000 Person-years (95% CI)	I ² , %	Cochran Q	P Value
Effects		17 857	4 725 445		98	9768	<.001 ^a
Random	183			484 (422-555)			
Fixed	183			509 (502-517)			
Sex							
Female	50	3335	948 434	412 (318-534)	95	2.2	.34
Male	49	4024	810 071	533 (415-685)	96		
Mixed	84	10 498	2 966 941	503 (407-622)	99		
Age							
Adolescent	20	106	80 490	158 (112-225)	54	41.5	<.001
Adults and unspecified by age	129	17 221	4 506 808	555 (474-650)	99		
≥65 y	19	296	85 504	496 (353-695)	76		
Long-term or forensic discharge facility	15	95	21 819	487 (376-632)	21		
Diagnosis							
Affective disorder	18	3394	620 690	524 (370-742)	95	2.0	.40
Psychosis ^b	24	437	75 812	599 (430-834)	88		
Mixed and other	141	14 026	4 028 943	463 (393-545)	99		
Sample type							
Suicidal patients	9	45	2479	2078 (1512-2856)	16	75.0	<.001
Not selected on the basis of suicidality	174	17 812	4 722 966	452 (396-517)	98		
Postdischarge follow-up status							
First admission	23	3684	1 904 192	305 (193-481)	98	75.0	<.001
Mixed first and earlier admitted	160	14 173	2 821 253	517 (449-595)	97		
Reporting strength							
Lower ≤3	103	6836	2 827 162	448 (369-543)	96	1.3	.30
Higher ≥4	80	11 020	1 898 283	526 (433-639)	98		

^a Null hypothesis: effect is equal to 11.4 events per 100 000 person-years.

^b Includes one sample of patients with affective psychosis.

Table 2. Multiple Meta-regression Using Covariates Associated With Between-Sample Heterogeneity in Postdischarge Suicide Rates^a

Covariate	Coefficient (SE) [95% CI]	z Score	P Value
Midyear of sample	0.011 (0.005) [0.0007 to 0.020]	2.10	.04
Follow-up ≤12 mo	0.63 (0.12) [0.39 to 0.87]	5.15	<.001
Suicidal patients	1.46 (0.29) [0.89 to 2.02]	5.02	<.001
Adolescent	-0.86 (0.21) [-1.27 to -0.44]	-4.05	<.001
First admission	-0.10 (0.17) [-0.45 to 0.24]	-0.59	.56
Intercept	-26.40 (9.93) [-45.86 to -6.93]	-2.66	.008

^a n = 183, Q_s = 100.8, R² analog = 0.39.

difference in suicide rates according to sex (533 for males, 412 for females, and 503 for mixed per 100 000 person-years; $P = .34$) or total strength of reporting scores (488 for lower scores and 526 for higher scores per 100 000 person-years; $P = .30$) (Table 1).

Publication Bias, Meta-regression, and Multiple Meta-regression

The funnel plot was symmetrical and the Egger regression was not significant (intercept, -0.27 ; $t_{181} = -38$; $P = .70$), suggesting an absence of publication bias. Samples with longer durations of follow-up were more likely to report lower suicide rates (coefficient = -0.0049 ; 95% CI, -0.0064 to -0.0034 ; $z = -6.34$;

$P < .001$). Samples reporting suicides from more recent studies reported higher suicide rates than older studies (coefficient = 0.02 ; 95% CI, 0.008 - 0.031 ; $z = 3.40$; $P = .007$). The general population suicide rate was not associated with rates of suicide among discharged patients (coefficient = 0.0064 ; 95% CI, -0.019 to 0.032 ; $z = 0.49$; $P = .60$).

Five moderators that were associated with between-sample heterogeneity were included in a mixed-effects multiple meta-regression model (Table 2). More recent samples, samples with follow-up of a year or less, and samples of suicidal patients were independently associated with higher postdischarge suicide rates. Samples of adolescent patients were independently associated with lower rates.

This model accounted for 39% of the observed between-sample variance.

Discussion

This study synthesizes more than half a century of research into postdischarge suicide rates. We identified a large number of studies reporting more than 17 000 suicides in almost 5 million person-years at a pooled rate of 484 per 100 000 person-years. This figure is more than 3 times the suicide rate estimated in a comparable study¹¹⁴ of the suicide rate among inpatients and 44 times the global suicide rate of 11.4 per 100 000 patients per year in 2012.¹ The suicide rate of studies that followed up patients for no more than 3 months was 100 times the global suicide rate. Studies with follow-up periods of 3 to 12 months had almost 60 times the global suicide rates, and the suicide rate among discharged patients was more than 30 times that in the general population even for periods of follow-up of 5 to 10 years.

Nordentoft et al¹¹⁵ recently described the phenomenon of postdischarge suicide as a “nightmare and disgrace.”^{115(p 1)} We agree; however, they formed this view in the light of a recent study¹¹⁶ that found a rate of suicide of 178 per 100 000 patients per year during the first 3 months after discharge. Of note, our meta-analytic estimate during the same duration of follow-up is more than 6 times higher.

Our data suggest that the suicide rates among discharged patients have not decreased in the past 50 years. This is a disturbing finding considering the increase in community psychiatry and the availability of a range of new treatments during this period. The increase that we observed in postdischarge suicides can be seen in the context of the recent finding of a more extreme increase in the suicide rate among current inpatients from 68 per 100 000 person-years in the 1960s and 1970s to 646 per 100 000 person-years since 2000.¹¹⁴ An increase in the suicide rate of admitted and discharged patients might be attributable to multiple factors, including changing legal and other criteria for admission, shorter lengths of inpatient treatment, increased prevalence of substance use, and a greater acuity of illness among those admitted in the era of deinstitutionalization.¹¹⁴ Publication bias in favor of recent studies from regions with a higher suicide rate might have also contributed to the observed increase in suicide rates over time.

The marked variation in postdischarge suicide rates was not fully explained by the duration of follow-up or the year of the sample. Studies with similar periods of follow-up and studies conducted in the same or similar years have between-study heterogeneity that is similar to that of the whole sample.

Limitations

Our study has a number of limitations, most relating to the high between-sample heterogeneity. Although we were able to explain some heterogeneity by using moderator variables, further unexplained heterogeneity might be attributable to factors that were not reported in the primary research. Few of the included studies reported comparisons of those who committed suicide with those who survived, and information about

the psychiatric care that the patients received in hospital or after discharge was absent. For example, the included studies did not report on the extent of any association between readmission and suicide. The association between readmission and suicide might matter because we found that samples of first-admission patients had a lower postdischarge suicide rate than samples of patients with a mix of first-time and previous patients. This finding suggests that readmission might be an important suicide risk factor.

Other limitations relate to the representativeness of the included studies. Almost all the research came from high-income economies of Asia, Australasia, North America, and Europe, and our results might not be representative of postdischarge suicide in low- and middle-income countries. Even the pooled results that we obtained from our 6 regions were heterogeneous and should not be considered to be a generalizable benchmark for all psychiatric hospital settings in high-income countries.

Furthermore, factors that are associated with increased suicide risk at an aggregate level should be interpreted cautiously and are not necessarily applicable to individual patients. For example, we found that samples of older patients had a higher suicide rate than samples of adolescents, whereas a meta-analysis¹⁰ of risk factors for suicide after discharge found that older age was not associated with an increased suicide risk. Likewise, we found that samples of patients with affective disorders did not have a particularly high suicide rate, whereas the earlier meta-analysis¹⁰ found an association between suicide and depressive symptoms and disorders.

Finally, our study did not estimate the suicide rate in the days immediately after discharge. Some studies^{117,118} have suggested that the days immediately after discharge are the period of the highest suicide risk, but our methods yielded insufficient numbers of samples to robustly estimate suicide rates during periods of less than 3 months. It is likely that rates of suicide in the initial period after discharge are substantially higher than the rate we report during the 3 months.

Conclusions

It has been argued that a way of combatting postdischarge suicide is to focus on individual patients with clinical characteristics that signify a high suicide risk.^{119,120} However, the very high suicide rates calculated in this study and the known limitations of suicide risk assessment^{116,121} suggest that a focus on clinical risk assessment might mislead clinicians into thinking that some patients can be regarded as having low risk after discharge.¹¹⁵ Our findings better support the views of authors who believe in a more universal approach to suicide prevention that might focus on periods of high risk but that extends for periods of years.¹¹⁶ However, the findings should curb enthusiasm for restrictive interventions directed at patients labeled as having high risk of suicide by virtue of demographic or clinical variables. Our figures suggest that 0.28% of all discharged patients can be expected to commit suicide during the first 3 months after discharge. The modest statistical strength of suicide risk assessment means that even patients

who are classified as having high risk because of their suicide risk factors¹²² will have a low absolute probability of suicide over clinically meaningful time frames, whereas patients with a low risk for suicide will still have a probability of suicide that is many times that in the general community.

Discharged patients have suicide rates many times that in the general community. Efforts aimed at suicide preven-

tion should start while patients are in hospital, and the period shortly after discharge should be a time of increased clinical focus. However, our study also suggests that previously admitted patients, particularly those with prior suicidality, remain at a markedly elevated risk of suicide for years and should be a focus of efforts to decrease suicide in the community.

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Drafting of the manuscript: Chung, Ryan, Singh, Large.

Critical revision of the manuscript for important intellectual content: All authors.

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Administrative, technical, or material support: Large.

Study supervision: Stanton, Large.

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