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The Impact of Serious Mental Illness on the Risk of Re-hospitalization among Patients with Diabetes

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Abstract

Objective—Medical-surgical re-hospitalizations within a month after discharge among patients with diabetes result in tremendous costs to the US healthcare system. This study aims to examine if comorbid serious mental illness (SMI) diagnoses (bipolar disorder, schizophrenia, or other psychotic disorders) among patients with diabetes are independently associated with medical-surgical re-hospitalization within a month of discharge after an initial hospitalization.

Methods—This cohort study of all community hospitals in Washington State evaluated data from 82,060 adults discharged in the state of Washington with any ICD-9 CM diagnosis indicating diabetes mellitus between 2010 and 2011. Data on medical-surgical hospitalizations were obtained from the Washington State Comprehensive Hospital Abstract Reporting System. Comorbid SMI diagnoses were identified based on ICD-9 CM diagnosis codes indicating bipolar disorder, schizophrenia or other psychotic disorders. Logistic regression analyses identified factors

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Disclosure
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independently associated with re-hospitalization within a month of discharge. Cox Proportional Hazard analyses estimated time to re-hospitalization for the entire study period.

Results—After adjusting for demographics, medical comorbidity, and characteristics of the index hospitalization, comorbid SMI diagnosis was independently associated with increased odds of re-hospitalization within one month among patients with diabetes who had a medical-surgical hospitalization (Odds Ratio: 1.24, 95% Confidence Interval: 1.07, 1.44). This increased risk of re-hospitalization persisted throughout the study period (up to 24 months).

Conclusions—Comorbid SMI in patients with diabetes is independently associated with greater risk of early medical-surgical re-hospitalization. Future research is needed to define and specify targets for interventions at points of care transition for this vulnerable patient population.

Keywords

Serious Mental Illness; Re-Hospitalization; Diabetes

Background

Diabetes imposes a tremendous economic burden on the US healthcare system: 10% of healthcare dollars are spent on direct costs related to diabetes. The total estimated cost of diabetes was $174 billion in 2007, and the Centers for Disease Control and Prevention project that spending on diabetes care will reach $192 billion in 2020 (1, 2). About half of diabetes-related health care costs are due to potentially preventable complications (3). In the US, hospital admissions for long-term complications such as cardiovascular disease, stroke, and renal failure comprise the majority of diabetes-related expenditures. Patients with diabetes are also at increased risk for medical conditions that can lead to unplanned re-hospitalization, such as community-acquired pneumonia (4, 5).

Among Medicare beneficiaries, re-hospitalization within 30 days of discharge occurs in almost 20% of patients, costing the healthcare system an estimated $17.4 billion in 2004 (6). Up to one-fifth of unplanned re-hospitalizations may be preventable (7), so even a small reduction might reduce costs. Indeed, a key part of the comprehensive strategy of the Centers for Medicare and Medicaid Services to reduce costs is a focus on reducing 30-day hospital re-hospitalizations for heart failure, acute myocardial infarction, and pneumonia (8, 9). Unplanned re-hospitalizations may be a marker of poorer quality of inpatient care or ineffective hospital-to-home transitions (10-13). But not all re-hospitalizations reflect poor quality of inpatient care, especially among complex patients with multiple chronic conditions (14-17). Among patients with diabetes, increased re-hospitalization rates have been associated with demographic factors (older age, non-white race/ ethnicity, and rural residence), ineffective transition to outpatient care (e.g., no outpatient follow-up within 30-days of discharge) (18, 19), and a broad range of social factors, including lack of social support (20-21). However, there have been few studies examining the impact of psychiatric disorders on risk of medical-surgical re-hospitalization.

Among patients with diabetes, those with comorbid serious mental illness (SMI) (such as bipolar disorder, schizophrenia or other psychotic disorders) have higher rates of diabetes complications (22), higher rates of hospitalizations for an ambulatory care-sensitive

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condition (23), more diabetes-related hospitalizations (24), and increased diabetes-specific mortality (22, 23). Both health-risk behaviors (e.g., smoking, poor diet, and sedentary lifestyle) and pharmacotherapy for psychiatric illness contribute to these poor outcomes, as treatment with second generation antipsychotic medications has been associated with poorer glycemic control among patients with diabetes (25-26). Among Medicaid enrollees with diabetes, those with a psychiatric illness receive poorer quality of outpatient diabetes care, including less intensive pharmacotherapy for diabetes and other cardiovascular risk factors (27, 28). Patients with SMI also appear to under-utilize primary care (29), increasing their risk of potentially preventable medical hospitalizations. Furthermore, these patients may also be at heightened risk of in-hospital adverse events such as nosocomial infections and postoperative complications (30).

Prior research has shown that hospitalized patients with comorbid major depressive or bipolar disorder are at increased risk of subsequent medical hospitalization over a 5-year period (31). Depression has also been associated with increased odds of unplanned re-hospitalization within 30 days among patients 65 years and older (32). But only one study has evaluated comorbid SMI diagnoses as risk factors for medical-surgical re-hospitalization within 30 days among patients with diabetes. This study found no increased risk associated with the presence of these diagnoses (33), but did suggest an association among patients older than 45 which failed to reach statistical significance. This study was done at a single site and may have lacked statistical power since 30-day re-hospitalization is a relatively rare outcome.

The current study had two aims. First, we evaluated the independent association of SMI diagnoses with risk of medical-surgical re-hospitalization among patients with diabetes. We hypothesized that the presence of a SMI diagnosis would be associated with re-hospitalization within one month of discharge from the index hospitalization as well as with elevated risk for re-hospitalization during the entire study period (up to 24 months of follow-up). Second, we sought to identify patient-level characteristics and index hospitalization-related factors that were associated with greater risk of re-hospitalization among these patients.

Methods

Study Design

Data on hospitalizations were obtained from the Washington State Comprehensive Hospital Abstract Reporting System (CHARS) (31). The CHARS database contains abstracts on de-identified patients hospitalized in community hospitals in Washington State. The CHARS database contains abstracts on patients hospitalized in all civilian hospitals in the state; federal (Veterans Affairs and Military) hospitals and state psychiatric hospitals are excluded. A revisit file provided by the Washington State Department of Health allowed hospitalizations to be linked to de-identified patients. Since patients in the study were de-identified, the study was considered exempt from review by the Washington State University IRB.

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This observational cohort study was comprised of 82,060 adults ≥ 18 years of age in Washington state who had a medical-surgical hospitalization between 2010 and 2011 with any discharge diagnosis indicating diabetes mellitus (International Classification of Disease – 9th Edition (ICD9-CM) diagnosis 250). Index hospitalizations ending in death and hospital transfers were excluded so that only patients discharged to home, long-term care, or hospice were included. Hospitalizations for prenatal care (ICD9-CM primary diagnosis 760-779), labor and delivery or maternity care (ICD9-CM primary diagnosis 630-679), and those for a primary diagnosis of a psychiatric disorder (ICD9-CM primary diagnosis 290-319) were excluded. An additional 6,483 patients were excluded based on the presence of any diagnosis indicating major depressive disorder (ICD9-CM diagnosis 296.2 or 296.3), other depressive disorders (ICD9-CM diagnosis 311), anxiety disorders (ICD9-CM diagnosis 300.4), or dementia (ICD9-CM diagnosis 290). Patients were followed for 1-24 months after their index hospitalization for longitudinal analyses.

Variable Definitions

Serious mental illness—Patients with comorbid SMI diagnoses were identified based on diagnosis codes indicating bipolar disorder (ICD9-CM 296. [0,1,4,5,6,7,8]), schizophrenia (ICD9-CM 295), and the psychotic disorders delusional disorder (ICD9-CM 297) and non-organic psychoses (ICD0-CM 298), consistent with definitions from previous literature (34, 35). The reference cohort was defined as all other patients in the study.

***Demographic characteristics* were drawn from the index hospitalization—** Primary health insurance payer of record on the index hospitalization was used to classify patients as Medicare, Medicaid, Commercial/Health Maintenance Organization and Self-pay. Primary and secondary health insurance payer on the index hospitalization was used to classify patients as dual-enrolled Medicare and Medicaid.

Co-morbidity—Medical comorbidity was determined from a comprehensive set of 24 variables drawn from the index hospitalization and any hospitalizations within 12 months prior to the index hospitalization using the Elixhauser method (36), each coded as present or absent and entered into statistical models as independent variables. Elixhauser definitions have been associated with increased inpatient costs, length of stay and in-hospital mortality (36). The presence of a substance disorder diagnosis was determined from ICD9-CM diagnoses (291, 292, 303, 304) from the index hospitalization records.

Previous hospitalizations—In order to control for varying entry points in the course of disease, we obtained a count of medical-surgical hospitalizations during the 12 months prior to the index hospitalization.

Hospitalization characteristics—Admission to the hospital through the Emergency Department (ED) and primary diagnosis for both index hospitalization and re-hospitalizations were recorded.

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Statistical Analyses

The primary outcome of the study was pre-specified as subsequent re-hospitalization within the first month following index hospitalization discharge. Additional outcomes of interest were subsequent re-hospitalization during the duration of the study (up to 24 months) and the elapsed time from index hospitalization to re-hospitalization. For descriptive analyses, patients with comorbid SMI diagnoses were compared to patients without these diagnoses.

We used binary logistic regression models to estimate Odds Ratios (ORs) and 95% Confidence Intervals (95%CIs) for the potential association of comorbid SMI diagnoses and re-hospitalization in the next month. First, we tested the association of comorbid SMI diagnoses with re-hospitalization in the next month without adjustment. We then sequentially adjusted for potentially confounding variables in the following sequence: 1) index hospitalization substance disorder diagnosis; 2) age, gender, payer, number of hospitalizations in the 12 months prior to baseline, index hospitalization admission through the ED and length of stay; 3) medical co-morbidity (Elixhauser method), and 4) index hospitalization primary diagnoses. We fitted an additional logistic regression model testing the presence of effect modification between comorbid SMI and substance abuse diagnoses with respect to re-hospitalization within a month following the index medical-surgical hospitalization.

For analyses of time from index hospitalization to re-hospitalization, we used sequentially adjusted Cox Proportional-Hazard regression models to estimate Hazard Ratios (HRs) and 95%CIs.

A p-value <0.05 was required to define statistical significance for all analyses. SPSS Version 18.0 (IBM; Chicago, Ill) was used for all statistical analyses.

Results

Of the 82,060 adults with diabetes in Washington State who had a medical-surgical hospitalization between 2010 and 2011, 1,820 (2.2%) patients had a co-morbid SMI diagnosis, including, 29% with a diagnosis of schizophrenia (n= 531); 60% with diagnosis of bipolar disorder (n = 1090) and 11% with a diagnosis of another psychotic disorder (n = 203). Four patients had diagnoses of both schizophrenia and another psychotic disorder. Table 1 describes the demographic and clinical characteristics of the patients at the index hospitalizations, and shows differences between patients with diagnoses of SMI and the reference group. Hospitalized patients with diabetes and comorbid SMI diagnosis were younger (mean age: 55.8, standard deviation [SD]: 14.4) than patients without any SMI diagnosis (mean age: 65.4, SD: 14.8). The percentage of patients with Type 1 diabetes was higher among patients with a comorbid SMI diagnosis than among the reference group (5.4% compared to 4.3%). More patients with diabetes and a SMI diagnosis had a substance use disorder diagnosis and some form of public insurance. A greater proportion of patients with a SMI diagnosis had ≥ 1 hospitalization in the preceding 12 months (16.6% compared to 11.6%).

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A greater proportion of patients with a SMI diagnosis were admitted through the ED for the index medical hospitalization; and primary diagnosis for the index hospitalization also differed between the groups. Among patients in the reference group, 6.8% of the index hospitalizations were for a primary diagnosis of diabetes, which is consistent with 2008 national data rate of 6.7% (37). Among the patients in this study with SMI diagnoses, however, a greater proportion of index hospitalizations (11.2%, Table 1) were for diabetes or diabetes-related complications, particularly diabetic ketoacidosis).

Of all re-hospitalizations over the study period, 10,613 occurred within a month of the index hospitalization. Patients with a comorbid SMI diagnosis had higher rates of re-hospitalization within the first month of discharge after the index hospitalization (15.4% compared to 13.1%), and also during the entire study period (42.7% compared to 37.9%). In logistic regression analyses, the presence of a comorbid SMI diagnosis was associated with an increased odds of re-hospitalization within a month of discharge from the index hospitalization (OR: 1.22, 95%CI: 1.07, 1.38). After adjusting for demographics, insurance type, comorbid substance use disorder diagnosis, number of hospitalizations in the year pre-baseline, index admission through the ED, and index admission length of stay, a significant association remained between a SMI diagnosis and re-hospitalization within the next month (OR: 1.17, 95%CI: 1.01, 1.36). This association remained significant after adjusting for comorbidities using the Elixhauser method (OR: 1.22, 95%CI: 1.05, 1.42). In the fully adjusted logistic regression model, a SMI diagnosis was independently associated with medical-surgical re-hospitalization within the next month (OR: 1.24, 95%CI: 1.07, 1.44) (Table 2 and supplemental table 1). In subgroup analyses to evaluate the impact of each SMI diagnosis on 30-day re-hospitalization, all diagnoses were significantly associated with increased odds of re-hospitalization in unadjusted models. Bipolar disorder and other psychoses remained significant in the fully adjusted models. The presence of a substance use disorder diagnosis was also associated with re-hospitalization within the next month in the final logistic regression model (OR: 1.10, 95%CI: 1.03, 1.18), but there was no evidence of effect modification between comorbid SMI and substance use disorder diagnoses with respect to re-hospitalization within one month (Table 2). Older age, public insurance, medical hospitalization in the 12 months prior to the index hospitalization, and admission through the ED and length of stay of the index hospitalization were also independently associated with increased odds of re-hospitalization in the final fully-adjusted model (supplemental table 1).

We next evaluated the association between SMI diagnosis and increased risk of re-hospitalization throughout the entire study period. In unadjusted analyses, patients with a comorbid SMI diagnosis had a 15% greater risk of re-hospitalization for medical-surgical illnesses during the 24-month study period (HR: 1.15, 95%CI: 1.07, 1.24). In the fully adjusted proportional-hazards model (Figure 2, supplemental table 2), a comorbid SMI diagnosis was independently associated with a 14% greater risk of re-hospitalization for medical-surgical illnesses (HR: 1.14, 95%CI: 1.05, 1.23) (Supplemental Table 2). As in the analyses of the odds of re-hospitalization within a month after discharge, there was also an independent association between a substance use disorder diagnosis and risk of re-hospitalization (HR: 1.08, 95%CI: 1.04, 1.12)—but no evidence of effect modification

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between SMI and substance use disorder diagnoses and risk of re-hospitalization during the study period.

Table 3 displays the most common primary diagnoses for re-hospitalizations occurring within one month of the index hospitalization. Among patients with comorbid diabetes and SMI diagnoses, diabetes itself was the most common primary diagnosis leading to early re-hospitalization. In contrast, complications related to procedures during the index hospitalization were the most common primary diagnoses leading to early re-hospitalization among patients without SMI diagnoses.

Discussion

In this prospective cohort study of adult patients with diabetes who had a medical-surgical hospitalization in Washington State between 2010 and 2011, the presence of a co-morbid SMI diagnosis was independently associated with increased odds of medical re-hospitalization within one month. This group had an increased odds of early re-hospitalization despite being, on average, younger than those patients without SMI diagnoses; and the increased odds of re-hospitalization persisted even after adjustment for demographic factors, medical comorbidity, and co-occurring substance use disorder diagnoses. There was an increased prevalence of substance use disorder diagnoses among those patients with SMI diagnoses compared to patients in the reference group—and substance use disorder diagnoses were independently associated with risk of re-hospitalization. Consistent with previous studies examining risk factors for medical-surgical re-hospitalization in general, we found that older age and index hospitalization length of stay were independently associated with this outcome among patients with diabetes (32, 38). We also found that admission through the ED for the index hospitalization was associated with greater odds of early medical-surgical re-hospitalization, which may reflect the acuity of the medical illness leading to the index hospitalization—or the ineffective use of primary care by persons with SMI (27).

Subgroup analyses suggested that this finding was most robust among those patients with a diagnosis of bipolar disorder, as a diagnosis of schizophrenia was no longer significant in the final fully adjusted models. This finding may be explained by imprecision in the diagnostic coding of psychiatric disorders among medical-surgical inpatients. Alternatively, given the significantly increased odds of re-hospitalization among patients with a schizophrenia diagnosis in the unadjusted model, covariates which were included in the adjusted model (e.g., substance use disorders medical co-morbidity, or insurance status) may have had a greater impact on re-hospitalization in this subgroup.

Among patients with diabetes and comorbid SMI diagnoses, the most common primary diagnosis for both index hospitalization and re-hospitalization within a month of discharge was diabetes itself. By comparison, rates of admission for a diagnosis of diabetes among patients in the reference group were consistent with national data on admission diagnoses among patients with diabetes (37), suggesting that poorly-controlled diabetes may be driving excess hospitalizations among patients with a comorbid SMI diagnosis. This interpretation is further supported by the observed higher rates of hospitalization for diagnoses of

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ketoacidosis, hyperosmolar states, and neurologic complications among patients with SMI diagnoses. A previous study found no association between SMI diagnosis and risk of medical re-hospitalization among patients with diabetes (33), but suggested an association among patients older than 45 years (not statistically significant). The larger sample size and number of hospitals in the current study may help to explain differences in our findings. Moreover, the exclusion of patients with a depression diagnosis from the SMI cohort in the current study may highlight a unique vulnerability among patients with bipolar disorder or psychotic disorders.

Patients with SMI hospitalized for medical illnesses may face unique challenges at key healthcare transition points (e.g., from the hospital back to primary care) due to poorer overall quality of care as well as psychiatric symptoms and impaired cognition. Previous work has identified that break downs in care at such key transition points due to both patient and system-level factors may increase the risk of early re-hospitalizations (39). Furthermore, patients with SMI may be at heightened risk of social vulnerabilities which may increase the risk of early re-hospitalization, such as homelessness, poor health literacy and poverty (21). But interventions that have been shown to prevent early re-hospitalizations (13, 40) have not been studied in patients with SMI and comorbid medical illnesses. As this study suggests, subgroups of patients with diabetes and comorbid SMI (those dual-enrolled with Medicaid/Medicare and those with comorbid substance use disorder diagnoses) may be at particular risk of early re-hospitalization, and require specific intervention.

Our study has several potential limitations. The use of administrative data to identify patients with SMI diagnoses may have resulted in the misclassification of patients with SMI disorders and their inclusion in the reference group. But the prevalence rate for bipolar disorder in this sample (1.3%) is comparable to lifetime prevalence estimates in the US population of 1-3% (41), as is the rate of schizophrenia (0.8% in the sample compared to population rates of 0.3-0.8%) (42). Also, the use of administrative data did not allow for us to capture and adjust for poor health behaviors that may mediate the greater risk of early medical-surgical hospitalization such as smoking, sedentary lifestyle and poor diet in patients with SMI. Furthermore, while we were able to rigorously evaluate the burden of medical comorbidity using the Elixhauser method, we were unable to adjust for diabetes severity, as laboratory data was not available. Second, while we found a robust independent effect of comorbid SMI, we cannot attribute this increased risk to the psychiatric disorders per se. Our inability to access pharmacy data still leaves open the question of the extent to which this increased risk of re-hospitalization is due to treatment with specific second generation antipsychotic medications, as there appears to be heterogeneity across these medications with respect to the risk of diabetic ketoacidosis (43). Additionally, no information about the utilization of outpatient (primary care) services is included; thus, it is possible that decreased access to outpatient medical care significantly contributes to the increased risk of medical re-hospitalization among patients with SMI.

In conclusion, we found that a comorbid SMI diagnosis in patients with diabetes was independently associated with greater odds of early medical-surgical re-hospitalization, possibly indicating poor quality of medical care for these patients with diabetes who have comorbid SMI. Alternatively, our findings may be further evidence that patients with SMI

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interact with healthcare system differently and have unique barriers to adherence with medical care and follow-up. Improving the coordination or integration of outpatient medical and psychiatric care for these complex patients may decrease risk of early re-hospitalizations. Future research is needed to develop interventions addressing the unique challenges that patients with SMI face surrounding key care transition points to both reduce healthcare costs and prevent potential morbidity and mortality.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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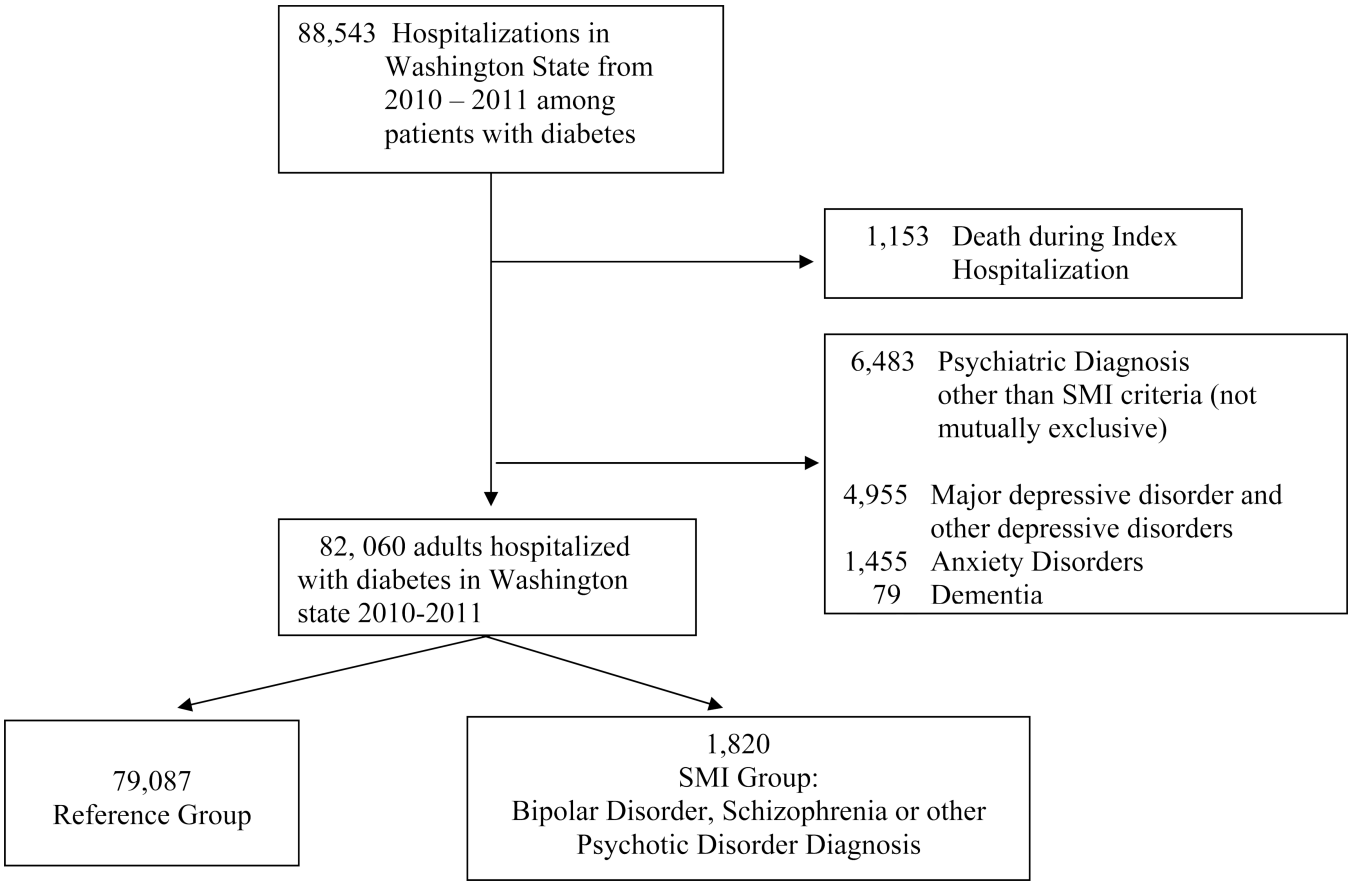

Figure 1.
Study Flow Diagram

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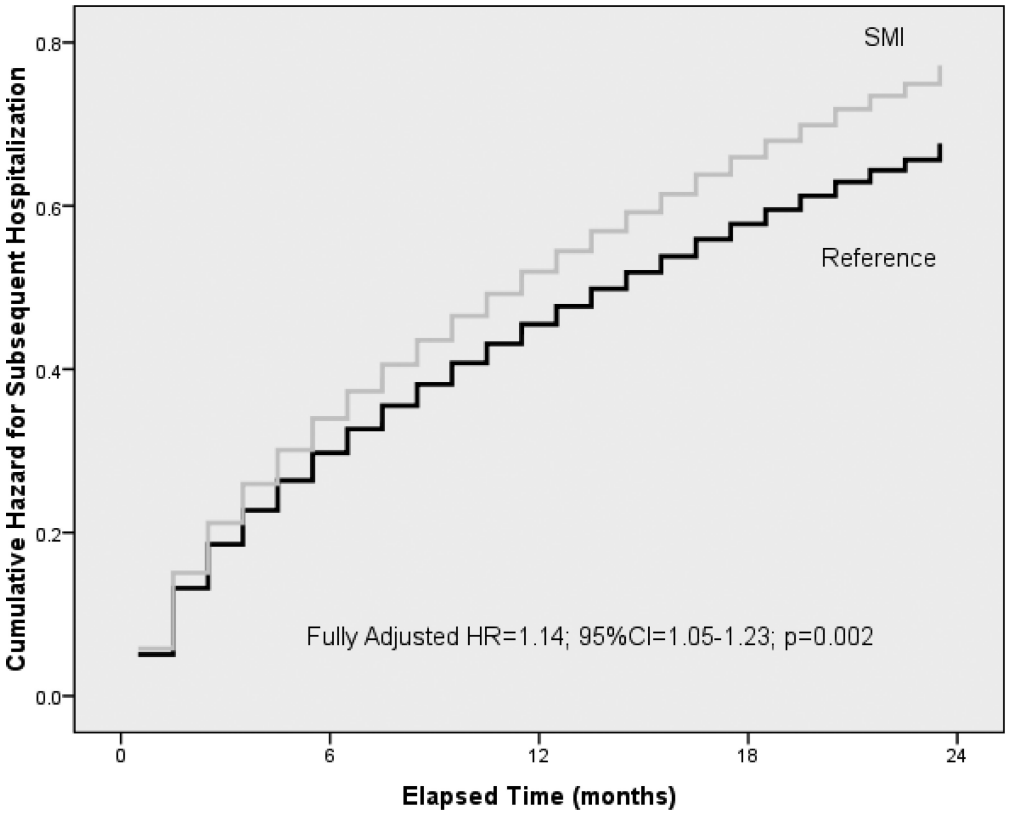

Figure 2.

Time to Re-Hospitalization using Cox Proportional Hazard Analysis for Patients with Diabetes Mellitus Discharged from Washington State Hospitals 2010-2011. (N=80,907)

Fully-adjusted model controlling for substance use disorder, interaction of substance use disorder and cohort, age, sex, race, payer, index admission through ED and length of stay, count of hospitalizations in the previous 12 months, Elixhauser medical comorbidities, and primary diagnosis for index hospitalization.

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Table 1

Characteristics of Patients with Diabetes Mellitus Discharged from Washington State Hospitals 2010-2011.

		Reference (n=79,087)		SMI[1] (n=1,820)	
Demographic Characteristics	**Values**	**n**	**%**	**n**	**%**
Gender	Male	40,364	51.0	722	39.7
	Female	38,723	49.0	1,098	60.3
Race[2]	White	23,802	86.1	495	84.0
	Black or African American	1,311	4.7	54	9.2
	American Indian or Alaska Native	511	1.8	9	1.5
	Asian	1,911	4.3	14	2.4
	Native Hawaiian/Pacific Islander	840	3.0	17	2.9
Primary payer	Medicare	33,774	42.7	494	27.1
	Medicaid	5,813	7.3	453	24.9
	Commercial/HMO	28,831	36.5	411	22.6
	Self-pay/Charitable Care	4,116	5.2	50	2.7
	Dual Medicare/Medicaid	6,552	8.3	412	22.6

	Mean	**SD**	**Mean**	**SD**
Age (years)	65.4	14.8	55.8	14.4

Comorbidity	**n**	**%**	**n**	**%**
Heart Failure	7,172	9.1	90	4.9
Renal Failure	12,216	15.4	153	8.4
Diabetes Complicated	14,473	18.3	246	13.5
Hypertension Complicated	10,712	13.5	138	7.6
Peripheral Vascular	4,104	5.2	38	2.1
Substance Use Disorder	8,620	10.9	407	22.4
1+ Previous 12 Month Hospitalizations	9,146	11.6	305	16.8

Characteristics of Index hospitalization	**ICD9-CM**	**n**	**%**	**n**	**%**
Primary Diagnosis					
Diabetes	250	5,412	6.8	203	11.2
Diabetes – Ketoacidosis	250.1	1,945	2.5	78	4.3
Diabetes – Hypoglycemia	250.8	1,295	1.6	33	1.8
Diabetes – Hyperosmolar and Neurologic	250.2; 250.3; 250.6	998	1.3	45	2.5
Diabetes – Uncomplicated	250.0	537	0.7	40	2.2
Ischemic Heart Disease	410-414	5,770	7.3	55	3.0
Cardiac Arrhythmias	427	2,400	3.0	28	1.5
Stroke	430-438	3,625	4.6	45	2.5
COPD	490-496	2,052	2.6	94	5.2
Sepsis	038	2,761	3.5	51	2.8
Pneumonia	480-486	2,747	3.5	72	4.0

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Characteristics of Index hospitalization	ICD9-CM	n	%	n	%
Congestive Heart Failure	428	2,894	3.7	20	1.1
Acute Kidney Injury	584	1,700	2.1	36	2.0
Poisoning	960-979	351	0.4	55	3.0
Procedural Complications	996-999	2,189	2.8	33	1.8
Injury	800-959	3,574	4.5	76	4.2
Admission Through ED		14,628	18.5	427	23.5

	Median	IQR[3]	Median	IQR[3]
Length of Stay	3	2-4	3	2-4

(N=80,907)

[1] SMI cohort includes patients with Diabetes Mellitus and co-occurring diagnosis for bipolar and psychoses disorders.

[2] Race indicated on subset of records. Rates based on cases in which race was indicated.

[3] IQR=Inter Quartile Range (25^{th}-75^{th} Percentile).

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Table 2

Re-hospitalization among Patients Hospitalized with Diabetes Mellitus in Washington State Hospitals 2010-2011. (N=80,907)

Cohort		Re- Hospitalization (next month)				
	N	n	%	OR[1]	95%CI	p
SMI[2]	1,820	281	15.4	1.24	1.07-1.44	0.006
Reference	79,087	10,332	13.1			
Numbers at Risk						
SMI	1,820	1,053	599	274	48	
Reference	79,087	46,291	27,832	13,170	2,344	

[1] OR=Fully Adjusted odds ratio computed by binary logistic regression for risk of re-hospitalization within the next month controlling for substance use disorder, interaction of substance use disorder and cohort, age, sex, race, payer, index admission through ED and length of stay, count of hospitalizations in the previous 12 months, Elixhauser medical comorbidities, and primary diagnosis for index hospitalization.

[2] SMI cohort includes patients with Diabetes Mellitus and diagnosis of bipolar disorder, schizophrenia or other psychotic disorders.

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Table 3

Primary Diagnosis for Re-hospitalization within the Next Month after Discharge from Index Hospitalization in Washington State 2010-2011.

Reference Cohort (10,332 Hospitalizations)				**SMI Cohort (281 Hospitalizations)**			
Primary Diagnosis	**ICD9-CM**	**n**	**%**	**Primary Diagnosis**	**ICD9-CM**	**n**	**%**
Procedural Complications	996-999	859	8.3	Diabetes Mellitus	250	22	7.8
Heart Failure	428	638	6.2	Procedural Complications	996-999	21	7.5
Ischemic Heart Disease	410-414	586	5.7	Sepsis	038	20	7.1
Diabetes Mellitus	250	514	5.0	Acute Kidney Failure	584	13	4.6
Sepsis	038	505	4.9	Chronic Pulmonary Disorders	490-496	11	3.9

SMI Cohort	0.21	0.08	1.24	1.07-1.44	0.006
Cohort*Substance Abuse	0.06	0.16	1.07	0.78-1.46	0.70
Substance Abuse	0.10	0.04	1.10	10.3-1.18	0.008
Age	0.01	0.001	1.01	1.01-1.01	<0.001
Gender Female	−0.03	0.02	0.97	0.93-1.01	0.15
Race Caucasian[1]	−0.09	0.03	0.91	0.87-0.96	<0.001
Race African American[1]	−0.04	0.09	0.97	0.82-1.14	0.68
Race American Indian[1]	−0.06	0.14	0.94	0.71-1.25	0.68
Race Asian[1]	−0.44	0.11	0.64	0.52-0.79	<0.001
Race Pacific Islander[1]	0.27	0.10	1.31	1.08-1.58	0.005
Race Mixed and Other[1]	0.12	0.77	1.13	0.25-5.05	0.88
Medicare and Medicaid	0.18	0.02	1.19	1.34-1.25	<0.001
Previous 12 Month Hospitalization	0.24	0.01	2.27	1.24-1.30	<0.001
Admission through ED	0.08	0.03	1.08	1.02-1.15	0.005
Length of Stay	0.04	0.003	1.04	1.04-1.05	<0.001
Comorbid Aids	−0.19	0.41	0.83	0.37-1.85	0.65
Comorbid Anemia Deficiency	0.09	0.03	1.10	1.03-1.17	0.002
Comorbid Rheumatoid Arthritis	0.16	0.07	1.17	1.02-1.34	0.03
Comorbid Blood Loss Anemia	0.18	0.09	1.20	1.00-1.43	0.05
Comorbid Congestive Heart Failure	0.24	0.03	1.27	1.18-1.35	<0.001