



## Research article

## Predictors of behavioral health unit readmission within 30 days of discharge: A retrospective study

Jaylene Everett<sup>a</sup>, Kaitlyn Druyor<sup>a</sup>, Claire Krasinski<sup>a</sup>, Marwah Obaid<sup>a,\*</sup>, Yueling Li<sup>a,b</sup><sup>a</sup> Lake Erie College of Osteopathic Medicine (LECOM), United States<sup>b</sup> Millcreek Community Hospital, Psychiatry Department, United States

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## ABSTRACT

Several studies have aimed to describe associated demographic and psychiatric risk factors that would lead to readmission to a behavioral health unit within 30 days of discharge. Here we considered 1,095 patients that were discharged from Millcreek Community Hospital (MCH) in Erie, Pennsylvania between June 2018 and June 2019. We extracted electronic medical data and analyzed various risk factors using a SPSS software and performed Chi square analysis to determine significance. We determined that patients between the age 30–39 that were diagnosed with major depressive disorder or bipolar disorder, and patients that had 12 or more previous behavioral health admissions were significantly more likely to be readmitted within 30 days of discharge. By analyzing risk factors that lead to a higher percentage of readmission rates, physicians can be more readily equipped and prepared while treating inpatient psychiatric patients. These physicians can take more precautionary measures when discharging patients with specific characteristic profiles to prevent the risk of being readmitted within 30 days of discharge.

## 1. Introduction

Frequency of emergency department (ED) visits continues to rise abroad [1] and nationally [2, 3, 4]. In the United States, 137.8 million visits occurred in 2014, a 14.8% increase since 2006 [4]. Growing costs [5], crowding [1, 6], length of inpatient stays [3], wait times, and premature exits [2], accompany this change and pressure EDs' as America's safety net of healthcare.

Subsequent revisits leading to early readmission can be an unfortunate consequence and amplifier of the above, as well as a burden to the individual and loved ones. Adult ED visits within 30 days of release commonly occur, representing 39.8% of hospital-based acute care post-discharge and the highest rate of utilization among psychiatric patients [7] of all ages and incomes [8]. The two most presenting psychiatric illnesses of 2012, mood disorders and schizophrenia/psychoses, were readmitted more often for principal or secondary diagnosis, 12.6% and 18.6%, respectively, than non-psychiatric conditions at 8.7% [9]. Likewise, child/adolescent psychiatric patients versus standard pediatric patients had readmission rates of 8.0% and 6.2%, respectively [10]. Intensifying such concerns are the prevalence and price tag of potentially preventable readmissions (PPRs). Schmidt *et al.* (2018) [11] identified

9.8% of 1.5 million ED visits and 33.6% of 1 million hospitalizations as psychiatric PPRs in California. Moreover, psychiatric PPRs cost NYS Medicaid more than \$200 million total, averaging over \$13,500 per patient [12]. Collectively, these statistics highlight the obligation to reduce and prevent ED revisits and readmissions overall but especially among vulnerable populations like the mentally ill.

One of the approaches implemented to better understand the rise in psychiatric ED revisits and readmissions is the investigation of predictive or risk factors. Previous hospital encounter(s) remains the most studied and supported predictor to date [13, 14, 15, 16, 17]. Strong evidence also exists for poor functioning/severity, diagnosis of schizophrenia, self-injury/suicide attempts, and financial/economic variables (namely homelessness and public insurance) [15, 17, 18].

Most risk factors for psychiatric revisit/readmission, however, remain mixed or ill-defined due to many reasons. Heterogeneity of different studies from various regions and populations, such as in research subjects (children vs. adults vs. mixed ages, specific psychiatric diagnosis vs. nonspecific) and locations (large metropolitan vs. multistate vs. town/rural), plays the greatest role in discrepancies of readmission rate. Regarding race/ethnicity, Ortiz (2019) [19] discovered Caucasian and non-Hispanic positively correlated with readmission, Lorine *et al.* (2015)

\* Corresponding author.

E-mail address: [yuelingli718@gmail.com](mailto:yuelingli718@gmail.com) (M. Obaid).

[14] found no relationship, and Feng *et al.* (2017) [10] cited potential health disparities for African Americans and Hispanics. In another example, Leon *et al.* (2015) [20] detected no association between hospital characteristics and readmission, while Phillips *et al.* (2020) [21] documented the negative impact of low numbers of total beds and Medicaid discharges. Age, gender, medications, legal mishaps, outpatient referrals/follow-ups, and case management have yielded unclear associations at present as well [15, 17, 18]. Predictors such as BMI [22] and post-traumatic stress disorder (PTSD) primary diagnosis [23], on the other hand, have been shown as significant positive influencers but minimally studied. The inability to precisely define factors may stem from inconsistencies across literature studies. Differences amongst readmission time frames ( $\leq 30$  days vs. 30+ days) also create difficulty in generalizing findings and adjusting for all confounding variables. Nevertheless, communities belonging to regions with one significant behavioral health (BH) inpatient facility may benefit from results representative of their psychiatric population.

Due to inconclusive predictors and knowledge gaps, interest remains to further understand risk factors and improve outcomes at the individual and systematic levels. This study aims to describe predictors of ER revisit or readmission within 30 days post-discharge from the largest regional mental healthcare provider of Northwest Pennsylvania.

## 2. Methods

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The Lake Erie College of Osteopathic Medicine Institutional Review Board reviewed and approved this research and waived informed consent from all participants.

### 2.1. Background of Millcreek Community Hospital (MCH) psychiatric inpatient facility

Our study is a retrospective chart review of psychiatric patients discharged from Millcreek Community Hospital (MCH) in Erie, PA. This osteopathic acute care facility offers comprehensive inpatient, outpatient, and 24-hour emergency services. With 85 psychiatric inpatient beds, an adult partial hospitalization program, and 24-hour BH emergency care, MCH also represents the largest regional and the third biggest statewide provider of inpatient psychiatric care in Pennsylvania.

### 2.2. Participants

The MCH Institutional Review Board approved the study and waived informed consent. Using the MCH electronic medical record (EMR) database, we extracted information regarding patients discharged from MCH ( $n = 1,034$ ) between June 2018 and July 2019. Those having 2 or more separate admissions within 30 days were identified, and the below information was compared with patients only being admitted once during the above time frame or being admitted more than once with 2 admissions of more than 30 days apart. Exclusion criteria were as follows: 1. Age younger than 18 years, 2. Missing essential variables or hospital information, 3. Admitted for a primary medical condition, then transferred to behavioral health, and 4. Those who left the hospital against medical advice.

### 2.3. Procedures

Data were collected from the EMR at MCH, the largest regional inpatient psychiatric care center in Northwest Pennsylvania. Patients were selected based on admission date. For this study, we used 1,034 patients admitted to the BH unit between June 1, 2018 and June 30, 2019. Variables of interest were collected from the EMR for each patient and included demographics, chief complaint, medical and psychiatric histories, living situation/environment, number of past hospital visits

(both ER and BH), discharge disposition, and discharge diagnoses. These variables were compared to "behavioral health visit within 30 days of discharge," which represents an admission to the BH unit within 30 days of discharge from the BH unit. Analysis was majorly conducted with SPSS software. Occasionally, the word search function tool in Microsoft Excel was used to aid in quantifying large amounts of qualitative data such as that of the discharge diagnoses.

Given that the comparison variable of interest was a yes/no question, referring to if the patient was re-admitted or not, statistical analysis was generally limited to the Chi-square test of independence to compare 2 independent categorical groups. For the post-hoc analysis, exact  $p$  values and chi-square values were calculated for each adjusted residual value using SPSS, then compared to the corrected Bonferroni  $p$  value to determine significance. Regarding the psychiatric diagnoses, in order to prevent recounting of patients with more than one psychiatric diagnosis, we completed 8 separate chi-square tables to analyze the frequency and significance of these diseases individually.

## 3. Results

### 3.1. Readmission rates

In general, our study showed that 19.1%, or 197 out of 1,034 participants, were readmitted to the BH unit within 30 days of discharge.

### 3.2. Demographic trends

Demographically speaking, data were collected on patients' age, gender, marital status, and race to view the correlation between demographics and readmission rate within 30 days. The most frequently observed individuals were single, white males in their 30's. Regarding age, the most frequent age group that was readmitted was 30–39 years, where 24.9% of the patients were readmitted. Also, in terms of age, this study demonstrated a statistically significant negative association for the age group  $< 19$  years old and being readmitted within 30 days, while having a statistically significant positive association for 30–39 years and readmission. As shown in Table 1, the exact  $p$  values calculated for age  $< 19$  years old ( $p = 0.0024$ ) and age 30–39 years old ( $p = 0.0008$ ) were less than the Bonferroni corrected  $p$  value of 0.005, indicating a statistically significant result. In our study, males were more frequently (21.3%) readmitted within 30 days. The male gender demonstrated a positive association with readmission, whereas the female gender demonstrated a negative association with readmission, as shown by the adjusted residual values in Table 1. Although the Pearson chi-square asymptomatic 2-sided  $p$  value ( $p = 0.042$ ) appeared to be significant, it did not survive the Bonferroni corrected  $p$  value analysis ( $p = 0.0125$ ); therefore it was not considered a statistically significant result. Lastly, both marital status and race did not show a significant association with readmission within 30 days. Marital status and race both showed Pearson chi-square asymptomatic 2-sided  $p$  values that were not significant,  $p = 0.457$  and  $p = 0.908$  respectively; therefore residual analyses were not performed. Notably for race, Caucasians had the highest count in readmitted patients (152 patients); proportionally, Hispanic origin had the greatest frequency (25.9%, Table 1). Additionally, single patients had the largest count in readmitted patients (159 patients), whereas legally separated had the highest frequency of readmission (21.4%, Table 1).

### 3.3. Psychiatric diagnoses

Eight main psychiatric diagnoses were analyzed within the discharge diagnoses: bipolar disorder (type I and II), major depressive disorder, anxiety, schizophrenia, schizoaffective, PTSD, panic disorder, and borderline personality disorder. Each diagnosis was analyzed separately from one another, by using 8 separate chi-square tables, to avoid recounting patients.

**Table 1.** Demographic Features in relation to readmission to BH within 30 days of discharge.

Category	Number of patients	Number of patient + readmission in 30 days	Frequency of patients in category + readmission in 30 days	Pearson Chi-Square Asymptomatic Significance (2-sided)	Adjusted Residual Value (Z-Score)	Chi Square Value	Exact p value	Bonferroni p value
Age (years)								
				<0.001				0.005
<19	95	7	7.4%		-3.04	9.2416	0.0024	
20–29	315	49	15.6%		-1.90	3.610	0.0574	
30–39	337	84	24.9%		3.34	11.156	0.0008	
40–49	201	43	21.4%		0.94	0.8836	0.3472	
50+	86	14	16.3%		-0.68	0.4624	0.4965	
Gender								
				0.042				0.0125
Male	568	121	21.3%		2.035	4.1412	0.0419	
Female	466	76	16.3%		-2.035	4.1412	0.0419	
Marital Status								
				0.457				
Single	807	159	19.7%		-	-	-	-
Married	115	15	13.0%		-	-	-	-
Divorced	61	13	21.3%		-	-	-	-
Legally Separated	42	9	21.4%		-	-	-	-
Widow/ Widower	9	1	11.1%		-	-	-	-
Race								
				0.908				
Caucasian	820	152	18.5%		-	-	-	-
African American	160	33	20.6%		-	-	-	-
Hispanic Origin	27	7	25.9%		-	-	-	-
Native American	8	2	25.0%		-	-	-	-
Asian	6	1	16.7%		-	-	-	-
Other	13	2	15.4%		-	-	-	-
Prior # of BH Visits								
				<0.001				0.005
0-2 Visits	707	105	14.9%		-5.06	25.604	0.000	
3-5 Visits	165	41	24.8%		2.07	4.285	0.0385	
6-8 Visits	61	19	31.3%		2.48	6.150	0.131	
9-11 Visits	34	11	32.4%		2.01	4.040	0.0444	
12 + Visits	67	21	17.9%		2.65	7.023	0.008	

**Table 2.** Psychiatric diagnoses in relation to readmission to BH within 30 days of discharge.

Psychiatric Diagnosis	Number of cases	Number of cases + readmission in 30 days	Frequency of patients in category + readmission in 30 days	Pearson Chi-Square Asymptomatic Significance (2-sided)	Adjusted Residual Value (Z-Score)	Chi Square Value	Exact p value	Bonferroni p value
Bipolar Disorder	342	74	21.6%	0.137	-	-	-	-
Major Depressive Disorder	498	109	21.9%	0.025	2.24	5.0176	<b>0.0251</b>	0.05
Anxiety Disorder	173	32	18.5%	0.839	-	-	-	-
Schizophrenia	128	28	21.9%	0.385	-	-	-	-
Schizoaffective Disorder	141	33	23.4%	0.157	-	-	-	-
Post-Traumatic Stress Disorder (PTSD)	152	27	17.8%	0.661	-	-	-	-
Panic Disorder	21	6	28.9%	0.262	-	-	-	-
Borderline Personality Disorder	137	28	20.4%	0.657	-	-	-	-

Bold value signifies patients with major depressive disorder were significantly more frequent to be readmitted within 30 days after discharge compared to patients without major depressive disorder.

These discharge diagnoses revealed some interesting insight into understanding patient return trends. The only statistically significant finding we discovered was patients diagnosed with major depressive disorder being readmitted within 30 days of discharge. The Pearson chi-square asymptomatic 2-sided  $p$  value was 0.025, so further residual analysis was performed to yield an exact  $p$  value of 0.0251, passing the comparison to the Bonferroni corrected  $p$  value of 0.05 (Table 2). Patients with major depressive disorder were the second highest count of patients readmitted within 30 days (109 patients, Table 2), trailing just behind bipolar disorder which had 123 patients return within 30 days of readmission. Unfortunately, the Pearson chi-square asymptomatic 2-sided  $p$  values for bipolar disorder ( $p = 0.137$ ), anxiety disorder ( $p = 0.839$ ), schizophrenia ( $p = 0.385$ ), schizoaffective disorder ( $p = 0.157$ ), PTSD ( $p = 0.661$ ), panic disorder ( $p = 0.262$ ), and borderline personality disorder ( $p = 0.657$ ) did not show statistical significance in our study; therefore, residual analyses were not checked. Interestingly and proportionally speaking, panic disorder had the greatest frequency of readmission (28.9%) and the lowest count number (6 of 21 patients readmitted) when compared to group size. Diagnoses of schizophrenia and schizoaffective disorder, with readmission frequencies of 21.9% and 23.4% respectively, came next (Table 2).

### 3.4. Prior number of BH admissions

“Prior number of inpatient behavioral health visits” was the only remaining variable significantly associated with BH readmission in 30 days. The data were organized into the following groups: patients with 0–2 prior visits, 3–5 prior visits, 6–8 prior visits, 9–11 prior visits, and 12+ prior visits, for chi-square analysis. The group with the largest count for readmission within 30 days was the patients with 0–2 prior BH visits (105 patients readmitted, Table 1). We discovered 2 statistically significant findings in our analysis: patients with 0–2 prior BH visits showed a statistically significant negative correlation (exact  $p$  value of 0.000), while patients with 12+ prior BH visits showed a statistically significant positive correlation (exact  $p$  value of 0.008) when compared to the corrected Bonferroni  $p$  value of 0.005. Patients in the ranges of 3–5, 6–8, and 9–11 prior visits showed positive association with readmission; however, no values were statistically significant.

### 3.5. Comorbidities

Although not our primary statistical analysis, it is important to note comorbidities of the 8 psychiatric diagnoses analyzed and appreciate that they often occur with multiple diseases, especially with the 2 highest frequency diagnoses, bipolar I/II and MDD. Overall, 457 patients were diagnosed with 2 or more psychiatric diagnoses concurrently for a total frequency of 44%. In this study, 342 patients were diagnosed with Bipolar I or II disorder, and 188 of these cases had 2+ total psychiatric diagnoses (55.0%). This result was similarly documented by Krishan (2015) [24], in that other psychiatric disorders accompany bipolar disorder at rates greater than predicted by chance. In this study, 498 patients were diagnosed with MDD and 276 of these cases had 2+ total psychiatric diagnoses (55.4%). Shown by Kessler et al. (2018) [25], MDD is more commonly seen secondary to another psychiatric or medical illness, most frequently anxiety disorder. In our study, we had 111 patients diagnosed with both MDD and anxiety disorder simultaneously.

## 4. Discussion

### 4.1. Readmission rates

Some of our selected patient characteristics depicted a statistically significant relationship with readmission to the BH unit at MCH within 30 days of discharge. Knowledge of this information can be used to alert physicians of the possibility of readmission to the BH unit for patients with specific demographics and medical diagnoses. Our study's general

readmission rate after 30 days was similar to, but slightly higher than, those found in previous literature. For example, Lyons et al. (1997) [26] observed a 7.1% psychiatric-related readmission rate within 30 days of discharge, and Ortiz (2019) [19] discovered 8% of psychiatric discharges were readmitted within 30 days. A strong contributor to our elevated readmission rate in comparison to those previous studies is the increased prevalence and subsequent treatment of mental disorders over the years [27]. The benefit of our large sample size in addition to a moderate pool of patients being readmitted to the BH unit within 30 days is that we can extrapolate conclusions about all community-based hospitals with BH units resembling our own.

### 4.2. Demographic trends

The association between a patient's age and gender with readmission rate has previously been unclear [15, 17, 18], but Manu et al. (2014) [22] identified age as a significant predictor for psychiatric readmission. Our study further reinforced these findings and demonstrated that patients ages 30–39 may return to the BH unit within 30 days of discharge. The age group 30–39 had the highest count for both patients and patient's readmittance, and the bigger sample size could be related to its significance. On the contrary, it is important to note that the age group <19 years old is less likely to return. This could possibly be due to wavering medical compliance within this age group, in that they prefer to avoid follow-ups, or in contrast, they are able to manage their diagnosis sufficiently and thus did not need to return. It is important for physicians to gauge their patients' adherence to treatment and identify which category they would supposedly fall into if they are under 19 years old. Gender, marital status, and race did not demonstrate significant results in this study. However, acknowledgement of demographic trends in readmitted patients is still critical. It appears that single, white males returned more frequently to the BH unit within 30 days of discharge. This knowledge provides precautionary awareness to physicians regarding patients at high risk for readmission.

### 4.3. Psychiatric diagnoses

Major depressive disorder is extremely prevalent in the U.S., affecting up to 20.6% of Americans throughout their lifetime [28]. Previously, Burke et al. (2013) [29] discovered patients with a diagnosis of major depressive disorder were significantly more likely to be readmitted within 30 days, which our findings support. Additionally, Cook et al. (2020) [30] identified bipolar disorder and major depressive disorder as the second and third most common diagnosis risk factors, respectively, that led to readmission within 30 days of discharge, also supported by our data. Since studies show that major depressive disorder has risen 49.86% from 1990 to 2017 worldwide [31] and the prevalence of bipolar disorder has increased from a range of 0.4–1.6% to 5–7% [32], patients with these disorders are becoming more frequently encountered. Due to their readmission risk, physicians should proceed cautiously when discharging these patients.

In previous literature, schizophrenia and schizoaffective disorder have also been found to be major predictors of readmission after 30 days [14, 29, 30]. In the U.S., schizophrenia affects only a small niche of people, about 0.25%–0.64% [33] of the population. Patients discharged with a diagnosis of schizophrenia also comprised a limited number of our data; 12.4% of the patients were diagnosed with schizophrenia and 21.9% of these patients were readmitted within 30 days of discharge. Comparable percentages surfaced for schizoaffective disorder. Our data however, did not support previous literature in that we did not identify statistically significant results for readmission within 30 days. This may be partly due to the smaller prevalence of schizophrenia and schizoaffective disorder diagnoses, compared to bipolar and MDD in our study. Interestingly, the previous literature dove into the concept of prescribed anxiolytics and outpatient psychiatric medications and how that could

contribute to higher readmittance of schizophrenia and schizoaffective patients, an intriguing topic of future study.

Borderline personality disorder is iconic for impulsive behavior, extreme mood swings, and suicidal ideation which makes it easy to assume that many of these patients enter the BH unit. However, our study did not demonstrate the significance one would expect. Previous literature depicted significant results with patients being diagnosed with borderline personality disorder and readmitted within 30 days [24, 25]. However, these previous studies had a sample group comprising a greater percentage, ranging from 26.6-33%, of patients diagnosed with borderline personality disorder, in comparison to our own which only consisted of 20.4% of patients. The smaller percentage of patients diagnosed with borderline could account for the possible significance discrepancy.

Previous studies did not find a statistical significance between anxiety disorder and readmission rate within 30 days of discharge [19], which our data supported as well. Limited studies were found on sole PTSD or panic disorder psychiatric diagnoses, not contributed to a concurrent incident that had happened on their hospital stay (for example, panic disorder due to a surgical procedure that required hospitalization), so it was difficult to compare our non-statistically significant results to other studies.

#### 4.4. Prior number of BH admissions

A possible explanation for why 0–2 prior BH visits was statistically significant with a negative association, or decreased readmittance, could be that the initial visit was the first diagnostic/introductory encounter with the physician, and the patient was suggested to follow-up in 1 month, a common clinical practice, which would result outside the 30-day window studied. Our findings supported existing literature that discovered previous hospitalization as a significant predictor of readmission [14, 15], in that 12+ prior BH visits had a statistically significant positive association with readmission in 30 days. Possible reasoning for 12+ prior BH visits having a significant readmission rate could be due to medication changes or tracking a patient's response to treatment over-time. Both of these concepts are often observed in the clinical setting, and it is essential for physicians to recognize 12 prior BH visits in order to increase awareness of a possible early readmit when they reach this threshold.

#### 4.5. Comorbidities

In future studies, deeper data analyses and consideration of comorbid psychiatric diagnoses could provide further insight to physicians on improvement of management and treat patients with multiple diagnoses. This is important since different psychiatric diagnoses can present with a wide variety of symptoms, features, and pharmacological treatments, and physicians should address a patient from all aspects to optimize their care.

#### 4.6. Study implications

This study's results complemented previous literature and provided this information more power. Now the question is: given our awareness of the factors influencing readmission, how should the psychiatry specialty respond? The answer will vary by location and practice type, but generally, if a patient fits the "descriptors" discussed in this and other studies, approaches like attentive medication management, outpatient follow-up, ensuring a strong support system, and resource provision are essential. Future research should focus on identifying the best interventions for these patients to reduce the likelihood of readmission. Inpatient psychiatric treatment is critical for many patients with mental illness, but frequently repeated encounters create social, financial, psychological, and even physical burden on the patient and family. Patients caught in the cycle of endless readmissions to the BH unit need help, and this is the first step – early identification of those at risk.

## Declarations

### Author contribution statement

Claire Krasinski and Yueling Li: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Jaylene Everett and Kaitlyn Druyor: Analyzed and interpreted the data; Wrote the paper.

Marwah Obaid: Analyzed and interpreted the data.

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### Data availability statement

Data will be made available on request.

### Declaration of interests statement

The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

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