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Predictors of 30-day rehospitalization in a sample of hospitalized patients with Bipolar I disorder

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ABSTRACT

The transition from psychiatric hospitalization to home is marked by high clinical vulnerability, characterized by risk of symptom rebound, exposure to preexisting stressors, and challenges with outpatient treatment linkage. Rates of rehospitalization during this post-discharge period, particularly for those with bipolar disorder, are reported to be high. This study evaluated demographic and clinical predictors of early rehospitalization (within 30 days) in a sample of hospitalized adults with Bipolar I disorder (BD-I). A chart review was conducted for 215 patients with BD-I admitted to an academically-affiliated psychiatric hospital within one calendar year. A computer algorithm was used to extract relevant demographic, clinical, and treatment information. Univariate and multivariate logistic regression models were used to examine predictors of early rehospitalization. Overall, 12% of participants were readmitted within 30 days of discharge. Controlling for other clinical and demographic variables, patient functioning and pre-admission psychiatric polypharmacy, but not comorbid psychiatric diagnoses, predicted early readmission in patients with BD-I. Findings highlight the relative importance of considering low psychosocial functioning, and medication regimens containing multiple psychiatric medications, during hospitalizations. These features may indicate a subset of patients with BD-I who require more comprehensive discharge planning and support to transition to the community following a psychiatric hospitalization.

1. Introduction

Bipolar Disorder I (BD-I) is a chronic and disabling illness associated with substantive psychosocial impairment, medical comorbidities, and increased risk of death by suicide (Kleinman et al., 2003). Approximately 90% of patients with BD-I experience multiple affective episodes, and a large proportion (35–57%) relapse symptomatically within 1 year of recovery from a mood episode (Bromet et al., 2005; Gitlin et al., 1995). Even after episodes remit, residual symptoms persist and interfere with patients' quality of life (Paykel et al., 2006), highlighting the complexity of maintaining stability among patients with a BD-I diagnosis.

Perhaps due to these challenges, patients with BD-I are at increased risk of psychiatric hospitalization (Ruggero et al., 2007). Factors such as acute symptom onset or worsening, persistent functional impairment, risk of harm to self or others, or need for clinical monitoring upon introduction of a new treatment (e.g., electroconvulsive therapy), often precipitate hospitalizations in BD-I. Inpatient treatment stays are designed to be time-limited and focused on goals of crisis stabilization, resolution of immediate safety concerns, and, ultimately, transition back into the community for long-term treatment (Sharfstein, 2009). However, the transitional period following discharge is a time of high clinical vulnerability, characterized by risk of symptom rebound, exposure to preexisting stressors, insufficient response to acute treatment, and challenges with medication adherence and outpatient treatment linkage. Patients with BD-I are at heightened risk for hospital readmission, especially within the first several weeks of discharge (Ilgen et al., 2008), indicating that the hospital to community transition is a particularly challenging time for patients with BD-I.

Factors that predict early rehospitalization (i.e., within 30 days of discharge) among patients with BD-I are not well understood. This is a critical knowledge gap since rehospitalization in BD-I is associated with heightened risk for a number of deleterious outcomes including suicide, long-term disability, unemployment, and poor quality of life (Peters et al., 2016), concerns that may be compounded among patients with early readmission. Moreover, early rehospitalization is costly, and

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research from the Centers for Medicare & Medicaid Services (CMS) indicates that a large percentage of early rehospitalizations may be preventable (Jencks et al., 2009). In line with the CMS priority of reducing early readmissions (Jencks et al., 2009), identifying factors that predict early readmission in BD-I may inform efforts to reduce rehospitalizations and potentially improve outcomes in this important risk group. A previous study found that patients with BD-I and Bipolar II Disorder who were younger, had been hospitalized three or more times, and had a lower Global Assessment of Functioning score were more likely to be rehospitalized within 30 days (Hamilton et al., 2016).

Previous research has not examined whether additional clinically-relevant factors (e.g., comorbid psychiatric diagnosis, comorbid medical conditions, history of suicidal behavior, psychiatric polypharmacy) are associated with early rehospitalization; moreover, previous studies have not examined predictors of rehospitalization in patients with BD-I specifically, who may have specific clinical needs. Thus, the present study built on this prior research by examining a wider range of demographic and clinical predictors of early rehospitalization in a sample of hospitalized adults with BD-I, specifically.

2. Methods

2.1. Participants

A retrospective chart review was conducted for all patients with BD-I (n = 230) consecutively admitted to the inpatient or partial hospitalization programs at an academically-affiliated private psychiatric hospital Butler Hospital in Providence, RI over one calendar year (Weinstock et al., 2014). The current study analysis relied upon the subsample of patients (n = 215) with at least 30 days of follow-up data (i.e., analysis excluded the 15 participants with an index hospitalization discharge date in the final calendar month of data extraction, resulting in fewer than 30 days of post-hospitalization data). Study inclusion criteria required participants to be 18 years or older, and given a primary diagnosis of BD-I by the treating psychiatrist at both hospital admission and discharge (to improve reliability). Demographic and clinical characteristics of the sample are provided in Table 1. A Protected Health Information (PHI) waiver and approval to conduct the chart review were obtained from the hospital Institutional Review Board prior to study initiation.

Table 1
Demographic and clinical characteristics of the study sample (n = 215).

	n (%)	M (SD)	Range
Age		42.11 (12.74)	18–77
Gender (female)	127 (59)		
Civil status (married or partnered)	56 (26)		
Race (White)	205 (95)		
Ethnicity (Non-Hispanic)	198 (92)		
Insurance status (private)	127 (59)		
History of prior psychiatric hospitalization	173 (81)		
Index hospitalization (inpatient)	151 (70)		
Length of index hospitalization (days)		9.93 (8.01)	1–41
BD-I episode upon admission			
Depressed	79 (37)		
Manic	87 (40)		
Mixed	44 (21)		
Unspecified	5 (2)		
GAF at admission		46.38 (9.77)	15–65
Psychosis at admission	97 (45)		
History of suicide attempt	96 (45)		
Comorbid anxiety disorder at discharge	73 (34)		
Comorbid substance use disorder at discharge	86(40)		
Comorbid personality disorder at discharge	39 (18)		
Other psychiatric comorbidity at discharge	26 (12)		
Comorbid medical condition at discharge	146 (68)		
Psychiatric polypharmacy (≥3 medications) at admission	116 (54)		
30-day rehospitalization	25 (12)		
Time to 30-day rehospitalization (n = 25)		8.32 (6.81)	0–23

2.2. Procedure

A detailed description of study methods used to collect this dataset is provided elsewhere (Weinstock et al., 2014). In brief, relevant demographic and clinical information were extracted from the electronic health record (EHR) using standard form fields. A hospital administrator used a computer algorithm to extract the following data from the hospital admission record: patient age, sex, race, ethnicity, civil status, history of suicide attempt, history of prior psychiatric hospitalization, and type of index hospitalization (i.e., inpatient vs. partial). Psychiatric diagnoses at hospital admission and discharge were made by the admitting psychiatrist and unit attending psychiatrist, respectively. Corresponding DSM-IV-TR diagnostic codes were extracted from the admission record to establish the presence of a BD-I diagnosis, the presence of psychosis at hospital admission, and global assessment of functioning (GAF) at hospital admission. All remaining diagnostic data, including presence of BD-I diagnosis at hospital discharge, were extracted from the discharge report. Corresponding DSM-IV-TR and ICD diagnostic codes were quantified into the following variables: polarity of BD-I mood episode, presence of any comorbid anxiety disorder, alcohol and/or substance use disorder (SUD), or other axis I disorder, and presence of any comorbid medical condition. These variables are consistent with those examined in psychiatric readmission studies in broader samples (e.g., Hamilton et al., 2016; Ilgen et al., 2008)

Medications prescribed immediately prior to hospital admission were extracted from each patient's medication reconciliation form within the EHR. This form was typically completed by the admitting physician in collaboration with the patient, but at times involved additional input from the hospital pharmacist and/or other reports (e.g., a patient's family member, community pharmacist). Medication data were coded by a trained research assistant, using a code book developed by study investigators. Psychiatric polypharmacy at the time of hospital admission was defined as taking 3 or more psychotropic medications (Mojtabai and Olfson, 2010). All categorical variables were dummy coded (0 = no, 1 = yes).

2.3. Data analysis

Univariate logistic regression analyses were used to examine predictors of early rehospitalization (coded as 0 = no, 1 = yes) in the BD-I sample. Potentially relevant clinical predictors that emerged in univariate analyses ($p < 0.10$) were then entered simultaneously in a multivariate logistic regression analysis to examine the relative contribution of each variable after controlling for others in the model.

3. Results

3.1. Sample characteristics

Demographic and clinical characteristics of the sample are provided in Table 1. Participants were predominantly women, Caucasian, non-Hispanic, and single. At the index hospitalization, the majority of participants were admitted during a manic or depressed episode, and nearly half exhibited comorbid psychotic symptoms. Most participants had been hospitalized previously; a total of 25 participants (12% of the sample) were rehospitalized within 30 days of discharge, and they were rehospitalized on average within approximately a week of discharge.

3.2. Characteristics associated with early rehospitalization

Characteristics associated with early rehospitalization in BD-I in univariate logistic regression models are presented in Table 2. Lower GAF scores ($R^2 = 0.07, p < 0.01$) and higher pre-admission psychiatric

Table 2
Univariate and multivariate models predicting 30-day rehospitalization.

Univariate associations between demographic and clinical characteristics and 30-day rehospitalization	*B* (SE)	X^2	OR	*P*	95% CI
Age	0.00 (0.02)	0.02	1.00	0.90	0.97–1.04
Gender (female)	0.03 (0.43)	0.01	1.03	0.99	0.44–2.42
Civil status (married or partnered)	−0.16 (0.25)	0.40	0.85	0.53	0.52–1.40
Race (White)	0.23 (1.10)	0.04	1.26	0.84	0.15–10.89
Insurance status (private)	0.38 (0.45)	0.72	1.47	0.72	0.60–3.57
History of prior psychiatric hospitalization	0.27 (0.58)	0.22	1.31	0.22	0.43–4.05
Length of index hospitalization (days)	0.03 (0.02)	2.31	1.03	0.13	0.99–1.08
Episode polarity (depressed vs. manic/mixed)	0.73 (0.49)	2.17	2.06	0.14	0.79–5.41
GAF at admission	**−0.06 (0.02)**	**7.32**	**0.95**	**0.01**	**0.91–0.99**
Psychosis at admission	0.63 (0.43)	2.13	1.88	0.15	0.80–4.41
History of suicide attempt	0.00 (0.47)	0.00	1.00	1.00	0.39–2.52
Comorbid anxiety disorder at discharge	0.30 (0.44)	0.46	1.34	0.50	0.57–3.16
Comorbid substance use disorder at discharge	0.37 (0.43)	0.75	1.45	0.39	0.63–3.34
Comorbid personality disorder at discharge	−0.17 (0.58)	0.09	0.84	0.77	0.27–2.61
Other psychiatric comorbidity at discharge	−0.51 (0.77)	0.44	0.60	0.51	0.13–2.71
Comorbid medical condition at discharge	0.01 (0.46)	0.00	1.01	0.99	0.41–2.46
Psychiatric polypharmacy (≥3 medications) at admission	1.37 (0.52)	**6.88**	**3.92**	**0.01**	**1.41–10.87**
Multivariate associations between demographic and clinical characteristics and 30-day rehospitalization	*B (SE)*	X^2	OR	*p*	95% CI
GAF at admission	−0.06 (0.02)	7.66	0.94	0.01	0.90 – 0.98
Psychiatric polypharmacy (≥3 medications) at admission	1.42 (0.53)	7.09	4.13	0.01	1.45 – 11.73

Note. ns ranged from 210 to 215 in univariate analyses. $n = 214$ in the multivariate analysis.

polypharmacy ($R^2 = 0.07, p < 0.01$) were associated with risk for early rehospitalization. In the multivariate logistic regression model, these variables explained 14% of the variance in rehospitalization ($p < 0.001$; medium effect size), correctly classifying 88.3% of cases.

4. Discussion

Reducing the high rate of early psychiatric rehospitalizations in the United States is an objective that has potential to improve patient outcomes and reduce healthcare costs (Jencks et al., 2009). To inform such efforts, this study examined rates and clinical predictors of early rehospitalization in recently hospitalized patients with BD-I. Approximately 12% of participants were rehospitalized within 30 days of discharge, rates comparable to those observed among patients with bipolar disorders (Hamilton et al., 2016) and patients with other serious mental illnesses (e.g., schizophrenia-spectrum disorders; Reeves et al., under review). Although a number of clinical and demographic factors were examined, only patient functioning and complex pre-admission polypharmacy predicted early rehospitalization in this sample. These results have important implications for understanding and reducing early readmissions among patients with BD-I.

Our analyses indicated that greater functional impairment at intake (indicated by lower GAF scores) predicted early psychiatric readmission, a finding that is consistent with prior research in patients with bipolar disorders (Hamilton et al., 2016). On average, our sample demonstrated serious functional impairment across one or more domains (e.g., limited social support, difficulty maintaining employment), impairments that could negatively affect their ability to adhere to their discharge plans (e.g., outpatient treatment, medication adherence) and consistently attend treatment. Indeed, treatment nonadherence has been linked with increased risk of readmission (Hamilton et al., 2016) among patients with severe mental illness, although future research is needed to examine whether it contributes to early readmission in patients with BD-I. In the context of this broader literature, poor functioning at admission may indicate to inpatient clinical teams that certain patients with BD-I could benefit from the implementation of targeted care (e.g., more intensive services while inpatient) and referral (e.g., support for critical transitions in care; referral to intensive case management) strategies to improve the feasibility and sustainability of transitioning to the community.

Moreover, independent of functional impairment, pre-admission psychiatric polypharmacy regimens also predicted early rehospitalization. Notably, our sample was acutely symptomatic despite high rates of polypharmacy at admission (50% of the sample). Since polypharmacy has been linked with illness complexity (Goldberg et al., 2009), but not symptomatic or functional improvement in bipolar disorder (Huxley and Baldessarini, 2007), it may be an indicator of treatment resistance in BD-I. Alternatively, since more complex medication regimens have been linked with adverse side effects (and drug interactions), and treatment nonadherence (Kingsbury et al., 2001; especially in patients with BD-I, Fung et al., 2019), polypharmacy at admission may index nonconformity to treatment. Finally, polypharmacy may also be a proxy for the type of care the patient was receiving in the community (i.e., primary reliance on medications due to limited knowledge of or access to psychosocial interventions or intensive case management services), although additional research is needed to ascertain whether this may be the case. Nevertheless, augmenting medication with evidence-based psychosocial interventions for Bipolar Disorder (e.g., Cognitive Behavior Therapy; Family Focused Therapy) may aid in reducing rehospitalization rates and improving treatment adherence and global functioning (Geddes and Miklowitz, 2013) among patients with more severe BD-I. Future research is needed to examine whether such an approach would be useful in reducing rehospitalization in this patient group.

Comorbid psychiatric diagnoses and specific symptoms (e.g., psychosis; type of BD-I episode) were not associated with readmission. Although these results are preliminary given our small sample size, they suggest that factors beyond diagnosis and symptoms, such as patients' level of functioning, may be more important predictors of rehospitalization. Moreover, our results indicated that prior hospitalization did not predict early readmission, perhaps due to the high rate of prior hospitalization in our sample and in BD-I (Ruggero et al., 2007). Interestingly, hospitalization within the prior year has been found to predict early readmission among patients with BD-I taking antipsychotic medication (Kreys et al., 2013); it may be that more recent hospitalization indexes chronic instability and is thus a more clinically useful indicator of early rehospitalization risk. Moreover, multiple prior hospitalizations appear to have clinical utility in predicting early

readmission in bipolar disorders more broadly (Hamilton et al., 2016) and more heterogeneous psychiatric samples (Monnelly, 1997). However, recency and number of hospitalization data were not available to examine in our sample.

Results from this study should be interpreted in the context of study limitations. First, our data about patient rehospitalizations was limited to the records of a single psychiatric hospital; thus, it is possible that some patients may have been rehospitalized who were not captured in our dataset. Second, given the brief length of hospital stays, it is unlikely that a large proportion of patients in our sample were discontinued from multiple psychiatric medications prior to discharge. However, we did not have information about psychiatric medications at discharge, and it is possible that some medications were changed post-admission. Third, our information was obtained via EHR review, with psychiatric diagnoses assigned to the chart by attending psychiatrists. Future research using structured assessments may be useful in confirming the reliability of our findings. Fourth, we were unable to examine post-discharge factors that may have contributed to early rehospitalization (e.g., medication nonadherence, attendance of follow-up appointments), and this is an important direction for future research in this area. Fifth, due to the limitations of our dataset, we were unable to examine critical social factors (e.g., long-term disability, homelessness, employment status) that may contribute to early rehospitalization. Examining these factors in future research is an important next step to further our understanding of early rehospitalization in BD-I. Sixth, because this study was conducted at a single psychiatric hospital, the generalizability of these results may be limited to psychiatric hospital in our geographical region with similar patient populations.

Nevertheless, this study offers an important contribution to the literature. It is the first to examine clinical and demographic predictors of early readmission in a unique, hospitalized sample of patients with BD-I. Our results suggest that patient functioning and pre-admission psychiatric polypharmacy, but not comorbid diagnoses, are risk factors for early readmission in patients with BD-I. Future studies are needed to examine the extent to discharge planning and adherence may predict rehospitalization, and to examine whether enhanced treatment (e.g., psychosocial interventions) and follow-up efforts (e.g., intensive case management) may improve the hospital-community transition among patients with BD-I, especially those who are lower functioning or who may have treatment-resistant symptoms. Moreover, our findings suggest that the issue of polypharmacy should be carefully examined during outpatient and inpatient care. Prescribers need to ensure that this prescribing practice is indeed rational and that the costs outweigh the risks for individual patients given its association with early rehospitalization.

Contributors

Melanie Bozzay conceptualized the manuscript, managed the literature searches and wrote the first draft of the manuscript. Dr. Weinstock conducted the statistical analyses. Drs. Weinstock, Gaudiano, Arias, Epstein-Lubow, and Miller contributed to study conceptualization. All authors contributed to and have approved the final manuscript.

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Declaration of Competing Interest

The authors have no conflicts to disclose.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.112559.

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