Factors Associated With Multiple Psychiatric Readmissions for Youth With Mood Disorders

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Abstract

Objective: Inpatient psychiatric readmission rates are increasingly considered indicators of quality of care. This study builds upon prior research by examining patient-, hospital-, and community-level factors associated with single and multiple readmissions for youth.

Method: A retrospective cohort study was conducted using Medicaid claims data from four states supplemented with the American Hospital Association survey, the Area Resource File, and the National Survey of Mental Health Treatment Services. Multinomial logistic regression examined patient-, hospital-, and community-level factors that were associated with inpatient psychiatric readmission for 6,797 Medicaid-eligible youth with a primary diagnosis of mood disorder using a three-level nominal dependent variable coded as no readmission, one readmission, and two or more readmissions within 6 months after discharge.

Results: Six months after initial discharge, 941 youth (13.8%) were readmitted once and 471 (6.9%) were readmitted two or more times. The odds of single or multiple readmissions were significantly higher ($p < .05$) for youth classified as disabled or in foster care, those with multiple psychiatric comorbidities, medical comorbidity, and prior psychiatric hospitalization. Treatment in hospitals with high percentage of Medicaid discharges and a high number of beds was associated

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with lower odds of readmission. There was a significant interaction between length of stay and outpatient mental health follow-up within 7 days of discharge.

Conclusion: Patient- and hospital-level factors are associated with likelihood of both single and multiple youth inpatient psychiatric readmissions, suggesting potential risk markers for psychiatric readmission.

Keywords

psychiatric readmission; adolescent; Medicaid; mood disorders

Policymakers, payers, and hospitals are increasingly focused on reducing psychiatric readmissions for children and adolescents. Although readmission may be clinically necessary, it is generally viewed as a negative outcome because of associated costs and burdens placed on affected children and caregivers, and the implication that the original admission somehow failed to adequately assess, treat, or transition the patient to the next appropriate level of care. Recurrent hospitalization is disruptive to families, interferes with work and school, and is emotionally and physically distressing.[1] Readmissions, particularly those shortly after discharge, are often viewed as indicative of lower-quality care and are sometimes assumed to be a consequence of shortened hospital length of stay.[2-4] Readmission rates for psychiatrically hospitalized youth have increased since the onset of managed care, with recent studies indicating that 33% to 38% will be readmitted within 1 year of discharge[5-7] and 8% will be readmitted within 30 days of discharge.[8] Readmissions may also be attributed to inadequate continuity of care, poor follow-up, or other factors such as illness severity, symptom burden, and treatment nonadherence.[9-11] Regardless of perspective, there is a critical need for research that examines factors associated with readmission.

Previous studies have examined patient demographic, clinical, and treatment factors that predict future psychiatric readmission among children and adolescents, with inconsistent results. Findings regarding demographic characteristics such as age, sex, and race/ethnicity are contradictory, with some studies suggesting that younger youth[5,11] or older youth[7,12-14] are more likely to be readmitted, and other studies showing no effect.[6,15-17] Neither race/ethnicity nor sex has been found to consistently predict readmission.[5,6,12,14,17] Clinical factors that have been associated with readmission include a variety of specific psychiatric diagnoses (most commonly affective disorders, behavioral disorders, and/or psychosis), medical and developmental comorbidities, prior suicide attempts, and symptom severity.[5-8,10,12,14,17]

Treatment factors that have been examined include length of stay, service history (eg, prior hospitalizations, noncompliance with treatment), and aftercare. Prior hospitalizations and nonadherence with treatment are strong predictors of readmission.[7] Findings on length of stay are mixed, with some studies associating higher readmission rates with shorter lengths of stay,[18] others with longer lengths of stay,[7,14] and still others showing no such associations.[6,10,12,16] Studies examining the impact of aftercare are similarly contradictory, with some reporting that receipt of aftercare reduced the readmission rate,[15,17,19,20] others that aftercare increased the readmission rate,[7,21,22] and some reporting no observable effect.

[6,12] However, studies varied considerably in length of follow-up periods and in definitions of aftercare (eg, any aftercare within a specified time period such as 30 days versus specific types of aftercare), making it difficult to compare findings across studies.[20]

Although previous research has examined factors associated with psychiatric hospital readmission, no studies to our knowledge have examined factors associated with multiple readmissions in children and adolescents, and it is unclear whether the factors associated with a single readmission are similar or different from those associated with multiple readmissions. In adults, patient-level characteristics including a diagnosis of schizophrenia or psychosis, younger age at first admission, greater numbers of previous admissions, unemployment at index admission, noncompliance with medication and/or therapy, and drug and alcohol problems are associated with multiple readmissions.[9,23-25] Moreover, existing studies on psychiatric readmission have focused primarily on patient demographic and clinical characteristics rather than hospital characteristics (eg, being a teaching or safety net hospital) and community-level factors (eg, availability of mental health providers) despite research in other areas of medicine[26-28] demonstrating that hospital characteristics and regional factors influence readmission outcomes. It is conceivable, for example, that availability of outpatient mental health professionals in the community might have an impact on readmission risk. At present, however, little is known about the association between hospital characteristics and community-level factors and readmission.

The current study addresses this gap in the literature by combining multiple data sources to examine a wide range of factors potentially associated with single and multiple psychiatric readmissions in a large sample of mood-disordered, Medicaid-enrolled youth from four states. We focus on pediatric mood disorders because they are the predominant admission diagnosis for children and adolescents admitted to the psychiatric inpatient setting, particularly in community hospitals.[7] Based on prior research, it was hypothesized that patient-level factors related to illness severity and level of need such as disabled status, bipolar disorder diagnosis, psychiatric comorbidities, chronic medical illness, and prior hospitalizations would be significantly associated with risk of readmission. In addition, it was hypothesized that rates of readmission would be lower for youth who had timely follow-up care, and that readmission would be independently associated with patient-, hospital-, and community-level factors.

METHOD

Study Design and Data Sources

A retrospective longitudinal cohort design was used to examine associations between patient-, hospital-, and community level-factors and multiple readmissions. Data were drawn from three sources: Medicaid Analytic eXtract (Max data),[29] the American Hospital Association (AHA) annual survey,[30] and the Area Resource File (ARF).[31] Medicaid data obtained from the Centers for Medicare and Medicaid Services were the primary source of patient-level data, including demographic characteristics, diagnoses, dates of services, procedures, and providers.[29] The AHA annual survey provided information on hospital-level data, including organizational structure, facilities and services, and use.[30] The Medicaid national provider identifier on the hospital discharge claims was used to link the Medicaid

patient-level data with the hospital data. The 2010 ARF provided information on county-level data, including sociodemographic, economic, and health care system characteristics.[31] The 2012 National Survey of Mental Health Treatment Facilities was used to capture county-level outpatient mental health facilities.[32] County of residence was used to link the Medicaid patient-level data with community-level data. All study procedures were approved by The Ohio State University Institutional Review Board.

Study Population

We identified youth (aged 6–17 years) from four states (California, Florida, Maryland, and Ohio) who were admitted to psychiatric hospitals with a primary diagnosis of mood disorder (*International Classification of Diseases, Ninth Revision* [*ICD-9*]–CM codes 296.xx and 311) between July 1, 2009, and June 30, 2010, and who were continuously enrolled in Medicaid for the 6-month period before the index hospitalization (N = 8,299). Because we were interested in examining the role of aftercare within 7 days, we excluded youth who were readmitted within 7 days of discharge (n = 282). Also excluded were youth with missing hospital (n = 1,213) and community-level (n = 7) data. The final analytic sample was 6,797 youth.

Outcome Variables

The dependent variable in this study is a three-level nominal variable coded as follows: (1) no readmissions; (2) one readmission; and (3) two or more readmissions within the 6-month period after discharge. Readmissions were defined as a repeat psychiatric hospitalization (ie, primary *ICD-9*-CM code 290–319) to any hospital. A 6-month timeframe was chosen because most readmissions occur within 6 months of discharge, and this timeframe allows for multiple readmissions.

Predictor Variables

Patient-level factors included age at hospital discharge (6–11 years versus 12–17 years), sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other), Medicaid-eligibility category (poverty, disability, and foster care), length of stay (1–7 vs. 8 or more days), and primary diagnosis (depressive disorder, bipolar disorder, and other mood disorder). The following variables were abstracted from Medicaid claims from the 6 months before the index hospitalization: presence or absence of prior outpatient mental health visits and recent psychiatric hospitalizations, substance use disorders (*ICD-9*-CM codes 291–292 and 303–305), chronic medical conditions, and number of psychiatric comorbidities (zero, one, and two or more). For medical comorbidities, youth were classified as having a chronic medical condition if they had two or more claims during the pretreatment period for any of the 12 diagnoses commonly used in previous studies.[33] These included diabetes, seizures, asthma, sickle cell anemia, cerebral palsy, congenital heart disease, cancer, major organ disease, congenital anomaly, HIV, autoimmune disease, and immunocompromised disease. Youth were identified as having a psychiatric comorbidity if they had two or more claims for a psychiatric disorder (*ICD-9*-CM codes 290–319). In addition, the presence of an outpatient follow-up visit for mental health within 7 days of hospital discharge was defined as any Medicaid-reimbursed behavioral health visit with a primary mental health diagnosis (*ICD-9*-CM codes 290–319), including visits for psychotherapy or pharmacotherapy, partial

hospitalization, rehabilitation, and other community-based services such as case management. This variable was based on the Health Plan Employer Data and Information Set quality of care guidelines for follow-up after psychiatric hospitalization.

Hospital-level factors included the total number of beds (low, <200; medium, 200–399; and high, 400), ownership (public, private not for profit, and private for profit), percentage of the total annual discharges involving patients enrolled in Medicaid (low, 0%–18.9%; medium, 19%–25.9%; and high, 26%), medical resident teaching status (teaching and nonteaching), and type of hospital (general and psychiatric).

Community-level factors included health care resources, such as the number of providers per 100,000 youth (child psychiatrists [low, 0.0–6.9 and high, 7.0], psychologists [low, 0.0–84.9 and high, 85.0], and social workers [low, <650 and high, 650]); the number of community health centers (eg, rural health clinics and federally qualified health centers [low, 0–6 and high, 7]); the number of outpatient mental health facilities that served youth (low, 0–6 and high, 7); availability of a psychiatric hospital; and the area of residence (metropolitan and nonmetropolitan).

Statistical Analysis

First, bivariate analyses (Pearson χ^2 tests) were conducted to compare the number of readmissions within 6 months (no readmissions, one readmission, two or more readmissions) on patient-level, hospital-level, and community-level factors. To control for Type I error rate due to multiple comparisons, the p values were adjusted using the Holm method.[34] Second, multinomial random-effects logistic regression models were used to examine the associations between patient-, hospital-, and community-level factors and one or multiple readmissions. We included state indicators to control unobserved state level characteristics and policies that could be associated with readmission. Random-effects logistic regression is the appropriate analysis for multilevel data because it takes into account the nesting of individuals within hospitals and counties and generates unbiased estimates as well as correct standard errors. The model-building process included several stages with variables entered into the model in blocks. First, the block of patient-level factors was entered into the model, followed by the addition of the block of hospital-level factors, and finally the addition of the block of community-level factors. The likelihood ratio test was used to compare the nested models and to determine whether the addition of each block significantly improved the overall model fit. We considered variables to be statistically significant at p .05 (two-tailed). All analyses were performed using SAS 9.4.[35]

RESULTS

Sample Description

Of the 6,797 youth in the study sample, 1,412 (20.8%) were readmitted at least once within 6 months of discharge, with 941 (13.8%) being readmitted only once and 471 (6.9%) experiencing multiple readmissions. Of those who were readmitted, 66.6% had only one readmission and 33.4% had two or more readmissions, with the mean number of readmissions 1.6 (SD = 1.04) and the median 1 (range = 1–13). The demographic and

clinical characteristics of the study sample are shown in Table 1. The mean $\pm$ SD age was 14.0 $\pm$2.5 years; 55.6% were female; 36.2% were non-Hispanic white, 23.7% were non-Hispanic black, 30.1% were Hispanic, and 10.0% were of other racial and ethnic backgrounds. About half were eligible for Medicaid through disability (23.5%) and foster care (22.3%). More than half were diagnosed with a depressive disorder (56.1%), predominantly major depression, 23.5% were diagnosed with bipolar disorder (12.5% had bipolar I or II, 11.0% had bipolar not otherwise specified [NOS]), and 20.4% were diagnosed with other mood disorders. In addition, more than half of the individuals in the sample were diagnosed with two or more comorbid psychiatric disorders (53.0%), and about one-fifth had a chronic medical condition (19.3%). The three most common comorbid psychiatric diagnoses were disruptive behavior (33.5%), attention-deficit/hyperactivity disorder (ADHD) (27.0%), and anxiety (23.5%). Less than 2% of subjects had been diagnosed with a substance use disorder.

Bivariate Analysis

Table 2 presents the bivariate comparisons of the patient-, hospital-, and community-level factors by no readmissions, one readmission, and multiple readmissions. All p values have been adjusted to control for Type I error. At the patient level, single and multiple readmissions were significantly more likely for youth categorized as disabled or in foster care; those diagnosed with bipolar disorder, two or more psychiatric comorbidities, or a chronic medical condition; and those with a history of inpatient or outpatient psychiatric treatment before the index hospitalization. Outpatient psychiatric follow-up within 7 days after discharge was also associated with one or multiple readmissions compared to no readmissions. At the hospital level, the likelihood of single and multiple hospital readmissions notably was significantly greater for youth treated in a for-profit hospital. Youth hospitalized in general hospitals rather than specialized psychiatric hospitals and nonteaching rather than teaching hospitals were significantly more likely to experience one or multiple psychiatric readmissions after discharge, as were youth hospitalized in smaller hospitals with fewer beds. At the community level, youth living in regions with a higher availability of mental health providers, health clinics, outpatient mental health care, and psychiatric hospitals had a higher likelihood of experiencing one and multiple readmissions.

Multivariate Analysis

Tables 3 to 5 present the estimated odds ratios for the multinomial random-effects logistic regression model, along with the significance levels based on the estimated regression coefficients for each predictor variable. The referent category for the three-level dependent variable is no readmissions within 6 months. Three multinomial logistic regression models were estimated. Model 1 included patient-level factors; Model 2 added hospital-level factors; and Model 3 added community-level factors. The three models were compared using the likelihood ratio test to determine whether the addition of predictor variables improved the overall model fit. In Model 1, patient-level factors were significantly associated with readmissions [χ^2 (df = 36) = 751.96, $p < .001$]. In Model 2, the addition of hospital-level variables significantly improved the fit of the model over the model with patient-level factors only [χ^2 (df = 16) = 35.16, $p = .004$]. In Model 3, the addition of community-level factors

and state also improved the overall fit of the model [χ^2 (df = 20) = 64.40, $p < .001$]. Results for the final model are described below.

Patient-Level Factors

The odds of single and multiple readmissions were significantly higher for youth who were eligible for Medicaid through disability and foster care (Table 3). Single and multiple psychiatric hospital readmissions were also significantly more likely to occur for youth with comorbid psychiatric disorders, a chronic medical condition, or a history of prior psychiatric hospitalization. In contrast, youth who had received outpatient mental health services prior to index hospitalization were less likely to be psychiatrically readmitted.

The relationship between inpatient length of stay and psychiatric readmission appears to be complex. Overall, longer hospital lengths of stay (8 or more days) were significantly more likely to be associated with subsequent psychiatric readmissions than shorter lengths of stay, but there was a significant interaction observed between length of stay and outpatient mental health follow-up within 7 days of discharge. Among individuals with shorter lengths of stay, defined as 1 to 7 days, the odds of one or multiple readmissions were significantly higher for those seen in outpatient mental health follow-up within 7 days of discharge compared to those who did not receive timely outpatient follow-up. For youth with longer lengths of index hospital stay, timeliness of outpatient follow-up did not significantly influence the likelihood of psychiatric hospital readmission, but timely aftercare did appear to attenuate the risk of readmission in such individuals.

Hospital- and Community-Level Factors

Youth treated in hospitals with a high number of beds had a significantly lower odds of being readmitted multiple times during the 6-month follow-up period (Table 4). Patients treated in a hospital with a medium or high percentage of Medicaid patients had lower odds of a single readmission, but not multiple readmissions. None of the community-level variables were significantly associated with single or multiple readmissions (Table 5).

DISCUSSION

The purpose of this study was to examine patient-, hospital-, and community-level factors associated with multiple inpatient psychiatric readmissions for youth with mood disorders. This multistate study of readmission for 6,797 publicly insured, mood disordered, and psychiatrically hospitalized youth documented multiple psychiatric readmissions within 6 months of initial hospital discharge in 6.9% of study subjects, a single readmission in 13.8%, and at least one readmission in 20.7%. This result is consistent with previous studies of pediatric readmission within 6 months of inpatient psychiatric discharge, which have reported rates between 12.1% and 28%.[20,36] The observed 6.9% rate of multiple pediatric readmissions was slightly lower than a prior study documenting a multiple readmission rate of 10% in an adult population in Finland.[37] Psychiatric hospital readmission can certainly be clinically appropriate, but readmissions are costly and can be painful and disruptive experiences for patients and families, as well as representative of failures in the content and process of clinical care. Consequently, reducing the likelihood of psychiatric hospital

readmission appears to be a worthy aspiration for mental health care providers and policymakers.

Notably, factors associated with the risk of multiple psychiatric hospital readmissions for youth with mood disorders were almost uniformly the same as those associated with single hospital readmission. As hypothesized, several patient-level factors were found to be significantly associated with both single and multiple readmission rates, including psychiatric comorbidity, the presence of a chronic medical condition, and prior psychiatric hospitalizations. These findings may be reflective of illness severity, and are consistent with those of several prior studies among children and adults.[7,8,24,37-39] The presence of one or multiple psychiatric comorbidities was associated with an increased likelihood of single and multiple readmissions more than other factors evaluated, with the odds of multiple readmissions nearly five times higher for youth with one comorbid psychiatric disorder and 20 times higher for youth with multiple psychiatric comorbidities. Yompolskaya *et al.* reported a similar finding among children who received inpatient mental health treatment in Florida.[40] Although the diagnosis of bipolar disorder was associated with a heightened chance of readmission on bivariate analysis, multivariate analysis failed to support this association. Documentation of a substance abuse diagnosis was relatively infrequent in our sample and was associated with single but not multiple readmissions, a finding differing from two previous studies showing an association between substance abuse and frequent readmission.[41,42] Medicaid eligibility through disability and foster care was associated with higher odds of single and multiple readmissions, likely related to greater illness burden. Higher levels of mental health service use have been reported previously in adults receiving disability pensions,[41] and foster children are well known to experience high rates of exposure to maltreatment, developmental delays, and mental disorders.[43]

A patient-level factor associated with a lower likelihood of single and multiple readmissions was the receipt of prior outpatient psychiatric care. Although it is difficult to draw firm conclusions about the nature of this association, other studies have noted that outpatient psychiatric care prior to hospitalization is associated with timely outpatient aftercare.[44] Continuity of care with a known and familiar provider might be comforting in the wake of psychiatric hospitalization, and youth without established treatment relationships may face more barriers to timely care after discharge relative to youth with pre-existing outpatient treatment relationships.

Patient-level factors that have been inconsistently associated with psychiatric hospital readmission rates include length of hospital stay and receipt of mental health outpatient follow-up or aftercare. Both shorter and longer hospital lengths of stay have been associated with greater and lesser likelihoods of readmission,[15,37,40] and findings regarding receipt of aftercare have been similarly inconsistent.[7,15,17,19-21,24] This puzzling state of affairs encouraged us to explore possible interactions between these two variables. In our study, youth hospitalized for 8 or more days were significantly more likely to be readmitted overall than youth hospitalized for shorter periods, but analysis of the interaction between length of stay and timely aftercare suggests a complex relationship. Notably, youth with shorter lengths of hospital stay were significantly more likely to be readmitted when they received timely aftercare, which was not the case for youth with longer lengths of stay. In contrast,

timely aftercare appeared to attenuate the likelihood of readmission for youth with longer hospital lengths of stay relative to those with shorter hospital stays.

Although this study is unable to offer a definitive explanation for how length of stay and timely aftercare might influence readmission rates, complex interactions such as these are likely underpinnings of the variability noted in studies attempting to relate hospital length of stay and readmission rates. Hospital readmission is multi-determined, with potential drivers including overall illness severity, inadequate or insufficient inpatient treatment, poor discharge planning, and lack of continuity of care. It would not be unreasonable to speculate that the association of longer length of stay with higher rates of readmission may reflect longer length of stay being a proxy for greater severity of illness. In comparison to shorter lengths of stay, longer hospital stays can provide motivated treatment teams more time to arrive at an effective management strategy and better plan for discharge independent of illness severity. Conversely, albeit potentially advantageous in terms of cost and moving patients to a less restrictive level of care, shorter hospital stays can be more challenging in terms of getting to know the patient and family, understanding the presenting problem, arriving at the correct diagnostic formulation, developing an effective treatment strategy, and ensuring continuity of care postdischarge. In this study, timely outpatient follow-up posthospitalization did not increase the likelihood of readmission for youth with longer lengths of stay but was associated with an increased likelihood of readmission for those hospitalized for shorter periods of time. One important function of outpatient follow-up is to identify individuals who may be in danger and in need of a more intensive level of care, highlighting how hospital readmission is not a uniformly negative outcome.

In addition to patient-level factors, several hospital-level factors were significantly associated with lower readmission rates. Treatment in a hospital with a high percentage of Medicaid enrollees among their annual discharges and treatment in a hospital with a high volume of beds was associated with lower odds of readmission. The lower odds of readmission among hospitals with higher penetration of Medicaid enrollees may be related to their experience with this population and location in regions with better infrastructure accessible to the Medicaid population. Furthermore, hospitals that have a higher percentage of Medicaid enrollees might have more established connections to community resources and better tailored clinical approaches compared to hospitals with a smaller percentage of Medicaid enrollees. Hospitals with a high number of beds are typically located in urban areas where services are readily available, which may result in more successful linkage to community resources. Staff at these hospitals may also experience less pressure to discharge patients quickly, given greater bed availability.

This study has several possible limitations. First, the observational nature of this study makes it impossible to draw causal inferences about the relationship between psychiatric hospital readmission and associated patient-, hospital-, and community-level factors. Second, the cohort was limited to Medicaid-enrolled children and adolescents from four states. Thus, our findings may not be generalizable to other state Medicaid programs and privately insured or uninsured populations. Third, given that study data were from 2010, it is possible that readmission patterns may have since changed, although there is little reason to expect that observed associations would necessarily differ. Fourth, because state hospitals do

not accept Medicaid reimbursement, we lacked information about readmissions to state hospitals. Fifth, the use of claims data prevents the analysis of important clinical and familial factors that have been consistently associated with the likelihood of readmission, such as a history of child sexual abuse and parent–child relations.[6,11] Sixth, data regarding diagnoses were derived from claims and clinical judgment rather than standardized assessments. Finally, nonresponse in the AHA survey and missing community data resulted in an exclusion of 14.7% of the cohort, creating a potential selection bias. Study limitations aside, study design strengths include the use of multiple data sources to simultaneously examine a wide range of factors at the patient, hospital, and community level and the use of Medicaid data to create a diverse cohort of youth from four states.

From the clinical perspective, this study identifies patient-, hospital-, and community-level factors associated with psychiatric readmission for psychiatrically hospitalized mood-disordered youth. Although not definitely causal, better understanding of factors associated with readmission may contribute to the design and implementation of relevant interventions, as psychiatric readmission rates are likely responsive to quality improvement efforts.[45] Using a predictive tool based on risk factors for psychiatric readmission, Ramsbottom and Farmer identified candidates for a nursing care management intervention that decreased readmission by 29.5% in its first year and an additional 7.8% in year 2 and 5.1% in year 3.[46] A Canadian study also validated a clinical risk index that predicted individual risk of psychiatric readmission within 30 days of discharge.[47]

A validated and practical predictive model combined with corresponding process changes has potential to decrease the revolving door phenomenon that some psychiatrically hospitalized youth experience. Such efforts could not only decrease the burden of mental illness for youth and families, but could also improve service efficiency and decrease mental health care costs.[38,48]

REFERENCES

1. Nakamura MM, Toomey SL, Zaslavsky AM, et al. Measuring pediatric hospital readmission rates to drive quality improvement. Acad Pediatr. 2014;14(5 Suppl):S39–S46. [PubMed: 25169456]

2. Appleby L, Desai PN, Luchins DJ, Gibbons RD, Hedeker DR. Length of stay and recidivism in schizophrenia: a study of public psychiatric hospital patients. Am J Psychiatry. 1993;150:72–76. [PubMed: 8417584]

3. Geller JL. In again, out again: preliminary evaluation of a state hospital's worst recidivists. Hosp Community Psychiatry. 1986;37:386–390. [PubMed: 2870978]

4. Lien L Are readmission rates influenced by how psychiatric services are organized? Nord J Psychiatry. 2002;56:23–28. [PubMed: 11869461]

5. Arnold EM, Goldston DB, Ruggiero A, Reboussin BA, Daniel SS, Hickman EA Rates and predictors of rehospitalization among formerly hospitalized adolescents. Psychiatr Serv. 2003;54:994–998. [PubMed: 12851436]

6. Blader JC. Symptom, family, and service predictors of children's psychiatric rehospitalization within one year of discharge. J Am Acad Child Adolesc Psychiatry. 2004;43:440–451. [PubMed: 15187804]

7. Fontanella CA. The influence of clinical, treatment, and healthcare system characteristics on psychiatric readmission of adolescents. Am J Orthopsychiatry. 2008;78:187–198. [PubMed: 18954182]

8. Feng JY, Toomey SL, Zaslavsky AM, Nakamura MM, Schuster MA. Readmission after pediatric mental health admissions. Pediatrics. 2017;140 pii: e20171571. [PubMed: 29101224]

9. Haywood TW, Kravitz HM, Grossman LS, Cavanaugh JL, Davis JM, Lewis DA. Predicting the "revolving door" phenomenon among patients with schizophrenic, schizo-affective, and affective disorders. Am J Psychiatry. 1995;152:856–861. [PubMed: 7755114]

10. Lyons JS, O'Mahoney MT, Miller SI, Neme J, Kabat J, Miller F. Predicting readmission to the psychiatric hospital in a managed care environment: implications for quality indicators. Am J Psychiatry. 1997;154:337–340. [PubMed: 9054780]

11. Bobier C, Warwick M. Factors associated with readmission to adolescent psychiatric care. Aust N Z J Psychiatry. 2005;39:600–606. [PubMed: 15996141]

12. Foster EM. Do aftercare services reduce inpatient psychiatric readmissions? Health Serv Res. 1999;34:715–736. [PubMed: 10445899]

13. Lapointe AR, Garcia C, Taubert AL, Sleet MG. Frequent use of psychiatric hospitalization for low-income, inner-city ethnic minority youth. Psychol Serv. 2010;7:162–176.

14. Pavkov TW, Goerge RM, Lee BJ. State hospital reentry among youth with serious emotional disturbance: a longitudinal analysis. J Child Family Stud. 1997;6:373–383.

15. James S, Charlemagne SJ, Gilman AB, et al. Post-discharge services and psychiatric rehospitalization among children and youth. Adm Policy Ment Health. 2010;37:433–445. [PubMed: 20063073]

16. Leon SC, Stoner AM, Dickson DA. Does the hospital predict readmission? A multi-level survival analysis approach. Adm Policy Ment Health. 2016;43:514–523. [PubMed: 25925793]

17. Romansky JB, Lyons JS, Lehner RK, West CM. Factors related to psychiatric hospital readmission among children and adolescents in state custody. Psychiatr Serv. 2003;54:356–362. [PubMed: 12610244]

18. Wickizer TM, Lessler D, Boyd-Wickizer J. Effects of health care cost-containment programs on patterns of care and readmissions among children and adolescents. Am J Public Health. 1999;89:1353–1358. [PubMed: 10474552]

19. Cheng C, Chan CWT, Gula CA, Parker MD. Effects of outpatient aftercare on psychiatric rehospitalization among children and emerging adults in Alberta, Canada. Psychiatr Serv. 2017;68:696–703. [PubMed: 28245702]

20. Trask EV, Fawley-King K, Garland AF, Aarons GA. Do aftercare mental health services reduce risk of psychiatric rehospitalization for children? Psychol Serv. 2016;13:127–132. [PubMed: 26147361]

21. Carlisle CE, Mamdani M, Schachar R, To T. Aftercare, emergency department visits, and readmission in adolescents. J Am Acad Child Adolesc Psychiatry. 2012;51:283–293. [PubMed: 22365464]

22. Gearing RE, Mian I, Sholonsky A, et al. Developing a risk-model of time to first-relapse for children and adolescents with a psychotic disorder. J Nerv Ment Dis. 2009;197:6–14. [PubMed: 19155804]

23. Schmutte T, Dunn C, Sledge W. Characteristics of inpatients with a history of recurrent psychiatric hospitalizations: a matched-control study. Psychiatr Serv. 2009;60:1683–1685. [PubMed: 19952162]

24. Silva NC, Bassani DG, Palazzo LS. A case-control study of factors associated with multiple psychiatric readmissions. Psychiatr Serv. 2009;60:786–791. [PubMed: 19487348]

25. Goodpastor WA, Hare BK. Factors associated with multiple readmissions to an urban public psychiatric hospital. Hosp Community Psychiatry. 1991;42:85–87. [PubMed: 2026414]

26. Auger KA, Teufel RJ, Harris JM, et al. Children's hospital characteristics and readmission metrics. Pediatrics. 2017;139 pii: e20161720. [PubMed: 28123044]

27. Horwitz LI, Bernheim SM, Ross JS, et al. Hospital characteristics associated with risk-standardized readmission rates. Med Care. 2017;55:528–534. [PubMed: 28319580]

28. Lee S, Rothbard AB, Noll EL. Length of inpatient stay of persons with serious mental illness: effects of hospital and regional characteristics. Psychiatr Serv. 2012;63:889–895. [PubMed: 22751995]

29. Wenzlow AT, Finkelstein D, Cook BL, et al. The Medicaid Analytic eXtract Chartbook. Baltimore: Centers for Medicare and Medicaid Services; 2010.

30. Annual Hospital Survey Data Base. Chicago: American Hospital Association; 2010.

31. Health Resources and Services Administration: Bureau of Health Professions, Area Resource File (ARF) System. Fairfax, VA: Quality Resource Systems, Inc; 2010.

32. National Survey of Mental Health Treatment Facilities. Rockville, MD: Center for Mental Health Services, Substance Abuse and Mental Health Services Administration; 2012.

33. Silber JH, Gleeson SP, Zhao H. The influence of chronic disease on resource utilization in common acute pediatric conditions. Financial concerns for children's hospitals. Arch Pediatr Adolesc Med. 1999;153:169–179. [PubMed: 9988247]

34. Sankoh AJ, Huque MF, Dubey SD. Some comments on frequently used multiple endpoint adjustment methods in clinical trials. Stat Med. 1997;16:2529–2542. [PubMed: 9403954]

35. SAS Institute Inc. SAS Software, Version 9.4 Cary, NC: SAS Institute Inc; 2014.

36. van Alphen NR, Stewart JG, Esposito EC, Pridgen B, Gold J, Auerbach RP. Predictors of rehospitalization for depressed adolescents admitted to acute psychiatric treatment. J Clin Psychiatry. 2017;78:592–598. [PubMed: 27529444]

37. Korkeila JA, Lehtinen V, Tuori T, Helenius H. Frequently hospitalised psychiatric patients: a study of predictive factors. Soc Psychiatry Psychiatr Epidemiol. 1998;33:528–534. [PubMed: 9803820]

38. Chung W, Edgar-Smith S, Palmer RB, Bartholomew E, Delambo D. Psychiatric rehospitalization of children and adolescents: implications for social work intervention. Child Adolesc Soc Work J. 2008;25:483–496.

39. Baeza FLC, da Rocha NS, de Fleck MP. Readmission in psychiatry inpatients within a year of discharge: the role of symptoms at discharge and post-discharge care in a Brazilian sample. Gen Hosp Psychiatry. 2018;51:63–70. [PubMed: 29324277]

40. Yampolskaya S, Mowery D, Dollard N. Predictors for readmission into children's inpatient mental health treatment. Community Ment Health J. 2013;49:781–786. [PubMed: 23314826]

41. Di Lorenzo R, Sagona M, Landi G, Martire L, Piemonte C, Del Giovane C. The revolving door phenomenon in an Italian acute psychiatric ward: a 5-year retrospective analysis of the potential risk factors. J Nerv Ment Dis. 2016;204:686–692. [PubMed: 27227558]

42. Kent S, Yellowlees P. Psychiatric and social reasons for frequent rehospitalization. Hosp Community Psychiatry. 1994;45:347–350. [PubMed: 8020919]

43. Oswald SH, Heil K, Goldbeck L. History of maltreatment and mental health problems in foster children: a review of the literature. J Pediatr Psychol. 2010;35:462–472. [PubMed: 20007747]

44. Fontanella CA, Hiance-Steelesmith DL, Bridge JA, et al. Factors associated with timely follow-up care after psychiatric hospitalization for youths with mood disorders. Psychiatr Serv. 2016;67:324–331. [PubMed: 26620293]

45. Molfenter T, Connor T, Ford JH, Hyatt J, Zimmerman D. Reducing psychiatric inpatient readmissions using an organizational change model. WMJ. 2016;115:122–128. [PubMed: 27443087]

46. Ramsbottom H, Farmer LC. Reducing pediatric psychiatric hospital readmissions and improving quality care through an innovative Readmission Risk Predictor Tool. J Child Adolesc Psychiatr Nurs. 2018;31:14–22. [PubMed: 29992678]

47. Vigod SN, Kurdyak PA, Seitz D, et al. READMIT: a clinical risk index to predict 30-day readmission after discharge from acute psychiatric units. J Psychiatr Res. 2015;61:205–213. [PubMed: 25537450]

48. de Oliveira C, Cheng J, Vigod S, Rehm J, Kurdyak P. Patients with high mental health costs incur over 30 percent more costs than other high-cost patients. Health Aff (Millwood). 2016;35:36–43. [PubMed: 26733699]

TABLE 1

Characteristics of Hospitalized Youth With Mood Disorders

	n	%
Total	6,797	
Age, y		
6–11	1,038	15.27
12–17	5,759	84.73
Sex		
Female	3,776	55.55
Male	3,021	44.45
Race/ethnicity		
Non-Hispanic white	2,461	36.21
Non-Hispanic black	1,610	23.69
Hispanic	2,046	30.10
Other[a]	680	10.00
Medicaid eligibility		
Poverty	3,686	54.23
Disability	1,594	23.45
Foster care	1,517	22.32
Primary diagnosis		
Depressive disorder	3,811	56.07
Bipolar disorder	1,599	23.53
Other mood disorder[b]	1,387	20.41
Length of stay		
Short (1–7 days)	4,981	73.28
Long (8 days)	1,816	26.72
Any substance use		
Present	129	1.90
Absent	6,668	98.10
Psychiatric comorbidity		
0	1,612	23.72
1	1,581	23.26
2	3,604	53.02
Any chronic medical condition[c]		
Present	1,313	19.32
Absent	5,484	80.68
Prior psychiatric hospitalization		
Present	742	10.92
Absent	6,055	89.08
Prior psychiatric outpatient visits		
Present	1,983	29.17

	n	%
Absent	4,814	70.83
Mental health outpatient follow-up in 7 days		
Present	3,519	51.77
Absent	3,278	48.23

Note:

[a]Includes Asian, Native American, and multiple race.

[b]Includes mood disorder not otherwise specified.

[c]Includes diabetes, seizures, asthma, sickle cell anemia, cerebral palsy, congenital health disease, cancer, major organ disease, congenital anomaly, HIV, autoimmune disease, and immunocompromised disease.

TABLE 2

Patient, Hospital, and Community Factors by Readmission Status

	No Readmissions		One Readmission		Two or More Readmissions		Statistics		
	n	%	n	%	n	%	χ^2	df	p [a]
Patient-level factors									
Age, y							0.38	2	1.00
6–11	816	15.15	150	15.94	72	15.29			
12–17	4,569	84.85	791	84.06	399	84.71			
Sex							0.35	2	1.00
Female	2,982	55.38	528	56.11	266	56.48			
Male	2,403	44.62	413	43.89	205	43.52			
Race/ethnicity							12.27	6	.17
Non-Hispanic white	1,924	35.73	348	36.98	189	40.13			
Non-Hispanic black	1,263	23.45	233	24.76	114	24.20			
Hispanic	1,669	30.99	262	27.84	115	24.42			
Other [b]	529	9.82	98	10.41	53	11.25			
Medicaid eligibility							187.68	4	<.001
Poverty	3,131	58.14	405	43.04	150	31.85			
Disability	1,187	22.04	265	28.16	142	30.15			
Foster care	1,067	19.81	271	28.80	179	38.00			
Primary diagnosis							63.05	4	<.001
Depressive disorder	3,117	57.88	464	49.31	230	48.83			
Bipolar disorder	1,157	21.49	287	30.50	155	32.91			
Other mood disorder [c]	1,111	20.63	190	20.19	86	18.26			
Length of stay							114.34	2	<.001
Short (1–7 days)	4,101	76.16	604	64.19	276	58.60			
Long (8 days)	1,284	23.84	337	35.81	195	41.40			
Any substance use							6.81	2	.13
Present	93	1.73	28	2.98	8	1.70			

	No Readmissions		One Readmission		Two or More Readmissions		Statistics		
	n	%	n	%	n	%	χ²	df	p^a
Absent	5,292	98.27	913	97.02	463	98.30	429.23	4	<.001
Psychiatric comorbidity									
0	1,505	27.95	92	9.78	15	3.18			
1	1,343	24.94	187	19.87	51	10.83			
2	2,537	47.11	662	70.35	405	85.99			
Any chronic medical condition^d							49.88	2	<.001
Present	947	17.59	243	25.82	123	26.11			
Absent	4,438	82.41	698	74.18	348	73.89			
Prior psychiatric hospitalization							184.48	2	<.001
Present	452	8.39	172	18.28	118	25.05			
Absent	4,933	91.61	769	81.72	353	75.95			
Prior psychiatric outpatient visits							101.20	2	<.001
Present	3,663	68.02	754	80.13	397	84.29			
Absent	1,722	31.98	187	19.87	74	15.71			
Mental health outpatient follow-up in 7 days							104.30	2	<.001
Present	2,619	48.64	587	62.38	313	66.45			
Absent	2,766	51.36	354	37.62	158	33.55			
Hospital-level factors									
Total beds							33.23	4	<.001
Low	3,295	61.19	614	65.25	347	73.67			
Medium	1,095	20.33	166	17.64	71	15.07			
High	995	18.48	161	17.11	53	11.25			
Ownership							17.59	4	.01
Private not for profit	2,190	40.67	360	38.26	154	32.70			
Public	421	7.82	69	7.33	29	6.16			
Private for profit	2,774	51.51	512	54.41	288	61.15			
Medicaid enrollees among annual discharges							20.87	4	.003
Low	1,022	18.98	203	21.57	82	17.41			
Medium	3,160	58.68	553	58.77	317	67.30			

	No Readmissions		One Readmission		Two or More Readmissions		Statistics		
	n	%	n	%	n	%	χ^2	df	p^a
High	1,203	22.34	185	19.66	72	15.29	10.85	2	.03
Teaching status									
Teaching	1,847	34.30	295	31.35	130	27.60			
Nonteaching	3,538	65.70	646	68.65	341	72.40			
Primary type							26.13	2	<.001
General	3,298	61.24	613	65.14	341	72.40			
Psychiatric	2,087	38.76	328	34.86	130	27.60			
Community-level factors									
Providers per 100,000 youth									
Child psychiatrist							22.69	2	<.001
Low	1,886	35.02	293	31.14	118	25.05			
high	3,499	64.98	648	68.86	353	74.95			
Psychologist							24.05	2	<.001
Low	1,618	30.05	251	26.67	94	19.96			
High	3,767	69.95	690	73.33	377	80.04			
Social worker							9.67	2	.05
Low	1,973	36.64	319	33.90	142	30.15			
High	3,412	63.36	622	66.10	329	69.85			
Health clinics							17.54	2	.002
Low	1,509	28.02	238	25.29	92	19.53			
High	3,876	71.98	703	74.71	379	80.47			
Outpatient mental health center							22.45	2	<.001
Low	1,099	20.41	154	16.37	60	4.57			
High	4,286	79.59	787	83.63	411	87.26			
Psychiatric hospital							25.53	2	<.001
Present	2,082	38.66	314	33.37	135	28.66			
Absent (referent)	3,303	61.34	627	66.63	336	71.34			
Residence							8.66	2	.07
Metropolitan	5,159	95.80	911	96.81	463	98.30			

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	No Readmissions		One Readmission		Two or More Readmissions		Statistics		
	n	%	n	%	n	%	χ^2	df	p [a]
Nonmetropolitan	226	4.20	30	3.19	8	1.70			

Note:

[a] p values adjusted with Holm method.

[b] Includes Asian, Native American, and multiple race.

[c] Includes mood disorder not otherwise specified.

[d] Includes diabetes, seizures, asthma, sickle cell anemia, cerebral palsy, congenital heart disease, cancer, major organ disease, congenital anomaly, HIV, autoimmune disease, and immunocompromised disease.

TABLE 3

Estimated Odds Ratios for Random Effects Multinomial Logistic Regression Model of Readmissions in 6 Months, by Patient-Level Factors[a]

Patient-Level Factors	Logit 1 One Readmission vs. No Readmissions			Logit 2 Two or More Readmissions vs. No Readmissions		
	AOR	95% CI	p	AOR	95% CI	p
Age, y						
6–11 (referent)	1.00			1.00		
12–17	1.07	.87 1.31	.55	1.20	.90 1.60	.22
Sex						
Female (referent)	1.00			1.00		
Male	0.87	.74 1.01	.06	0.86	.69 1.05	.14
Race/ethnicity						
Non-Hispanic white (referent)	1.00			1.00		
Non-Hispanic black	1.01	.83 1.23	.94	0.94	.72 1.23	.66
Hispanic	1.11	.91 1.35	.32	0.90	.68 1.18	.43
Other[b]	0.98	.75 1.29	.89	0.90	.63 1.30	.58
Medicaid eligibility						
Poverty (referent)	1.00			1.00		
Disability	1.26	1.03 1.53	.02	1.63	1.23 2.15	<.001
Foster care	1.33	1.10 1.60	.004	1.85	1.43 2.40	<.0001
Primary diagnosis						
Depressive disorder (referent)	1.00			1.00		
Bipolar disorder	1.06	.88 1.27	.53	0.92	.72 1.18	.51
Other mood disorder[c]	0.92	.75 1.13	.41	0.75	.57 1.00	.05
Any substance use						
Present	1.61	1.02 2.53	.04	0.93	0.43 1.99	.85
Absent (referent)	1.00			1.00		
Psychiatric comorbidity						
0 (referent)	1.00			1.00		
1	2.45	1.85 3.25	<.0001	4.73	2.60 8.61	<.0001

Patient-Level Factors	Logit 1 One Readmission vs. No Readmissions				Logit 2 Two or More Readmissions vs. No Readmissions			
	AOR	95% CI		p	AOR	95% CI		p
2	4.50	3.36	6.03	<.0001	22.59	12.59	40.54	<.0001
Any chronic medical condition [d]								
Present	1.42	1.20	1.69	<.0001	1.32	1.05	1.68	.02
Absent (referent)	1.00				1.00			
Prior psychiatric hospitalization								
Present	1.60	1.31	1.96	<.0001	2.02	1.58	2.59	<.0001
Absent (referent)	1.00				1.00			
Prior psychiatric outpatient visits								
Present	0.67	.53	0.84	<.001	0.41	0.30	0.57	<.0001
Absent (referent)	1.00				1.00			
Interaction between mental health outpatient follow-up in 7 days and length of stay								
Follow-up vs. no follow-up with short length of stay	1.60	1.31	1.95	<.0001	1.44	1.08	1.91	.01
Follow-up vs. no follow-up with long length of stay	1.11	.86	1.44	.43	1.19	0.84	1.68	.34
Long length of stay vs. short length of stay with follow-up	1.45	1.19	1.77	<.001	1.70	1.31	2.20	<.0001
Long length of stay vs. short length of stay without follow-up	2.08	1.61	2.68	<.0001	2.06	1.44	2.95	<.0001

Note: Overall model = χ^2 = 851.52, df = 72, p < .001. Base referent category for the dependent variable is no readmission in 6 months. Vs = versus.

[a] Multinomial logistic regression for adjusted odds ratios (AORs) included all patient-, hospital-, and community-level factors presented in Tables 3 to 5.

[b] Includes Asian, Native American, and multiple race.

[c] Includes mood disorder not otherwise specified.

[d] Includes diabetes, seizures, asthma, sickle cell anemia, cerebral palsy, congenital heart disease, cancer, major organ disease, congenital anomaly, HIV, autoimmune disease, and immunocompromised disease.

TABLE 4

Estimated Odds Ratios for Random Effects Multinomial Logistic Regression Model of Readmissions in 6 Months, by Hospital-Level Factors[a]

Hospital-Level Factors	Logit 1 One Readmission vs. No Readmissions			Logit 2 Two or More Readmissions vs. No Readmissions		
	AOR	95% CI	p	AOR	95% CI	p
Total beds						
Low (referent)	1.00			1.00		
Medium	0.92	0.60 1.41	.70	1.05	0.64 1.72	.86
High	0.54	0.28 1.03	.06	0.37	0.17 0.80	.01
Ownership						
Private not for profit (referent)	1.00			1.00		
Public	1.08	0.79 1.49	.63	1.16	0.71 1.90	.55
Private for profit	1.18	0.94 1.48	.15	1.22	0.90 1.64	.20
Medicaid enrollees among annual discharges						
Low (referent)	1.00			1.00		
Medium	0.80	0.65 0.97	.02	1.06	0.79 1.40	.71
High	0.62	0.47 0.84	.002	0.81	0.52 1.25	.33
Teaching status						
Teaching	0.99	0.77 1.27	.92	1.32	0.94 1.86	.10
Nonteaching (referent)	1.00			1.00		
Primary type						
Psychiatric	1.00	0.65 1.54	.98	0.64	0.32 1.25	.19
General (referent)	1.00			1.00		

Note: Overall model $\chi^2 = 851.52$, $df = 72$, $p < .001$. Base referent category for the dependent variable is no readmission in 6 months. Vs = versus.

[a]Multinomial logistic regression for adjusted odds ratios (AORs) included all patient-, hospital-, and community-level factors presented in Tables 3 to 5.

TABLE 5

Estimated Odds Ratios for Random Effects Multinomial Logistic Regression Model of Readmissions in 6 Months, by Community-Level Factors[a]

Community-Level Factors	Logit 1			Logit 2		
	One Readmission vs. No Readmissions			Two or More Readmissions vs. No Readmissions		
	AOR	95% CI	p	AOR	95% CI	p
Providers per 100,000 youth						
Child psychiatrist						
Low (referent)	1.00			1.00		
High	0.97	0.74 1.28	.85	0.95	0.64 1.42	.80
Psychologist						
Low (referent)	1.00			1.00		
High	0.97	0.73 1.29	.83	0.73	0.47 1.14	.16
Social worker						
Low (referent)	1.00			1.00		
High	1.00	0.81 1.23	.98	0.93	0.70 1.24	.61
Health clinic						
Low (referent)	1.00			1.00		
High	1.09	0.86 1.38	.47	1.17	0.84 1.64	.35
Outpatient mental health center						
Low (referent)	1.00			1.00		
High	1.18	0.90 1.55	.23	1.30	0.87 1.96	.20
Psychiatric hospital						
Present	1.23	0.97 1.55	.08	1.05	0.76 1.46	.76
Absent (referent)	1.00			1.00		
Residence						
Metropolitan (referent)	1.00			1.00		
Nonmetropolitan	1.07	0.69 1.67	.76	0.76	0.35 1.67	.50

Note: Overall model $\chi^2 = 851.52$, df = 72, p < .001. Base referent category for the dependent variable is no readmission in 6 months.

[a] Multinomial logistic regression for adjusted odds ratios (AORs) included all patient-, hospital-, and community-level factors presented in Tables 3 to 5.