



Factors associated with 30-day readmissions following medical hospitalizations among Medicaid beneficiaries with schizophrenia, bipolar disorder, and major depressive disorder

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ABSTRACT

While evidence suggests that adults with serious mental illness have an elevated rate of 30-day readmissions after medical hospitalizations, most studies are of patients who are privately insured or Medicare beneficiaries, and little is known about the differential experiences of people with schizophrenia, bipolar disorder, and major depression. We used the Truven Health Analytics MarketScan® Medicaid Multi-State Database to study 43,817 Medicaid enrollees from 11 states, age 18-64, who were discharged from medical hospitalizations in 2011. Our outcome was unplanned all-cause readmissions within 30 days of discharge. In a multivariable analysis, compared to those with no SMI, people with schizophrenia had the highest odds of 30-day readmission (aOR: 1.46, 95% CI: 1.33-1.59), followed by those with bipolar disorder (aOR: 1.25, 95% CI: 1.14-1.38), and those with major depressive disorder (aOR: 1.18, 95% CI: 1.06-1.30). Readmissions also were more likely among those with substance use disorders, males, those with Medicaid eligibility due to disability, patients with longer index hospitalizations, and those with 2 or more medical co-morbidities. This is the first large-scale study to demonstrate the elevated risk of hospital readmission among low-income, working-age adults with schizophrenia. Given their greater psychological, social, and economic vulnerability, our findings can be used to design transition interventions and service delivery systems that address their complex needs.

1. Introduction

Research indicates that almost one-fifth of U.S. patients discharged from hospital care are readmitted within 30 days (Forster, et al., 2003) and that close to half of these readmissions may be preventable (Jencks et al., 2009). Consequently, reduction of hospital readmissions is a priority for improving quality of healthcare and reducing costs, and is the focus of a federal initiative, the Centers for Medicare & Medicaid Services Hospital Readmissions Reduction Program, authorized by Congress in the Affordable Care Act (Bailey et al., 2019; McIlvennan et al., 2015). Considerable evidence suggests that patients with serious mental illness (SMI) have higher 30-day readmission rates following medical hospitalizations than those without SMI (Germack et al., 2018). However, little prior research has addressed the potentially differential rates of readmission for people with different diagnoses of SMI. The purpose of our study was to determine the likelihood and predictors of 30-day readmissions following medical hospitalizations among working-age Medicaid beneficiaries with schizophrenia, bipolar disorder, and major depressive disorder compared to those with no SMI diagnoses.

A recent meta-analysis of observational studies of hospital admissions and discharges conducted between 2003 and 2011

(Germack et al., 2018) estimated that patients with SMI have greater odds of 30-day readmissions than patients without SMI (pooled OR 1.38, $p < .001$). Study populations have consisted largely of privately insured adults (Daratha et al., 2012) and/or Medicare beneficiaries (Burke et al., 2013; Chwastiak et al., 2014; Germack et al., 2019; Hanrahan et al., 2016; Singh et al., 2016), many of whom were elderly. An exception is the research of Becker and colleagues (2017) who studied Florida Medicaid beneficiaries and found that, compared to those without SMI, patients with SMI had a higher risk of 30-day re-hospitalization, and that the highest risk was for those with major depressive disorder, followed by psychotic disorder, and then bipolar disorder. An earlier study of primarily Medicare and privately insured patients examined diagnoses of schizophrenia, bipolar disorder, depression, and anxiety disorders after medical hospitalizations (Burke et al., 2013), and found no relationships with 30-day all-cause readmissions, but greater odds of potentially avoidable readmissions among those with schizophrenia and depression.

There are a number of reasons to expect that people with schizophrenia may be more likely to experience 30-day readmissions from medical hospitalizations. They have significantly higher rates of morbidity and mortality compared to the general population (Kisely et al., 2005; Razzano et al., 2015), as well as to people with other major mental illnesses

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such as bipolar disorder and major depression (Callaghan et al., 2014; Laursen et al., 2013; Lomholt et al., 2019). A number of factors associated with poor physical health are more prevalent among people with schizophrenia, including lifestyle-related risks such as smoking and poor dietary habits, social factors such as socioeconomic deprivation and interpersonal isolation, and clinical factors such as co-morbid substance use disorders and use of anti-psychotic medication (Brown et al., 2000; Heald et al., 2017). They also have restricted access to high quality medical care, such that their physical health problems often go undetected or undertreated (Cook et al., 2015; Nasrallah et al., 2006) in contrast to people with non-psychotic mental illness, who are more likely to seek medical care and engage in preventative health care services such as routine physicals and screenings (Folsom et al., 2002). They also have lower health literacy than individuals with other diagnoses of mental illness (Osborn et al., 2007). Thus, people with schizophrenia may have higher morbidity and fewer skills and supports to remain out of the hospital than those with major depression or bipolar disorder.

Given the equivocal findings of prior studies, our aim was to investigate the differential impact of specific diagnoses of serious mental illness on the likelihood of 30-day readmissions. We focused on working-age Medicaid beneficiaries for two reasons. First, we were interested in a group that is not yet impacted by 30-day readmission penalties such as those imposed on systems serving Medicare beneficiaries (Zuckerman et al., 2016). Second, they are a group of interest to the Social Security Administration given the potential for intervention to delay the onset or exacerbation of work disability and federal disability program enrollment, especially among beneficiaries with SMI and multiple chronic conditions (Cook and Burke-Miller, 2018). For the largest and only multistate study to date of exclusively working-age Medicaid beneficiaries, we hypothesized that, among people with SMI, those with schizophrenia would have significantly higher 30-day medical readmission rates than those with bipolar and major depressive disorders, and that differential rates of readmission would persist despite controlling for potentially confounding factors identified in prior studies.

2. Methods

2.1. Medicaid claims

We analyzed inpatient admissions for the year 2011 from the MarketScan® Medicaid Multi-State Database (MMSD). MMSD is part of MarketScan, a warehouse of proprietary health research databases developed and maintained by Truven Health Analytics,™ a U.S. company based in Ann Arbor, Michigan. MarketScan databases are large claims-based resources specifically designed for health research and informatics, and have been used in over 900 peer-reviewed health research journal articles published since 1990 (Quint, 2015). All MarketScan databases comply fully with the Health Insurance Portability and Accountability Act of 1996 (HIPAA); patient-level and provider-level data contain synthetic identifiers to protect the privacy of individuals and data contributors.

The MMSD contains individual enrollment and demographic data, and outpatient, inpatient, and prescription claims data of more than 8 million Medicaid enrollees annually and is collected from state Medicaid agencies in 11 geographically dispersed states, representing about 12% of the 69 million individuals enrolled in Medicaid in 2011 (Centers for Medicare and Medicaid Services Medicare & Medicaid Statistical Supplement, 2013). States are not identified in order to protect patient confidentiality. Claims data undergo cleaning and quality assurance checks, including: comparison of diagnosis and procedure codes; editing of the diagnosis and procedure codes when necessary; addition of Major Diagnostic Categories (MDCs) to claims; and use of fully paid and adjudicated claims.

The 2011 Truven MMSD includes 8,135,159 individuals. We excluded those under age 18, those over age 64, those who were dual

Medicare-Medicaid beneficiaries, and those not continuously enrolled in Medicaid for the entire year (365 days), leaving 1,058,214 working-age adults for the analysis.

2.2. Index hospitalization

Of the total population, 16% (169,405/1,058,214) had at least one inpatient medical admission. This number excludes admissions for surgical, maternal/newborn, and psychiatric/substance abuse reasons. We further characterized medical admissions by excluding those that were due to injuries, poisonings, toxic effects of drugs, burns, and multiple significant trauma because these readmissions for these conditions are often either planned or unavoidable (Goldfield et al., 2008; Jackson et al., 2015). We also excluded medical hospitalizations for reasons other than illness (e.g., rehabilitation, prophylactic isolation, organ donation, or palliative care). Finally, we excluded hospitalizations that resulted in death or transfer to another facility.

For the readmission analyses, we limited cases to medical hospitalizations that had 2011 discharge dates occurring before December 1, 2011, in order to allow for time to observe 30-day rehospitalization in 2011. As a result, we identified 43,817 working-age adults with at least one medical inpatient admission and discharge in 2011 for the analysis. This admission (or the first of its type if more than one) became the index hospitalization for the analysis.

2.3. Study outcome

The primary study outcome was any inpatient readmission within 30 days of discharge following the index hospitalization. This outcome included unplanned readmissions for any cause to an acute care hospital. We chose this operationalization to match the definition used as a key measure for the quality of patient care in national initiatives such as the Centers for Medicare & Medicaid Services Hospital Readmissions Reduction Program, and the Partnership for Patients (Bailey et al., 2019).

2.4. Study predictors

The primary predictor was SMI status. Following the methodology of prior studies (Becker et al., 2017) we identified adults with SMI as those who had claims with a primary or secondary psychiatric diagnosis in any setting in 2011, and not just at the index hospitalization. These ICD-9 diagnosis codes were: schizophrenia and other psychoses (295, 297.1, 297.3, 298.8–298.9); bipolar disorders (296.0, 296.1, 296.4–296.7, 296.80, 296.89); and major depressive disorders (296.2–296.3). A second predictor was the specific SMI diagnosis, which was defined using a vectoring algorithm (Ortiz, 2019) in which the diagnosis hierarchy was as follows: (1) schizophrenia or other psychotic disorders, (2) bipolar disorder, and (3) major depressive disorder.

2.5. Study covariates

Prior research in this area has identified a number of co-variables that are associated with the likelihood of 30-day readmission, including age, gender, race/ethnicity, co-morbid substance abuse/dependence identified from 2011 claims, disability status (based on Medicaid eligibility), Medicaid managed care delivery system (versus fee for service), major diagnostic category associated with the index hospitalization, length of the index hospitalization, and medical comorbidity at the index hospitalization (Albrecht et al., 2012; Forster et al., 2003; Gilmer & Hamblin, 2010; Jiang & Wier, 2010; Lemieux et al., 2012; Mark et al., 2013; Regenstein and Andres, 2014; Trudnak et al., 2013). The latter covariate was assessed by the Charlson Comorbidity Index score (Quan et al., 2002), a prognostic measure of morbidity based on up to 15 ICD-9 diagnoses.

2.6. Statistical analysis

We examined characteristics of the sample population in total, by SMI status, and by specific SMI diagnosis using chi-square tests of association or t-tests of mean differences. We calculated the rate of 30-day hospital readmissions as a percent of the entire sample and by diagnostic group. We examined factors associated with 30-day readmissions using unadjusted and multivariable logistic regression analyses. The 43,817 adults with index medical hospitalizations were treated at 1,157 different hospitals (each hospital averaged 195 individuals (standard deviation = 180), ranging from 1 to 911). The intraclass correlation (ICC) of variance in readmissions associated with hospitals rather than individuals (between hospital variance divided by total variance) was negligible (ICC < .0001). Because of this, we determined that a multi-level model was not necessary to account for hospital variation in readmission outcomes.

3. Results

3.1. Sample characteristics

As shown in Table 1, just over a quarter of the analysis sample met the diagnostic criteria for SMI (26%, 11,547/43,817). These included 9% (3,854/43,817) with diagnoses of schizophrenia, 8% (3,776/43,817) with diagnoses of bipolar disorders, and 9% (3,917/43,817) with diagnoses of major depressive disorder. In the total sample, 7% had 2 or more of these SMI diagnoses (3,111/43,817).

Characteristics of the sample population by SMI status also are shown in Table 1. A lower proportion of those with SMI diagnoses was male compared to those without SMI (32% vs 40%, p < .001). Just under half of the total population was White non-Hispanic (49%), but Whites made up a higher proportion of the SMI group than the non-SMI group (60% vs 45%, p < .001). Adults ranged in age from 18-64 years, with a median age of 48 years. A lower proportion of those with SMI were covered by a capitated/managed care Medicaid program than

those without SMI (30% vs 40%, p < .001). A higher proportion of the SMI group were Medicaid eligible due to disability than the non-SMI group (80% vs 73%, p < .001). A higher proportion of those with SMI also had substance abuse diagnoses than those without SMI (20% vs 9%, p < .001).

The medical basis for the index hospitalization differed somewhat between SMI and non-SMI groups statistically, but the same seven conditions accounted for around 80% of all admissions in both groups. The most common index hospitalization was due to respiratory illness for both SMI and non-SMI groups (20%), followed by circulatory disorders (15%), digestive system disorders (13%), nervous system disorders (10%), endocrine/metabolic system disorders (7%), kidney/urinary tract disorders (7%), and skin/subcutaneous tissue/breast disease (6%). The length of stay of the index hospitalization ranged from 1 to 107 days, with a median of 3 days. A smaller proportion of those with SMI had longer than median stays compared to those without SMI. Finally, scores on the Charlson Comorbidity Index indicated that, compared to those without SMI, those with SMI had less physical comorbidity and better prognoses.

Because of our focus on patients with schizophrenia, we compared their characteristics to those with bipolar and major depressive disorders (not shown). Compared to patients with diagnoses of bipolar or major depressive disorders, those with schizophrenia spectrum diagnoses were more frequently male, African American, older, eligible for Medicaid due to disability, and engaged in substance use. In addition, those with schizophrenia also had significantly longer index hospitalizations, and a significantly greater number of medical comorbidities than those with bipolar or major depressive disorders.

3.2. Thirty-day readmission rates

Fourteen percent of the total sample (5,932/43,817) had a hospital readmission within 30-days of their index hospitalization discharge. Among the group with SMI, this rate was 16% compared to 13% in the non-SMI population. The readmission rate was highest among those

Table 1

Working age adult Medicaid enrollees with an index medical hospitalization (N = 43,817): characteristics of the total population and by diagnoses with and without serious mental illness (SMI).

Characteristic	Total (N = 43,817)n (%)	SMI (N = 11,547)n (%)	Non-SMI (N = 32,270)n (%)	χ ² (df)	p-value
Male	16485 (37.6%)	3681 (31.9%)	12804 (39.7%)	220.4 (1)	< .001
Race-ethnicity				729.8 (3)	< .001
White	21415 (48.9%)	6888 (59.7%)	14527 (45.0%)		
African American	15688 (35.8%)	3247 (28.1%)	12441 (38.6%)		
Hispanic	932 (2.1%)	186 (1.6%)	746 (2.3%)		
Other	5782 (13.2%)	1226 (10.6%)	4556 (14.1%)		
Age >= 48 years (> = median)	22037 (50.3%)	5512 (47.7%)	16525 (51.2%)	41.0 (1)	< .001
Capitated/Managed Care Medicaid	16333 (37.3%)	3410 (29.5%)	12923 (40.0%)	402.1 (1)	< .001
Blind/Disabled Medicaid Eligibility	32674 (74.6%)	9182 (79.5%)	23492 (72.8%)	202.5 (1)	< .001
Substance Abuse Diagnosis	5109 (11.7%)	2323 (20.1%)	2786 (8.6%)	1088.9 (1)	< .001
Index Admission Major Diagnostic Category				190.8 (7)	< .001
Respiratory System	8901 (20.3%)	2346 (20.3%)	6555 (20.3%)		
Circulatory System	6681 (15.2%)	1627 (14.1%)	5054 (15.7%)		
Digestive System	5827 (13.3%)	1604 (13.9%)	4223 (13.1%)		
Nervous System	4474 (10.2%)	1463 (12.7%)	3011 (9.3%)		
Endocrine/Metabolic System	3177 (7.3%)	957 (8.3%)	2220 (6.9%)		
Kidney/Urinary Tract	3168 (7.2%)	781 (6.8%)	2387 (7.4%)		
Skin/Subcutaneous Tissue/Breast	2479 (5.7%)	670 (5.8%)	1809 (5.6%)		
Other Diagnostic Category	9110 (20.8%)	2099 (18.2%)	7011 (21.7%)		
Length of stay of index hospitalization > 3 days	16287 (37.2%)	4060 (35.2%)	12227 (37.9%)	27.1 (1)	< .001
Charlson Comorbidity Index				64.2 (2)	< .001
0	13212 (30.2%)	3723 (32.2%)	9489 (29.4%)		
1	11230 (25.6%)	3080 (26.7%)	8150 (25.3%)		
2+	19375 (44.2%)	4744 (41.1%)	14631 (45.3%)		
Serious Mental Illness	11547 (26.4%)	11547 (100%)	-	-	-
Schizophrenia and other psychoses	3854 (8.8%)	3854 (33.4%)	-	-	-
Bipolar disorders without schizophrenia	3776 (8.6%)	3776 (32.7%)	-	-	-
Major depressive disorders	3917 (8.9%)	3917 (33.9%)	-	-	-
2+ co-occurring SMI diagnoses	3111 (7.1%)	3111 (26.9%)	-	-	-

Table 2

Associations between serious mental illness and 30-day all-cause readmissions following index medical hospitalization (N = 43,817): unadjusted and multivariable logistic regression odds ratios.

Characteristic	Unadjusted Odds ratio	95% CI	Adjusted ^a Odds ratio	95% CI
Serious Mental Illness (vs no SMI)	1.36***	1.28, 1.44	1.30***	1.22, 1.39
Substance Use Diagnosis (vs no SUD)	1.58***	1.46, 1.70	1.47***	1.36, 1.59
Male	1.22***	1.15, 1.29	1.09**	1.03, 1.16
Race/ethnicity				
White	reference	reference	reference	reference
African American	0.98	0.92, 1.04	0.93*	0.88, 0.99
Hispanic	0.92	0.76, 1.12	1.06	0.87, 1.29
Other	0.89*	0.82, 0.98	0.92	0.84, 1.01
Age ≥ 48 years (vs <48 years)	1.15***	1.09, 1.22	0.99	0.92, 1.06
Capitated/Managed Care (vs fee for service)	0.81***	0.76, 0.86	0.96	0.90, 1.02
Medicaid eligibility due to disability (vs non-disability eligibility)	1.87***	1.74, 2.01	1.70***	1.56, 1.84
Index hospitalization length of stay ≥ 4 days (median) (vs ≤ 3 days)	1.51***	1.43, 1.59	1.44***	1.36, 1.53
Charlson Index of Comorbidity				
0	reference	reference	reference	reference
1	1.15***	1.06, 1.24	0.95	0.86, 1.05
2+	1.41***	1.32, 1.51	1.27***	1.17, 1.37

CI = confidence interval

* < .05

** < .01

*** < .001

^a Multivariable model also adjusts for major diagnostic category of index hospitalization.

with diagnoses of schizophrenia (19%), followed by those with bipolar disorders (15%), and those with major depressive disorders (15%). Results presented in Table 2 show that SMI diagnosis was associated with significantly greater likelihood of 30-day readmission in unadjusted (OR: 1.36, 95% CI: 1.28-1.44) and in multivariable logistic regression models (aOR: 1.30, 95% CI: 1.22-1.39). Other factors significantly associated with greater likelihood of 30-day readmission in the multivariable model included substance use (aOR: 1.47, 95% CI: 1.36-1.59), being male (aOR: 1.09, 95% CI: 1.03-1.16), Medicaid eligibility due to disability status (aOR: 1.70, 95% CI: 1.56-1.84), longer index hospitalization stay (aOR: 1.44, 95% CI: 1.36-1.53), and having 2 or more comorbid medical conditions (aOR: 1.27, 95% CI: 1.17-1.37). In the multivariable model, being African American was associated with significantly lower likelihood of readmission compared to White patients (aOR: 0.93, 95% CI: 0.88-0.99).

Regarding our hypothesis of differential 30-day readmission rates by SMI diagnosis, Table 3 shows that, compared to those without SMI, in unadjusted logistic regression analysis, those patients with schizophrenia had the greatest likelihood of 30-day hospital readmissions (OR: 1.63, 95% CI: 1.50-1.78), followed by those with bipolar disorders (OR: 1.27, 95% CI: 1.16-1.39), and major depressive disorders (OR: 1.18, 95% CI: 1.07-1.30). This pattern remained consistent in the multivariable model, where those with schizophrenia had the greatest risk of readmission (aOR: 1.46, 95% CI: 1.33-1.59), followed by those with bipolar disorders (aOR: 1.25, 95% CI: 1.14-1.38), and finally those with major depressive disorder (aOR: 1.18, 95% CI: 1.06-1.30). We also re-ran the multivariable model with each of the three SMI diagnoses measured as dichotomous variables rather than using the vectoring algorithm. Results were highly similar (not shown), with the greatest odds of 30-day readmission for schizophrenia.

One final set of analyses (not shown) examined the interaction of substance use with the three SMI diagnoses. Results revealed that the effect of co-occurring SMI and substance use on the likelihood of readmission was either not significant (major depressive disorder*substance use, bipolar disorder*substance use) or not greater than the main effects of each (schizophrenia*substance use), suggesting that the risk of readmission associated with either SMI or substance use was not contingent on the presence of the other.

4. Discussion

We found that working-age Medicaid beneficiaries with SMI were more likely than those without SMI to experience unplanned 30-day readmissions, and that the odds of readmission were highest for those with schizophrenia, followed by bipolar disorder, and then major depressive disorder. Our study is the largest and only multistate study to date of exclusively working age Medicaid beneficiaries. Becker and colleagues (Becker et al., 2017) studied a single-state Medicaid cohort and found a readmission rate of 22% for major psychotic disorders, similar to our readmission rate of 19% for schizophrenia and other psychotic disorders. However, the Becker et al. study found that the highest risk for readmission was among people with major depressive disorder, followed by psychotic disorder, and then bipolar disorder. There were some differences between the two study populations and research designs. First, the Becker et al. study population was notably older, with more than a third over age 70, while we focused on working-age Medicaid beneficiaries under age 65. Unlike Becker et al., we excluded index hospitalizations for surgical reasons given their higher readmission rates due to surgical site infections (Kirkland et al., 1999). Also, Becker and colleagues focused on non-behavioral health hospitalizations while we looked at all-cause readmissions, although a full 94% of our study's readmissions were for medical or surgical reasons.

Similar to the findings of Becker et al. (2016) and other prior studies, we found a greater risk of readmission among males, among those who qualified as having a disability, those with substance use disorders, and those with longer index hospitalizations. However, unlike Becker's and other prior studies, we found that, adjusting for other factors, African American patients were less likely to be readmitted than White patients. In our sample, African Americans represented almost half of those diagnosed with schizophrenia (41%) but a much lower proportion of those diagnosed with bipolar or major depressive disorders (22%). It is possible that our lower rate of readmission for African Americans is due to their disproportionate representation among patients with schizophrenia in our multistate population. Future studies should explore the intersection of race and diagnosis to address this issue in greater depth.

It is noteworthy that even controlling for type of SMI diagnosis, patients were more likely to be readmitted within 30 days if they had

Table 3

Associations between types of serious mental illness and 30-day all-cause readmissions following index medical hospitalization (N=43,817): unadjusted and multivariable logistic regression odds ratios.

Characteristic		Unadjusted Odds ratio	95% CI	Adjusted ^a Odds ratio	95% CI
SMI category	No SMI	reference	reference	reference	reference
	Schizophrenia and other psychoses	1.63***	1.50, 1.78	1.46***	1.33, 1.59
	Bipolar Disorders	1.27***	1.16, 1.39	1.25***	1.14, 1.38
	Major Depressive Disorder	1.18**	1.07, 1.30	1.18**	1.06, 1.30
Substance Use Diagnosis (vs no SUD)		1.58***	1.46, 1.70	1.47***	1.36, 1.59
Male		1.22***	1.15, 1.29	1.09**	1.02, 1.15
Race/ethnicity	White	reference	reference	reference	Reference
	African American	0.98	0.92, 1.04	0.92*	0.86, 0.98
	Hispanic	0.92	0.76, 1.12	1.06	0.86, 1.28
	Other	0.89*	0.82, 0.98	0.91	0.83, 1.00
Age ≥ 48 years (vs <48 years)		1.15***	1.09, 1.22	0.98	0.91, 1.06
Capitated/Managed Care (vs fee for service)		0.81***	0.76, 0.86	0.96	0.90, 1.02
Medicaid eligibility due to disability (vs non-disability eligibility)		1.87***	1.74, 2.01	1.68***	1.55, 1.83
Index hospitalization length of stay ≥ 4 days (median) (vs ≤ 3 days)		1.51***	1.43, 1.59	1.44***	1.36, 1.53
Charlson Index of Comorbidity	0	reference	reference	reference	reference
	1	1.15***	1.06, 1.24	0.95	0.86, 1.05
	2+	1.41***	1.32, 1.51	1.27***	1.17, 1.37

CI= confidence interval

* <.05

** <.01

*** p<.001

^a Multivariable model also adjusts for major diagnostic category of index hospitalization.

longer index hospital stays, a greater number of medical comorbidities, and were qualified for Medicaid and/or federal cash assistance due to disability. Given the inconsistent quality of medical care for people with SMI (Cook et al., 2015), particularly those with schizophrenia (De Hert et al., 2009; Torres-Gonzalez et al., 2014), and Medicaid beneficiaries (McGinty et al., 2015), these patients may have more complex medical needs and lower levels of functioning due to disability once they are discharged.

Our findings suggest a clear and compelling need for interventions aimed at people with SMI and particularly those with schizophrenia. Unfortunately, addressing psychiatric illness among medical inpatients has not been the focus of most hospital-to-community transitional care interventions (Kripalani et al., 2014). Despite the growing evidence base for transitional care, little is known about how best to deliver it to patients who have co-occurring SMI and medical comorbidities (Jackson et al., 2015). Transition programs may direct more emotional support and less instrumental support to patients with vulnerabilities such as mental illness, substance abuse, trauma, and other disabilities (Kangovi et al., 2014). However, evidence suggests that focusing transitional care on delivery of behavioral health services alone is not a viable approach. A review of mental health interventions designed to prevent readmissions after medical hospitalizations (Benjenk et al., 2018) found only limited support for their effectiveness.

Patients with SMI and medical comorbidities have complex needs that must be served by a fragmented system with little real-time communication between behavioral health and physical healthcare systems (Jackson et al., 2015). The demonstrably greater impact of lifestyle, social, and clinical factors on the physical and mental health of adults with schizophrenia compared to other diagnoses of SMI suggests that changes in community-based infrastructure are needed in addition to transition interventions. This altered infrastructure should allocate care management resources with the specific intent of ensuring safe transitions from hospital to home along with linkage back to primary care, with the *explicit inclusion of people with major forms of mental illness*. A recent study (Jackson et al., 2015) of such a transitional care initiative for Medicaid recipients in North Carolina found that patients with schizophrenia were 30% less likely to experience a readmission in the

year following a general hospital discharge compared to those receiving usual care. Importantly, this advantage was seen even for patients already receiving intensive mental health services using the Assertive Community Treatment model.

4.1. Limitations

The study had several limitations. One limitation is that the Medicaid enrollees in the Truven data are a non-random subsample of all enrollees, and their geographic region is unknown. However, the sample is sizeable and includes at least 10% of the total population of working-age non-dual eligible adults on Medicaid in multiple States (Centers for Medicare and Medicaid Services Medicare & Medicaid Statistical Supplement, 2013). A second limitation is that administrative claims data may be incomplete, although the Truven data undergo cleaning and quality assurance checks and use fully paid and adjudicated claims. A third limitation was our focus on proximal rather than distal outcomes, preventing us from knowing the longer-term health outcomes of those with and without 30-day readmissions. Despite the limitations, analysis of these data provides the strongest evidence to date of the association of SMI with post medical discharge readmission among working-age adults, and the first evidence of the greatest likelihood of 30-day readmissions among people with schizophrenia.

4.2. Conclusion

Patients hospitalized for physical health conditions who had comorbid SMI had a 30% greater likelihood of being readmitted within thirty days than their counterparts without SMI. Those with comorbid schizophrenia had a 46% greater likelihood, those with bipolar disorders a 25% greater likelihood, and those with major depressive disorder an 18% greater likelihood of an unplanned 30-day readmission than those without SMI. Along with the need for transition interventions that explicitly address the needs of patients with SMI, especially those with schizophrenia, our results further suggest that these approaches should address substance use and disability, and consider

gender-specific needs.

CRediT authorship contribution statement

Judith A. Cook: Conceptualization, Investigation, Funding acquisition, Methodology, Writing - original draft. **Jane K. Burke-Miller:** Data curation, Software, Investigation, Formal analysis, Writing - original draft. **Jessica A. Jonikas:** Project administration, Investigation, Funding acquisition, Writing - review & editing. **Frances Aranda:** Methodology, Writing - review & editing. **Alberto Santos:** Writing - review & editing.

Declaration of Competing Interests

The authors have no conflicts of interest to disclose.

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Supplementary materials

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