



Serious mental illness, other mental health disorders, and outpatient health care as predictors of 30-day readmissions following medical hospitalization

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ABSTRACT

Objective: Prior research has not addressed whether both serious mental illness (SMI) and other mental health (OMH) disorders affect the likelihood of 30-day readmissions after medical hospitalizations, or whether post-discharge use of outpatient medical, mental health, and pharmacy services is associated with readmission likelihood.

Methods: Using the Truven Health Analytics MarketScan® Medicaid Multi-State Database, we studied 43,817 Medicaid beneficiaries, age 18–64, following discharge from medical hospitalizations in 2011. Logistic regression models compared all-cause, 30-day readmissions among those with SMI, OMH, and no psychiatric diagnosis, and examined associations of 30-day outpatient service use with 30-day readmissions.

Results: Thirty-day readmission rates were 15.9% (SMI), 13.8% (OMH), and 11.7% (no mental illness). In multivariable analysis, compared to patients without mental illness, odds of readmission were greater for those with SMI (aOR = 1.43, 95%CI: 1.32–1.51) and OMH (aOR = 1.21, 95%CI: 1.12–1.30), and lower among those using outpatient mental health services (aOR = 0.50, 95%CI: 0.44–0.56).

Conclusion: The adult Medicaid population disproportionately includes patients with SMI and OMH disorders, both of which were found to be associated with 30-day hospital readmissions. Receiving outpatient mental health services after hospital discharge may be protective against readmission following medical hospitalizations, suggesting the need for further research on these topics.

1. Background

As often noted, 30-day hospital readmissions among Medicaid¹ populations have not been well studied [1–5], including the impact of non-severe forms of mental illness, and use of post-discharge outpatient services by this group. This study investigates whether Medicaid beneficiaries with serious mental illness² (SMI) and other mental health (OMH) disorders had higher rates of 30-day readmissions after medical hospitalizations than the general population, and the impact of outpatient health, mental health, and pharmacy services on readmission likelihood.

In 2015, Medicaid covered 21% of adults with mental illness, and 26% of adults with SMI, compared to 14% of the general adult population [6]. A recent meta-analysis of published observational studies between 2003 and 2011 estimated that patients with SMI have greater odds of 30-day hospital readmission than patients without SMI (pooled

OR 1.38, $p < .001$) [7]; however, only one of these studies focused on Medicaid enrollees [8]. This is important because readmission in the Medicaid population differs in important ways from other groups [1,4], due to factors such as discontinuities in coverage, low literacy, lack of transportation, unstable housing, poverty, and unemployment [2,9,10].

Another group of under-studied behavioral health patients are those with non-severe, less disabling mental health conditions, known as OMH disorders [11]. While receiving less attention than SMI, OMH disorders such as anxiety, personality, eating, and adjustment disorders are associated with poorer outcomes in health, employment, education, social relationships, and financial status than those of the general population [12–17]. Moreover, OMH disorders are associated with significant individual and societal costs due to high health service utilization, interrupted labor force participation, low work productivity, more lost-work days, and high social welfare program participation [18–21].

Outpatient service utilization in the month after discharge is also an

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¹ Medicaid is a jointly funded state-federal program that provides health coverage to millions of Americans, including eligible low-income adults, children, pregnant women, elderly adults, and people with disabilities.

² Serious mental illness is defined by a diagnosis of schizophrenia, bipolar disorder, or major depressive disorder meeting criteria established in the American Psychiatric Association's *Diagnostic and Statistical Manual*.

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under-studied topic. For people with co-occurring mental illness, use of outpatient mental health services as well as medical care may influence 30-day readmissions [22]. Research on outpatient physical health care for general patient populations suggests that early physician follow-up in the first weeks post-discharge is associated with reduced likelihood of 30-day readmissions [23–26]. Similarly, studies of 30-day readmissions following psychiatric hospitalizations suggest that mental health outpatient visits are associated with lower likelihood of subsequent psychiatric rehospitalization [27–29]. No studies have examined whether use of *medical, mental health, and pharmacy services* after discharge from *medical* hospitalizations is associated with lower readmissions among patients with mental health disorders.

Most beneficiaries with mental health disorders qualify for Medicaid due to low incomes, while others, especially those with SMI, qualify for Medicaid based on disability [6]. While one in five Medicaid beneficiaries has a behavioral health diagnosis, this group accounts for almost half of total Medicaid expenditures [6]. Moreover, this group has presumably been unaffected by 30-day readmission penalties imposed on systems serving Medicare³ beneficiaries [30]. Thus, our first hypothesis was that patients with SMI and OMH disorders would have significantly higher 30-day readmission rates than those with no mental illness, and that these differences would persist despite controlling for potentially confounding factors identified in prior studies. Our second hypothesis was that use of outpatient services in the month following discharge would be associated with lower likelihood of 30-day readmission.

2. Methods

2.1. Study setting and participants

We analyzed inpatient admissions for the year 2011 from the MarketScan® Medicaid Multi-State Database (MMSD). MarketScan databases are large claims-based resources specifically designed for health research and informatics [31]. 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. Because of this, institutional review board approval was not required for this study.

The MMSD contains individual enrollment and demographic data, and outpatient, inpatient, and prescription claims data for more than 8 million Medicaid enrollees annually and are collected from state Medicaid agencies in 11 geographically dispersed states, representing about 12% of the 69 million individuals enrolled in Medicaid in 2011 [32]. States are not identified in order to protect patient confidentiality. Both managed care and fee-for-service plans are included.

The 2011 Truven MMSD includes 8,135,159 individuals. We excluded those under age 18, those over age 64, those who were otherwise Medicare dual eligible, and those not continuously enrolled in Medicaid for the whole year (365 days), leaving 1,058,214 working age adults for the analysis.

2.2. Index hospitalization

Of these 1,058,214, 16% ($N = 169,405$) had at least one all-cause inpatient admission. We excluded surgical, maternal/newborn, and psychiatric/substance abuse admissions. We further characterized medical admissions by excluding those that were due to injuries, poisonings, toxic effects of drugs, burns, and multiple significant trauma, whether self-inflicted or perpetrated by others. We also excluded medical hospitalizations for reasons other than illness (e.g., rehabilitation,

prophylactic isolation, organ donation, or palliative care), and hospitalizations that resulted in death, transfer to another facility, or had a planned readmission at discharge. See the online supplement for further detail.

We limited cases to medical hospitalizations that had discharge dates on or before December 1, 2011 in order to allow time to observe readmissions and outpatient services used in the 30 days post-discharge. 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 occurred) was designated as the index hospitalization.

2.3. Study outcomes

The study outcome was all-cause inpatient readmissions within 30 days of discharge following the index hospitalization. This is the most commonly used measure in research on 30-day readmissions, and it is a key outcome for patient care quality in national initiatives such as the Centers for Medicare and Medicaid Services Hospital Readmissions Reduction Program [33].

2.4. Study predictors

The primary predictors were SMI defined as schizophrenia and other psychoses, bipolar disorders, and major depressive disorders, and OMH defined as anxiety disorders, phobias, personality disorders, adjustment disorders, eating disorders, and other depressive disorders. These were identified from primary or secondary ICD-9 diagnoses on any 2011 inpatient or outpatient claim before or after index admission [8,34]. See the online supplement for further detail.

The secondary predictor was outpatient health care utilization defined as medical, mental health, and pharmacy services used in the 30 days after discharge from the index hospitalization and prior to readmission if one occurred. Outpatient medical treatment included office visits, emergency department and urgent care visits, home health visits, laboratory or radiological diagnostic tests, and receipt of medical supplies or equipment. Outpatient mental health treatment included individual or group behavioral therapy, non-therapy mental health visits, psychiatric evaluation, and case management delivered by a psychiatrist, psychiatric nurse, psychologist, or case manager in a mental health or psychiatric facility, community mental health center, or other outpatient setting. Outpatient prescription drug use included psychotropic medications, other central nervous system agents, cardiac drugs, hormone and synthetic substitutes, autoimmune and anti-infective agents, gastrointestinal medications, and supplements for electrolyte and caloric intake. We used the number of service claims closest to the population median among service users to dichotomize each type of service into low and high intensity user groups. In each case, the population median prevalence fell between two whole numbers of services and, as a result, the proportions of low and high intensity users are not equal for these service intensity variables. See the online supplement for further detail.

2.5. Covariates

Covariates and other factors included participants' age, gender, race, comorbid substance abuse/dependence (identified from claims), disability status (based on Medicaid eligibility), Medicaid managed care delivery (versus fee-for-service), major diagnostic category associated with the index hospitalization, length of the index hospitalization, and medical comorbidity at the index hospitalization as assessed by the Charlson Comorbidity Index [35]. For the outpatient services analysis only, models included an additional variable representing community tenure in the month following discharge. Community tenure was assessed as the percentage out of 30 days that the person was not hospitalized and presumably able to access outpatient services,

³ Medicare is the federal health insurance program for people who are 65 or older, younger people with disabilities who qualify due to their work history, and people with end-stage renal disease.

dichotomized at the median.

2.6. Statistical analysis

We examined characteristics of the total population and of mental health status groups (i.e., SMI, OMH disorders, no diagnosis of mental illness) using chi-square tests of association or t-tests of mean differences. We calculated the rate of 30-day hospital readmissions as a proportion of the total sample and of each mental health status group. The association of mental health status (independent variable) with 30-day readmissions (dependent variable) was examined in unadjusted and multivariable logistic regression analyses. We next examined associations between our two independent variables (service use, mental health status group) and 30-day readmissions using multivariable logistic regression models both with and without interaction terms. We first looked at *any use* of outpatient medical, mental health, or pharmacy services. Next, we examined the *intensity of service use* defined as none, low, and high use groups for each type of service. Multilevel models were not used because the intraclass correlation of variance in readmissions associated with hospitals rather than individuals was negligible (ICC < 0.01). The threshold of statistical significance was set at $p < .05$.

3. Results

3.1. Sample characteristics

In the analysis sample shown in Table 1, around a third (31.5%) met the diagnostic criteria for SMI, around a quarter (23.6%) met criteria for OMH disorder, and approximately two-fifths (44.9%) did not have a mental health disorder. Compared to those without mental illness, the groups with SMI and with OMH disorders had significantly lower proportions of males and Black Americans, and higher proportions of Whites and those with substance use disorders. Compared to the other two groups, the SMI group was younger, less likely to be in a managed care plan, and less likely to have a high comorbidity score; they also were more likely to qualify for Medicaid due to disability, and to have

experienced a shorter index hospitalization.

The medical basis for the index hospitalization differed somewhat between groups, but the same seven conditions accounted for about 80% of admissions for all three groups: with respiratory system being most common, followed in decreasing frequency by circulatory, digestive, nervous, endocrine/metabolic, kidney/urinary tract, and skin/subcutaneous tissue/breast systems.

In the entire sample, the percentage of days in the community in the 30 days after discharge ranged from 0.03% to 100% with a mean (SD) of 98.0% (7.2). A higher proportion of people with SMI had lower community tenure (<90% of days) following discharge than those with OMH or no mental health disorders (7.0% vs 6.3% and 5.9%, respectively).

In the 30 days post index hospital discharge and prior to readmission if one occurred, 85.1% of the analysis sample used any outpatient medical services; 13.3% used any outpatient mental health services; and 82.8% used any outpatient pharmacy services. For physical health services, 14.9% of the total group were non-users, 43.2% were low intensity users (1–7 claims), and 41.9% were high intensity users (≥ 8 claims). For mental health services, 86.7% were non-users, 8.8% were low intensity users (1 claim), and 4.5% were high intensity users (2+ claims). For pharmacy services, 17.2% of the total group were non-users, 43.2% were low intensity users (1–6 claims), and 39.6% were high intensity users (≥ 7 claims).

3.2. Mental health status and 30-day readmissions

Our first hypothesis was that patients with SMI and OMH disorders would have significantly higher 30-day readmission rates than those with no mental illness. Thirty-day readmission rates were 15.9% for those with SMI, 13.8% for those with OMH disorders, and 11.7% for those with no mental illness ($p < .001$). Regarding our hypothesis of differential 30-day readmission rates by SMI and OMH status, Table 2 shows that, compared to those with no mental illness, in multivariable logistic regression analysis, those patients with SMI had the greatest risk of readmission, followed by those with OMH disorders. Table 2 also shows other factors significantly associated with the likelihood of 30-

Table 1
Description of study sample by mental health status (N = 43,817).

Demographic & Clinical Characteristics: n (%)	Serious Mental Illness n = 13,791 (31.5%)	Other MH disorder n = 10,340 (23.6%)	No MH disorder n = 19,686 (44.9%)	p value*
Male	4322 (31.3)	3566 (34.5)	8597 (43.7)	<0.001
Race				
White	8431 (61.1)	5738 (55.5)	7246 (36.8)	<0.001
Black	3601 (26.1)	2919 (28.2)	9168 (46.6)	
Hispanic	256 (1.9)	214 (2.1)	462 (2.3)	
Other	1503 (10.9)	1469 (14.2)	2810 (14.3)	
Age in years: Mean [SD;Median]	45 [12;47]	45 [13;48]	45 [14;48]	<0.001
Age > 48 years	6077 (44.1)	4982 (48.2)	9766 (49.6)	<0.001
Capitated/Managed Care	4176 (30.3)	3865 (37.4)	8292 (42.1)	<0.001
Medicaid Eligibility Due to Disability	10,670 (77.4)	7551 (73.0)	14,453 (73.4)	<0.001
Substance Abuse Diagnosis	2243 (16.3)	1127 (10.9)	855 (4.3)	<0.001
Index Admission Major Diagnostic Categories				
Respiratory System	2841 (20.6)	2249 (21.8)	3811 (19.4)	<0.001
Circulatory System	1945 (14.1)	1511 (13.9)	3225 (12.4)	<0.001
Digestive System	1951 (14.1)	1437 (13.9)	2439 (12.4)	<0.001
Nervous System	1705 (12.4)	1109 (10.7)	1660 (8.4)	<0.001
Endocrine/Metabolic	1087 (7.9)	699 (6.8)	1391 (7.1)	0.00
Kidney/Urinary Tract	946 (6.9)	690 (6.7)	1532 (7.8)	<0.001
Skin/Subcutaneous Tissue/Breast	795 (5.8)	594 (5.7)	1090 (5.5)	0.61
Other	2521 (18.3)	2051 (19.8)	4538 (23.1)	<0.001
Index hospitalization length of stay in days: Mean [SD; median]	3.6 [3.6;3]	3.9 [4.2;3]	3.8 [3.8;3]	<0.001
Index hospitalization >3 days	4765 (34.6)	3970 (38.4)	7552 (38.4)	<0.001
Charlson Comorbidity Index				
0	4495 (32.6)	3023 (29.2)	5694 (28.9)	<0.001
1	3610 (26.2)	2623 (25.4)	4997 (25.4)	
2+	5686 (41.2)	4694 (45.4)	8995 (45.7)	
Community Tenure, <90% of days	963 (7.0)	652 (6.3)	1165 (5.9)	<0.001

* chi-square or t-test.

Table 2
Adjusted and unadjusted odds ratios for 30-day readmissions by mental health status and other factors (N = 43,817).

Factors	Unadjusted OR (95% CI)	Unadjusted p-value	Adjusted ¹ OR (95% CI)	Adjusted p-value
Mental Health Status				
No mental health disorder	Reference	Reference	Reference	Reference
Other mental health disorder	1.20 (1.12–1.29)	<0.001	1.21 (1.12–1.30)	<0.001
Serious mental illness	1.42 (1.34–1.52)	<0.001	1.43 (1.32–1.51)	<0.001
Substance Abuse Diagnosis	1.61 (1.48–1.74)	<0.001	1.46 (1.34–1.59)	<0.001
Male	1.22 (1.15–1.29)	<0.001	1.12 (1.05–1.18)	<0.001
Race				
White	Reference		Reference	Reference
Black	0.98 (0.92–1.04)	0.47	0.98 (0.91–1.03)	0.33
Hispanic	0.92 (0.76–1.12)	0.41	1.08 (0.88–1.31)	0.49
Other	0.89 (0.82–0.98)	0.01	0.93 (0.85–1.02)	0.14
Age > 48 years	1.15 (1.09–1.22)	<0.001	1.00 (0.93–1.08)	0.91
Capitated/Managed Care	0.81 (0.76–0.86)	<0.001	0.96 (0.90–1.02)	0.19
Medicaid Eligibility Due to Disability	1.87 (1.74–2.01)	<0.001	1.69 (1.56–1.84)	<0.001
Index Hospitalization >3 days	1.51 (1.43–1.59)	<0.001	1.45 (1.37–1.53)	<0.001
Charlson Comorbidity Index				
0	Reference		Reference	
1	1.15 (1.06–1.24)	<0.001	0.94 (0.85–1.04)	0.25
2+	1.41 (1.32–1.51)	<0.001	1.26 (1.17–1.36)	<0.001

¹ Multivariable model also controls for major diagnostic category of index hospitalization.

day readmissions. In the adjusted model these included having a substance use diagnosis, being male, being disabled, having an index hospitalization longer than the median, and having a higher Charlson Comorbidity Index score.

3.3. Outpatient service use and mental health status

Use of any services and of specific types of outpatient services by mental health status group is shown in a table in the online supplement. This table also shows the proportions of users versus non-users of each type of service who had a 30-day readmission. Use of any outpatient medical services was more prevalent among those with SMI and OMH than those without mental health disorders (SMI = 88.2%, OMH = 88.4%, and no MH = 81.3%), including use of each specific type of service: office or clinic visit (SMI = 83.4%, OMH = 82.6%, and no MH = 72.4%), urgent care or emergency room visit (SMI = 23.7%, OMH = 19.8%, and no MH = 13.0%), home health visit (SMI = 14.5%, OMH = 13.8%, and no MH = 11.6%), laboratory/diagnostic tests (SMI = 63.6%, OMH = 61.2%, and no MH = 54.4%), and medical supplies or equipment (SMI = 38.7%, OMH = 39.5%, and no MH = 32.4%). Across the three mental health status groups, those who used any medical services had higher 30-day readmission rates than those who did not, with the most pronounced difference seen among those who did not have mental health disorders (16.0% vs 14.9% among those with SMI, 13.8% vs 13.6% for those with OMH, and 12.4% vs 8.9% for those without disorders). This pattern of higher rates of readmissions was seen among those who used *specific* services as well, with the difference in readmission status being greatest between those who did and did not use urgent care/emergency room services (19.8% vs 14.7% among those with SMI, 19.8% vs 12.3% for those with OMH, and 17.2% vs 10.9% for those without mental health disorders).

Examination of readmission status by use of outpatient mental health services revealed different patterns. First, much higher proportions of people with SMI used any mental health service (35.4%) than people with OMH disorders (5.9%) or no psychiatric disorders (1.6%). Use of specific outpatient mental health services was more common among those with SMI compared to those with OMH, including individual/group therapy (SMI = 31.3% and OMH = 3.9%), non-therapy mental health visit (SMI = 3.2% and OMH = 0.4%), psychiatric exam/testing (SMI = 4.0% and OMH = 0.6%), and case management services (SMI = 2.0% and OMH = 0.7%). In addition, patterns of use by readmission status were reversed from that seen with medical services; here, mental health service users had lower 30-day readmission rates than non-service users. Across both SMI and OMH groups, those who used any

mental health services had lower rates of 30-day readmissions than those who did not use any mental health services (10.7% vs 18.8% for those with SMI and 6.0% vs 14.3% for those with OMH). This pattern of lower rates of 30-day readmission among mental health service users compared to non-users was similar for individual/group therapy, psychiatric exam/testing, and case management services, and for the OMH group, use of non-therapy mental health services.

As with outpatient medical services, use of any outpatient pharmacy services was again more common among those with SMI and OMH than those without mental health disorders (SMI = 87.8%, OMH = 85.8%, and no MH = 77.7%), as was use of specific classes of medications, including psychotropic (SMI = 70.9%, OMH = 57.6% and no MH = 28.1%), other central nervous system (SMI = 56.8%, OMH = 54.6%, and no MH = 41.1%), cardiovascular (SMI = 42.1%, OMH = 42.4%, and no MH = 39.3%), hormones/synthetic substitutes (SMI = 37.8%, OMH = 36.6%, and no MH = 33.0%), autonomic (SMI = 35.1%, OMH = 31.2%, and no MH = 21.8%), anti-infective (SMI = 33.6%, OMH = 32.5%, and no MH = 28.3%), and gastrointestinal medications (SMI = 33.9%, OMH = 33.2%, and no MH = 23.7%). The use of psychotropic drugs by patients without mental illness was not unexpected, since these drugs are used to treat the effects of a wide variety of medical conditions, including Alzheimer’s disease, ADHD, sleep disorders, and Parkinson’s disease [36,37]. Psychotropic medications for those without mental illness in our sample included anticonvulsants, benzodiazepines, anxiolytics, sedatives, hypnotics, and miscellaneous CNS agents; moreover, these patients had diagnoses of nervous system or respiratory disorders for which these medications would have been indicated. Across the three mental health status groups, those who used any outpatient pharmacy services had lower 30-day readmission rates than those who did not (13.2% vs 35.7% among those with SMI, 11.0% vs 30.8% among those with OMH, and 9.6% vs 19.3% among those without MH). For the SMI and OMH groups, this difference was most pronounced between users and non-users of psychotropic medications (13.5% vs 21.7% among SMI and 11.3% vs 17.2% among OMH), but was also observed with other classes of medications as well, including cardiovascular agents (14.2% vs 17.2% among SMI and 10.8% vs 16.0% among OMH), hormones and synthetic substitutes (including treatments for diabetes) (15.1% vs 16.4% among SMI and 11.9% vs 14.9% among OMH), and autonomic drugs (including treatments for cardiovascular and respiratory conditions) (14.3% vs 16.8% among SMI and 12.5% vs 14.4% among OMH).

3.4. Outpatient service use and 30-day readmissions

Our second hypothesis was that use of outpatient services in the

Table 3

Relationship between outpatient services use in the 30 days post index hospitalization discharge and 30-day all-cause readmission among adults with serious mental illness (SMI $n = 13,791$), other mental disorders (OMH $n = 10,340$), and no mental disorders (No MH $n = 19,686$)¹.

Outpatient service use	30-day readmission			
	Main effects		Interaction terms	
	OR (95% CI)	<i>p</i> -value	OR (95% CI)	<i>p</i> -value
Medical services				
Any use (vs none)	1.45 (1.29–1.64)	<0.001	1.41 (1.25–1.60)	<0.001
SMI (vs no MH)	1.51 (1.38–1.65)	<0.001	1.49 (1.14–1.94)	0.003
OMH (vs no MH)	1.28 (1.16–1.41)	<0.001	1.55 (1.16–2.07)	0.003
Medical services*SMI	–	–	1.01 (0.77–1.34)	0.932
Medical services*OMH	–	–	0.81 (0.59–1.09)	0.164
Mental health services				
Any use (vs none)	0.50 (0.44–0.56)	<0.001	0.44 (0.34–0.57)	<0.001
SMI (vs no MH)	1.87 (1.70–2.05)	<0.001	1.85 (1.68–2.04)	<0.001
OMH (vs no MH)	1.33 (1.21–1.47)	<0.001	1.35 (1.22–1.49)	<0.001
Mental health services*SMI	–	–	0.95 (0.53–1.70)	0.870
Mental health services*OMH	–	–	0.57 (0.27–1.19)	0.133
Pharmacy services				
Any use (vs none)	0.38 (0.34–0.41)	<0.001	0.36 (0.33–0.39)	<0.001
SMI (vs no MH)	1.73 (1.58–1.90)	<0.001	2.35 (1.98–2.79)	<0.001
OMH (vs no MH)	1.43 (1.30–1.58)	<0.001	1.92 (1.60–2.31)	<0.001
Pharmacy services*SMI	–	–	0.65 (0.54–0.79)	<0.001
Pharmacy services*OMH	–	–	0.66 (0.53–0.81)	<0.001

¹ Adjusted logistic regression odds ratios associated with likelihood of 30-day readmission. Multivariable models adjust for age, gender, race, substance abuse, capitated managed care, disability status, index hospitalization diagnostic category, index hospitalization length of stay, Charlson Comorbidity Index, and community tenure.

month following discharge would be associated with lower likelihood of 30-day readmissions. Table 3 presents the results of two sets of multivariable logistic regression models testing, first, the relationship of outpatient service use and mental health status with 30-day readmission likelihood, adjusting for demographic features, clinical variables, Medicaid status, and community tenure. The second set of models included interaction terms for mental health status and service use, to test whether relationships between service use and readmission differed for those with SMI and OMH disorders. In the first model testing medical service use, those who received medical services were almost 1.5 times as likely as those who did not to be readmitted within 30 days. Readmission also was significantly more likely among those with SMI or OMH disorders compared to those without mental illness. The interaction of mental health status and outpatient medical service use was not significant, indicating that the greater likelihood of 30-day readmissions associated with medical service use did not differ by mental health status.

In the second model, those who received mental health services were about half as likely as those who did not receive mental health services to be readmitted within 30 days, and again, compared to those with no mental health disorder, people with SMI and OMH disorders were significantly more likely to be readmitted. The interaction of mental health status and mental health service use was not significant, indicating that the lower likelihood of readmissions associated with mental health services did not differ by mental health status.

In the third model, those who used outpatient pharmacy services were less than half as likely as those who did not to be readmitted within 30 days, and again, compared to those without mental health disorders, those with SMI and OMH disorders were significantly more likely to be readmitted within 30 days. In this model, the interaction of mental health status and pharmacy services was significant. We used the model coefficients to investigate the conditional effects of the interaction and found that, compared to SMI and OMH groups and those who did not receive pharmacy services, those without mental health disorders who

received pharmacy services had the lowest likelihood of readmission. SMI and OMH groups receiving pharmacy services were still at greater risk of readmission than those without mental health disorders, although the magnitude of the likelihood was reduced compared to the SMI and OMH groups who did not receive pharmacy services.

In a final set of multivariable analyses presented in the online supplement, we examined associations between outpatient *service intensity* and 30-day readmission, controlling for the same covariates used in previous models, stratified by mental health status. Turning first to intensity of *medical* service use, among those with SMI and OMH, compared to no medical services, the group with the lowest intensity of outpatient medical services was significantly more likely to have 30-day readmissions, although this relationship was not significant for those with higher intensity medical services. Among those without mental health disorders, both low and high intensity outpatient medical services were associated with greater likelihood of 30-day readmissions.

Regarding intensity of outpatient *mental health* service use, and restricting the analysis to those with SMI or OMH disorders, both low and high intensity mental health service use were associated with significantly lower odds of readmission for both groups, compared to non-use. The magnitude of this effect was larger for the high intensity mental health services group compared to the lower intensity group.

Turning last to intensity of use of *pharmacy* services, across all three mental health status groups, both low and high intensity pharmacy services were associated with lower likelihood of 30-day readmissions. As with mental health services, the magnitude of the effect was larger for the high intensity pharmacy services group compared to the lower intensity group.

A final supplementary analysis addressed the question of whether the inverse association between mental health service use and 30-day readmissions might be due to greater use by those who were physically healthier at discharge. Measures of health included: length of the index hospitalization; cost of the index hospitalization; being discharged to home health care versus no home health assistance; and Medicaid

eligibility due to having a disability rather than low income. The first three measures were not related to variations in mental health service use, and disability status was positively and significantly related to receiving mental health care ($p < .05$). These findings suggest that health at discharge did not account for use of mental health services.

4. Discussion

4.1. Main findings

This analysis confirmed our first hypothesis that those with SMI and with OMH disorders would have significantly greater odds of 30-day readmissions following medical hospitalizations than those with no mental illness, and that these differences would persist despite controlling for potentially confounding factors identified in prior studies. While most previous research has focused on Medicare or privately insured populations, our study is the largest and only multi-state study of working-age Medicaid beneficiaries to address this topic to date. It is also the first to document that milder forms of mental illness also are associated with 30-day readmission, in addition to more severe forms of psychiatric disorders.

We hypothesized that post-discharge outpatient care would be protective against 30-day readmission, and found that outpatient mental health care was consistently associated with lower likelihood of readmission, even controlling for factors such as length of hospitalization, comorbid conditions, being disabled, substance abuse, managed care, age, gender, race, index hospitalization diagnostic category, and community tenure. There are a number of reasons why engagement in mental health care by adults with mental illness might lower the likelihood of 30-day readmissions. One reason is that those whose mental health needs are being addressed may be more emotionally stable and therefore better able to understand and follow-through with treatment regimens for their physical health conditions [38,39]. Another reason is that people receiving outpatient mental health care may feel more supported and encouraged to be active participants in their medical care, leading to more investment in receiving services [40,41]. Still another reason is that some patients' mental health care providers may have engaged in care coordination activities that fostered better communication between medical and mental health providers, resulting in more integrated care that led to better medical outcomes and an associated lower likelihood of readmission [42]. However, an alternate explanation should also be acknowledged, which is that those who were healthier at discharge may have been more able to access and engage in mental health services.

The same potentially protective effect observed with outpatient *mental health* services after discharge was not found with outpatient *medical* services. One reason is that medical service use may be a proxy for greater illness severity. For example, Pourat and colleagues [43] found that among low-income adult patients with any behavioral health disorder discharged from medical hospitalizations, higher severity of medical illness increased the probability of an outpatient medical visit in the 15 days following hospital discharge, and also the probability of 30-day readmission. Another possibility is that patients with mental illness had undiagnosed comorbidities that contributed to post-hospital deterioration requiring outpatient medical care or rehospitalization. Prior research has confirmed a high rate of undiagnosed chronic medical conditions among people with SMI [44,45]. A study of acute general hospital admissions found that the records of patients with SMI were more likely to contain non-specific diagnostic categories than records of patients without mental illness; the authors speculated that misinterpretation of patient complaints as psychosomatic may have led to delayed recognition of comorbid medical conditions [46]. This also may account for our finding that those with SMI had lower comorbidity scores than patients without mental illness. We found that while any outpatient medical services increased the likelihood of 30-day readmissions for people with SMI and OMH, this risk did not increase with

greater intensity of medical services, which may reflect the high prevalence of service use among those with SMI and OMH. This is supported by prior studies finding that people with SMI who are engaged in care have greater numbers of outpatient medical visits than others regardless of comorbid condition or severity [47], and that less severe mental health disorders also are associated with high utilization of healthcare services [48].

Another noteworthy finding was the relatively low level of outpatient behavioral health service utilization we observed. Only around a third of people with SMI in our study population (35%) received mental health services, with only about 6% of those with OMH disorders receiving mental health care. It is possible that patients were unable to obtain an appointment for mental health services within 30 days of discharge due to long waiting lists [49], or were unable to find a behavioral healthcare provider due to the severe mental health workforce shortage in the U.S. [50] Other patients may not have kept their scheduled appointments for mental health care given high rates of missed visits especially among those with SMI [51,52].

Given the potentially protective role of mental health services, increasing their utilization in this group could have a significant impact on lowering readmissions. This can be done through models such as behavioral health homes that integrate medical and mental health services to improve physical health outcomes among people with SMI [53,54]. We also found that increasing intensity of mental health services appeared to magnify the protective effect against hospital readmissions for patients with SMI. This suggests that meeting the more intensive and complex needs of some patients with SMI with an adequate volume of mental health services may further prevent 30-day readmissions.

Another outpatient service frequently used by patients with SMI and OMH and associated with lower odds of 30-day readmission was pharmacy services. This finding is especially important given evidence that some primary care providers hesitate to prescribe medications for chronic medical conditions to patients with SMI due to concerns about non-compliance [55]. This is so even given studies showing that medication adherence is not poorer among patients with SMI and co-occurring chronic conditions such as hypertension and diabetes [56,57] compared to patients without mental illness. Remedies such as more coordinated prescribing practices, enhanced communication between patients and providers, and adequate refill periods for both psychotropic and non-psychotropic agents have been suggested to promote effective medication usage in this group [57]. More research is needed on this topic.

4.2. Limitations

One limitation of the study is that the Medicaid enrollees in the Truven data are a non-random subsample of all enrollees from multiple states, and their geographic region is unknown. However, the sample is sizeable and includes at least 10% of the total population of working age, non-dually eligible adults on Medicaid in multiple states [32]. Second, administrative claims data may be incomplete, although the Truven data undergo cleaning and quality assurance checks and use fully paid and adjudicated claims. Another weakness is our inability to infer cause and effect from our analysis, and the fact that our data come from 2011. Finally, we did not adjust for multiple comparisons in this study. Despite these limitations, our results provide the strongest evidence to date of the association of SMI and OMH disorders with 30-day readmission following medical hospitalization among working-age adults, and the first evidence of the potential role of outpatient mental health services in preventing readmissions.

4.3. Conclusions

In this large, multi-state population of low-income, working-age adults covered by Medicaid, we found that people with both severe and

less severe forms of mental illness are more likely to experience 30-day readmissions after discharge from a medical hospitalization. We also found evidence suggesting that engagement in outpatient mental health care may be a means to curtail avoidable rehospitalizations for those with mental health disorders. Further research on specific types, settings, and amounts of outpatient mental health and other services is needed to develop post-hospital transition interventions that meet a wide range of behavioral health and medical needs.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.genhosppsych.2021.02.004>.

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