Influence of psychiatric comorbidity on 30-day readmissions for heart failure, myocardial infarction, and pneumonia

Brian K. Ahmedani, PhD, MSW,
Henry Ford Health System

Leif I. Solberg, MD,
HealthPartners

Laurel Copeland, PhD,
Scott & White Healthcare

Ying Fang, MPH,
Scott & White Healthcare

Christine Stewart, PhD,
Group Health Cooperative

Jianhui Hu, PhD,
Henry Ford Health System

David R. Nerenz, PhD,
Henry Ford Health System

L. Keoki Williams, MD, MPH,
Henry Ford Health System

Andrea E. Cassidy-Bushrow, PhD,
Henry Ford Health System

Jeanette Waxmonsky, PhD,
University of Colorado, Denver

Christine Y. Lu, PhD,
Harvard Pilgrim Health Care and Harvard Medical School

Beth E. Waitzfelder, PhD,
Kaiser Permanente Hawaii

Ashli A. Owen-Smith, PhD,
Kaiser Permanente Georgia

Karen J. Coleman, PhD,
Kaiser Permanente Southern California

Frances L. Lynch, PhD,

Corresponding Author: Brian K. Ahmedani, PhD, Henry Ford Health System, Center for Health Policy & Health Services Research, 1 Ford Place, Suite 3A, Detroit, Michigan 48202, bahmeda1@hfhs.org / Phone: (313) 874-5485 / Fax: (313) 874-7137.

Kaiser Permanente Northwest

Ameena T. Ahmed, MD,
Kaiser Permanente Northern California

Arne L. Beck, PhD,
Kaiser Permanente Colorado

Rebecca C. Rossom, MD, MSCR, and
HealthPartners

Gregory E. Simon, MD, MPH
Group Health Cooperative

Abstract

Objective—The Centers for Medicare and Medicaid Services (CMS) implemented a policy in 2012 that penalizes hospitals for 'excessive' all-cause hospital readmissions within 30 days after discharge for heart failure (HF), acute myocardial infarction (AMI), and pneumonia. The aim of this study is to investigate the influence of psychiatric comorbidities on 30-day all-cause readmissions for heart failure, acute myocardial infarction, and pneumonia.

Methods—Longitudinal study from 2009-2011 within 11 Mental Health Research Network (MHRN) affiliated health systems. Data were derived from the HMO Research Network Virtual Data Warehouse. Participants were individuals admitted to the hospital for HF, AMI, and pneumonia. All index inpatient hospitalizations for HF, AMI and pneumonia were captured (n=160,169 patient index admissions). Psychiatric diagnoses were measured for the year prior to admission. All-cause readmissions within 30 days of discharge were the outcome variable.

Results—Approximately 18% of all individuals with these conditions were readmitted within 30-days. The rate was 5% greater for individuals with a past-year psychiatric comorbidity (21.7%) than for those without (16.5%; $p<.001$). Depression, anxiety, and dementia were associated with more readmissions for those with index hospitalizations for all three conditions independently and combined ($p<.05$). Substance use and bipolar disorders were linked with higher readmissions for those with initial HF and pneumonia hospitalizations ($p<.05$). Readmission rates declined overall from 2009-2011.

Conclusions—Individuals with HF, AMI, and pneumonia experience high rates of readmission, but psychiatric comorbidities appear to increase that risk. Future readmission interventions should consider adding mental health components.

Keywords

CMS; Hospital Readmission; Mental Health; Heart Failure; Myocardial Infarction; Pneumonia

Introduction

Hospital readmissions account for a large proportion of healthcare spending in the United States (US), including over 17 billion dollars of Medicare costs annually.(1) In an effort to curb rising healthcare costs and simultaneously improve quality, the Centers for Medicare

and Medicaid Services (CMS) implemented a new policy as part of the Affordable Care Act that ties levels of health care reimbursement to hospital readmission rates.(2) Beginning in October 1, 2012 (Fiscal Year 2013), hospitals with excessive all-cause re-hospitalizations within 30 days of discharge from an index admission for heart failure (HF), acute myocardial infarction (AMI), or pneumonia will be penalized by a reduction in payment from CMS.(3, 4) These three general medical conditions are initially targeted, since they are expensive, common, and frequently result in readmission.(5-8) However, over time, the list of conditions subject to CMS' readmission payment policy will likely expand to include all diagnoses.(9)

The current policy and the possibility of impending expansion to other conditions make 30-day hospital readmissions a major concern for hospitals across the nation.(10) Thus, developing effective interventions to reduce readmission is essential to avoid penalties and to improve the quality of care. A primary question is how to target interventions to provide the greatest reduction in readmissions at the lowest cost. Since psychiatric conditions are highly comorbid with the CMS-targeted conditions as well as many other chronic medical conditions, and since they are known to complicate the care for those conditions, they may represent an efficient place to focus interventions. Previous studies, using small, localized samples have reported varying levels of association between various mental health comorbidities and 30-day hospital readmissions for general medical conditions, including those conditions targeted by CMS' policy.(11-13) For example, a recent study of 84 patients with congestive heart failure found that both cognitive impairment and a history of mental health conditions were associated with higher rates of 30-day readmissions.(12) On the other hand, a single-site study of nearly 7,000 patients who were admitted to the hospital for any general medical condition showed that anxiety and substance abuse comorbidities were associated with fewer 30-day readmissions, while there was no relationship between other psychiatric comorbidities and all-cause readmission risk.(11) These two single-site studies report conflicting results. Thus, the extent to which psychiatric comorbidities influence the likelihood of readmission for HF, AMI, and pneumonia is unclear. This collaborative, multi-site study addresses the aforementioned gap by investigating whether comorbid mental illnesses (in combination and by diagnostic category) influence 30-day hospital readmission rates in a national sample of 11 large health care delivery systems, including more than 160,000 index hospitalizations for HF, AMI, or pneumonia.

Methods

This study was conducted within the Mental Health Research Network (MHRN), a consortium of 11 large health care systems with affiliated health insurance plans. These systems are part of the larger HMO Research Network (HMORN), which includes 17 US-based health system members. The MHRN systems serve over 11 million individuals across 11 states with diverse populations. These sites and their primary locations include: Group Health Cooperative (Washington), Harvard Pilgrim Health Care (Massachusetts), HealthPartners (Minnesota), Henry Ford Health System (Michigan), Kaiser Permanente Colorado, Kaiser Permanente Georgia, Kaiser Permanente Hawaii, Kaiser Permanente Northern California, Kaiser Permanente Northwest (Oregon), Kaiser Permanente Southern

California, and Scott & White Healthcare (Texas). Institutional Review Boards at each site approved data use for this project.

Each participating site maintains an HMO Research Network Virtual Data Warehouse (VDW), which consists of both electronic medical record and insurance claims data for their health plan patients.(14, 15) Data on encounters, pharmacy fills, diagnoses, procedures, medical tests, demographics, costs and other healthcare information are organized using standardized definitions across sites and are quality checked locally. Data for this project were extracted from the local VDW at each site using a common programmatic code distributed across sites.

In the current study, the sample included all health plan patients with an index inpatient hospitalization for HF, AMI, or pneumonia between January 2009 and December 2011 at all of the participating health systems. Continuous enrollment in the health plan for the 12-month period prior to admission and the 30 day period after admission was required for inclusion. On average, approximately 85% of members maintain enrollment for at least 12-months, ranging between 79-90% at different sites. Thus, a portion of the population was excluded from the analysis as they were not continuously enrolled for the full period. In total, there were 160,169 index patient admissions that met eligibility criteria for the sample.

Individuals admitted to hospitals with any of the three main general medical conditions were identified using the same International Classification of Diseases, 9th Revision codes used by CMS to calculate admission and readmission.(2, 4, 16) We also pooled these diagnoses into a 'combined' group of individuals with any of these conditions. Data were extracted if individuals had one of these conditions listed as an inpatient discharge diagnosis. Consistent with the CMS policy, each admission >30 days following a prior admission is counted as a new index admission. Thus, some individuals have multiple index admissions and are represented in multiple disease groups. Psychiatric comorbidities were also identified by ICD-9 codes.(16) Individuals were counted as having a psychiatric condition if two diagnoses for the same condition were observed in any setting (emergency, inpatient, outpatient) during the 12 month period prior to and including the inpatient discharge date. For individuals with index hospital admissions in 2009, prior-year data were calculated dating back into 2008. Psychiatric conditions were grouped into the following categories: Anxiety disorders (300.00-300.02, 300.21- 300.24, 300.3, 309.21, 309.24, 309.81), bipolar disorders (296.00-296.06, 296.40-296.89, 301.13), dementia (290.xx, 780.93), depressive disorders (296.20-296.36, 300.4, 309.0, 309.28, 311), schizophrenia disorders (295.xx), other psychoses (297.1, 297.3, 298.8-298.9, 301.20-301.22), and substance use disorders (e.g., alcohol or other drug use; 291.xx, 292.xx, 303,xx, 305.xx). These conditions were all included in this group as they are all considered mental disorders in the ICD-9. Individuals with any of these conditions were pooled together into a category for 'any psychiatric diagnosis'.

A 30-day readmission was defined as any admission for any reason to any hospital within and including 30 days after discharge from the initial index hospitalization for HF, AMI, or pneumonia. Following CMS' policy, planned readmissions for revascularizations among patients with AMI were not counted as readmissions.(3)

Demographic information on age, sex, race/ethnicity, and insurance type were available from the VDW. Estimated household income and education levels were calculated using patient addresses and local neighborhood census data.

Statistical analyses began with aggregated descriptive characteristics of the study sample. Then, mean-readmission rates were calculated by dividing the number of readmissions by the total number of index hospitalizations within each diagnostic subgroup. Readmission rates were calculated for all individuals as well as for those with no psychiatric diagnosis, any psychiatric diagnosis, and specific psychiatric diagnosis categories as described above for each of the three CMS-targeted conditions separately and combined. Chi-squared tests were used to compare rates of readmission among those with and without psychiatric comorbidity. Odds ratios were included for relationships between any psychiatric comorbidity and readmission to indicate strength of association. Finally, annual trends in 30-day readmission rates were calculated between 2009 and 2011 for individuals with and without psychiatric comorbidity.

Results

As shown in Table 1, there were 160,169 index hospitalizations for HF, AMI, or pneumonia from 2009-2011 across all 11 sites. The majority of the sample was male (53.1%; n=85,117), non-Hispanic white (62.1%; n=99,433), over 65 years old (63.2%; n=101,206), and had health care coverage through a Medicare advantage product (67%; n=107,273). Individuals in the study sample most often lived in neighborhoods where the median income was over $40,000 per year (77%; n=123,264) and less than 25% were college graduates (54%; n=86,559). Overall, 55.8% of the patient hospital admissions were for HF (n=89,406), while 21.5% were for AMI (n=34,515) and 45.2% for pneumonia (n=72,438). Among these individuals, 22.5% were admitted at different points for more than one of these conditions. Also, 29.4% of the total sample had a psychiatric condition (n=47,140), with depression (15.8%; n=25,301), substance use disorder (11.3%; n=18,160), and anxiety (7.1%; n=11,400) as the most commonly diagnosed.

Table 2 shows 30-day hospital readmission rates for individuals with index hospitalizations for HF, AMI, or pneumonia, with or without psychiatric comorbidities. All-cause readmission was most common after index hospitalizations for HF (20.1%), as compared with AMI (9.9%) and pneumonia (17.5%). In combination, all-cause readmissions occurred 18.1% of the time overall, including rates of 21.7% for individuals with any psychiatric diagnosis in the past year vs. 16.5% for those with no psychiatric comorbidity, which varied significantly (X^2 = 602.5, df=1, p<.001, OR = 1.4). Similarly, for individuals originally admitted for any of the three conditions independently, those with any psychiatric comorbidity had higher rates of readmission than individuals with none (*HF*: 22.9% vs. 19%, X^2 = 175.2, df=1, p<.001, OR = 1.4; *AMI*: 12.1% vs. 9.2%, X^2 = 60.2, df=1, p<.001, OR = 1.4; and Pneumonia: 20.2% vs. 16.2%, X^2 = 180.8, df=1, p<.001, OR = 1.3). Compared with individuals without any psychiatric comorbidity, those with comorbid anxiety, dementia, and depression were significantly associated with increased 30-day all-cause readmissions (p<.05). Schizophrenia was not associated with higher numbers of readmissions for individuals with an index hospitalization for HF, AMI, or pneumonia,

separately (*p*>.05). However, the subgroup sample size was insufficient. Bipolar and substance use disorders were not associated with increased readmissions for those originally admitted for AMI (*p*>.05). Data were insufficient to test for differences among individuals with 'other psychoses' and AMI. Otherwise, the remaining psychiatric diagnosis subcategories were all associated with an increase in 30-day all-cause readmissions as compared to those without any mental health comorbidity (*p*<.05).

Figure 1 shows changes in aggregated 30-day readmissions rates for individuals with HF, AMI, or pneumonia both with and without any psychiatric comorbidity, by year (2009-2011). Rates for both those with and without psychiatric comorbidities trended downward over the three-year period. For those with any psychiatric diagnosis, rates fell from 24.3% in 2009 to 21.3% in 2010 and 18.3% in 2011. Similarly, 30-day readmission rates for those without a mental health condition were 18.3%, 16.5%, and 14.2% in 2009, 2010, and 2011, respectively. The annual readmissions gap between those with and without psychiatric comorbidities converged during the study period from 6.0% in 2009 to 4.1% in 2011.

Discussion

This study represents the largest and most diverse investigation of the contribution of psychiatric illness to 30-day hospital readmission rates for patients with original admissions for heart failure, acute myocardial infarction, or pneumonia in the US general healthcare population. Previous studies, using smaller, single-site samples have reported varying results,(11, 12) but the current study of over 160,000 patient index admissions for HF, AMI, or pneumonia found that individuals with psychiatric comorbidities in the previous year were readmitted to the hospital within 30-days 3-5% more often than those without a psychiatric diagnosis (21.7% vs. 16.5%, overall; Relative Risk = 1.32). In total, findings from this study suggest that psychiatric comorbidities influence 30-day all-cause readmission rates for individuals with HF, AMI, and pneumonia.

Perhaps even more troubling is the large proportion of individuals with mental health comorbidities in the sample. Nearly 30% of individuals admitted to the hospital with HF, AMI, or pneumonia were diagnosed with a mental health condition in the year prior to the index hospitalization. This number is greater than the 26% of general population members who reported mental health conditions in the past year on national surveys.(17) Most importantly, the proportion of HF, AMI, and pneumonia-afflicted individuals who were admitted to the hospital and also had a psychiatric concern is likely much higher considering that mental health conditions are often not diagnosed,(18) and therefore their illnesses would not be captured in medical records. However, individuals with a diagnosis likely had more severe symptoms, which may have increased the likelihood of readmission. Similarly, it would be interesting to understand whether receipt of different outpatient mental health or medical treatments impacted readmissions. However, those who received treatment likely had more severe conditions, so this relationship cannot be assessed without controlling for severity. Thus, for several reasons, more research is needed to understand the influence of severity of illness on readmissions.

This study is particularly important when considering interventions to reduce readmissions for individuals with HF, AMI, and pneumonia. In a recent paper, Burke and Coleman reported 5 important principles to consider when designing readmissions interventions.(19) The last of these principles is to broaden interventions to specifically target high-risk groups, such as individuals with psychiatric disease.(19) Given the increased risk for readmission among individuals with psychiatric comorbidities, and the large proportion of individuals with these conditions, it suggests that health system interventions to prevent 30-day all-cause hospital readmissions should consider adding elements of mental health assessment, diagnosis, monitoring, and treatment. Unfortunately, while numerous interventions have been developed to reduce readmissions for individuals with HF, AMI, and pneumonia, (20-22) there are very few that include specific mental health content.(19) However, some interventions have been developed to alleviate mental health and medical comorbidities in general.(23) We may draw knowledge from these studies when focusing interventions to reduce readmissions.

While beyond the scope of the results, clinical recommendations are that future readmissions-focused interventions consider adding mental health components. For example, these components may include psychiatric screening and assessment, multi-condition discharge planning, and mental health specific follow-up. The first step in this process is identification, including screening and assessment.(24-28) Screening for mental health can be accomplished using a battery of brief instruments.(29-31) Since depression, anxiety, and substance use appear to be most common in this study, and each is associated with increased readmission rates, these may be the focus of primary screening.

Previous studies also demonstrate dramatically lower rates of readmission after psychiatric hospitalization when individuals receive discharge planning and attend outpatient specialty treatment.(32, 33) A health care provider can assist with coordinating follow-up appointments, monitoring both conditions, and supporting individuals regarding their psychosocial and environmental concerns. This is particularly important for individuals with mental health concerns, who are more likely to miss follow-up appointments.(34) Part of this process may involve improving health literacy, which is traditionally low for individuals with mental health conditions.(35) This can include a brief assessment of the patient's understanding of discharge instructions and postoperative self-care.(36, 37)

While data in this study indicate that the gap between those with and without psychiatric comorbidities appears to be shrinking, the rates are unlikely to converge without specially designed interventions for both conditions.(19) It is promising that health systems appear to be able to reduce overall readmissions, especially given the high cost of hospitalizations. For example, the average heart failure related hospitalization is estimated to be around $25,000. (38) The declining rates from 2009-2011 are likely due to increased efforts to reduce readmissions in response to impending CMS policy changes, which began in 2012.(4) It is estimated that well-designed, multiple condition focused interventions may be even more effective at reducing readmission rates, thereby improving the quality and cost of care and mitigating hefty CMS penalties of up to 1-2% for healthcare systems.

This study has several limitations. First, all of the participating health systems are well-resourced and have affiliated health plans. This combination may provide improved care coordination, and thus represent lower overall rates of mental health and readmissions than in other settings. Second, while this study presents data on a large national sample, the participating hospitals did not cover every geographic region in the US, and may not be representative of poor or uninsured community populations Third, while nearly all health care is captured by the combination of systems (health plan and health system), utilization that occurred outside of the health system, and was not reimbursed by the affiliated health plan may have been missed. Although these visits are typically large expenses, so the extent of this issue is likely very low. Fourth, it is not possible to disentangle the relationship between many mental health conditions and severity of medical illness, but that relationship is almost certainly bi-directional (e.g., depression can lead to worsening of heart disease and more severe heart disease can contribute to depression). Future research may seek to clarify the important relationship between these variables. Fifth, we were not able to assess whether hospitalizations (e.g., difference in length of stay) and/or post-hospitalizations (e.g., drug interaction concerns) were more difficult for individuals with mental health conditions or whether having multiple, comorbid psychiatric conditions may have exacerbated their illnesses. Sixth, our ability to capture admissions for HF, AMI and pneumonia and comorbid psychiatric conditions was limited to the diagnostic codes entered by clinicians at inpatient and outpatient encounters in each healthcare system. Thus, we were not able to assess 1) diagnoses that were present, but were not coded and 2) severity of disease. Seventh, we were not able to present site-specific data in this study. However, the data were consistent across sites. Thus, the results of this study were not likely influenced by abnormal rates at a small number of sites. Finally, the data for this study included aggregated counts collected from all the sites, and thus we were not able to perform additional stratified and adjusted analyses that may have shed more light on the relationships. It is possible that there are differences in readmission rates by demographics and diagnostic characteristics. Future research may consider additional investigation along these lines.

Overall, this study demonstrates that mental health comorbidities are associated with 30-day all-cause readmissions for individuals with index hospitalizations for HF, AMI, and pneumonia. The large proportion of individuals with HF, AMI, or pneumonia and psychiatric comorbidities suggests that comprehensive multiple condition interventions may be necessary. By implementing more comprehensive interventions and/or by targeting higher risk individuals, the long-term goal is to improve the quality and cost of health care, and mitigate the risk for hospital penalties for excessive readmissions.

Acknowledgments

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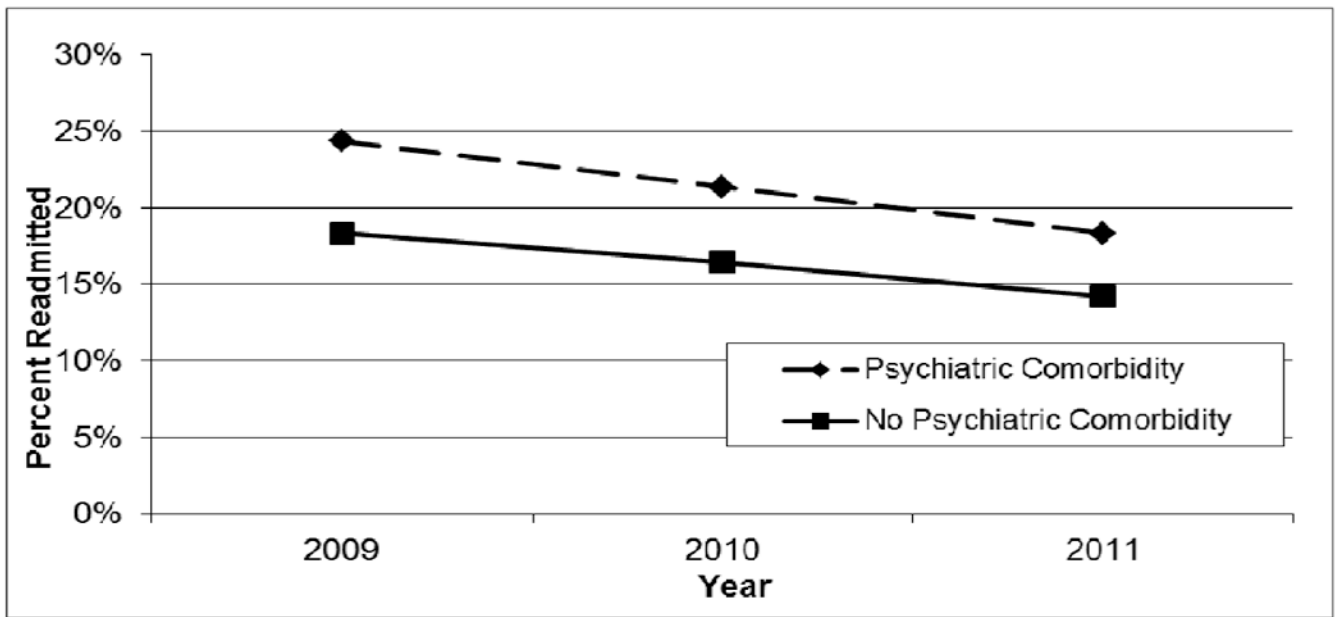
Figure 1. 3-year trend in 30-day all-cause hospital readmissions for CHF, MI, and pneumonia combined with or without any psychiatric comorbidity

Table 1

Descriptive characteristics of the sample

	n	%
Total	160,169	
Sex		
Female	75,052	46.9%
Male	85,117	53.1%
Race/Ethnicity		
White, Non-Hispanic	99,433	62.1%
Black, Non-Hispanic	16,166	10.1%
Hispanic	20,186	12.6%
Asian	10,517	6.6%
American Indian / Alaska Native	391	0.2%
Native Hawaiian / Pacific Islander	949	0.6%
Multiple Races	2,761	1.7%
Unknown	9,761	6.1%
Age		
18-39	6,678	4.2%
40-64	52,285	32.6%
65+	101,206	63.2%
Insurance Type		
Any Medicaid	3,101	1.9%
Any Medicare	107,273	67.0%
Commercial only	46,559	29.1%
Self-pay only	676	0.4%
Other	2,552	1.6%
Neighborhood Median Income		
<$40,000/year	36,905	23.0%
$40,000/year	123,264	77.0%
Neighborhood Education		
<25% college graduates	86,559	54.0%
25% college graduates	73,610	46.0%

Table 2

30-day all-cause hospital readmission rates

	Heart Failure			Acute Myocardial Infarction			Pneumonia			Combined		
	Total N	n, Readmitted	% Readmitted	Total N	n, Readmitted	% Readmitted	Total N	n, Readmitted	% Readmitted	Total N	n, Readmitted	% Readmitted
All Individuals	89,406	17,948	20.1	34,515	3,427	9.9	72,438	12,684	17.5	160,169	28,914	18.1
No Psychiatric Diagnosis	64,240	12,183	19.0	25,975	2,393	9.2	48,893	7,917	16.2	113,029	18,684	16.5
Any Psychiatric Diagnosis	25,166	5,765 **	22.9	8,540	1,034 **	12.1	23,545	4,767 **	20.2	47,140	10,230 **	21.7
Anxiety	5,771	1,376 **	23.8	1,765	257 **	14.6	6,039	1,286 **	21.3	11,400	2,692 **	23.6
Bipolar	696	158 **	22.7	194	19	9.8	1,020	192 **	18.8	1,644	348 **	21.2
Dementia	710	192 **	27.0	150	24 **	16	601	153 **	25.5	1,191	352 **	29.6
Depressive	14,280	3,365 **	23.6	3,683	555 **	15.1	12,843	2,694 **	21	25,301	5,873 **	23.2
Other Psychosis	502	143 **	28.5	N/A	N/A	N/A	460	121 **	26.3	885	269 **	30.4
Schizophrenia	257	51	19.8	48	7	14.6	346	57	16.5	588	124 **	21.1
Substance Use	8,368	1,850 **	22.1	4,181	390	9.3	9,293	1,910 **	20.6	18,160	3,731 **	20.5

** Number of people readmitted for strata compared with no psychiatric diagnosis is statistically significant using chi-square test (p<.05).