American Journal of Medical Quality

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On behalf of:

American College of Medical Quality

Serious Mental Illness and Acute Hospital Readmission in Diabetic Patients

Jennifer S. Albrecht, BA,[1] Jon Mark Hirshon, MD, MPH, PhD,[1] Richard Goldberg, PhD,[1,2] Patricia Langenberg, PhD,[1] Hannah R. Day, PhD,[1] Daniel J. Morgan, MD,[1,2] Angela C. Comer, MPH,[1] Anthony D. Harris, MD, MPH,[1] and Jon P. Furuno, PhD[1,3]

Abstract

Patients with serious mental illness (SMI), particularly those with other chronic illnesses, may be vulnerable to unplanned hospital readmission. The authors hypothesized that SMI would be associated with increased 30-day hospital readmission in a cohort of adult patients with comorbid diabetes admitted to a tertiary care facility from 2005 to 2009. SMI was defined by *International Classification of Diseases, Ninth Revision*, discharge diagnosis codes for schizophrenia, schizoaffective, bipolar, manic, or major depressive disorders, or other psychosis. The primary outcome was 30-day readmission to the index hospital. Among 26 878 eligible admissions, the prevalence of SMI was 6% and the incidence of 30-day hospital admission was 16%. Among patients aged <35 years, SMI was significantly associated with decreased odds of 30-day hospital readmission (odds ratio [OR] = 0.39; 95% confidence interval [CI] = 0.17, 0.91). However, among patients ≥35 years, SMI was not significantly associated with 30-day hospital readmission (OR = 1.11; 95% CI = 0.86, 1.42). SMI may not be associated with increased odds of 30-day hospital readmission in this population.

Keywords

SMI, hospital readmission, diabetes, health services outcomes

Unplanned hospital readmission is a common but potentially preventable health care outcome and quality indicator associated with considerable health care costs.[1,2] Furthermore, Medicare Payment Advisory Commission guidelines now recommend reducing reimbursements to hospitals with higher-than-average 30-day readmission rates.[2] Although previous studies have identified patient characteristics (eg, older age, longer length of hospital stay, higher Charlson comorbidity index score) associated with hospital readmission, for the most part, knowledge of these risk factors has not translated into successful interventions to reduce the incidence of readmission.[1,3-6]

Serious mental illness (SMI) may represent a better target for intervention if associated with hospital readmission. SMI, which includes schizophrenia and bipolar disorder, is associated with decreased capacity for self-care, lack of access to medical care, and poorer quality of care received, all of which may be associated with hospital readmission.[7-9] Furthermore, whereas many previously identified risk factors of hospital readmission are nonmodifiable patient factors, patients with SMI potentially could be targeted for readmission-reducing interventions, including intensified case management.

The authors hypothesized that SMI would be associated with increased risk of 30-day hospital readmission. They tested this hypothesis in a cohort of adult patients with diabetes because these patients often require considerable self-maintenance post hospital discharge. Previous research has suggested that patients with diabetes and SMI

[1]University of Maryland School of Medicine, Baltimore, MD
[2]VA Capitol Health Care Network (VISN 5) Mental Illness Research, Education, and Clinical Center, Baltimore, MD
[3]Oregon State University/Oregon Health and Science University College of Pharmacy, Portland, OR

Corresponding Author:
Jennifer S. Albrecht, Department of Epidemiology and Public Health, University of Maryland School of Medicine, 685 W Baltimore St, MSTF-Room 360A, Baltimore, MD 21201
Email: jalbr003@umaryland.edu

may receive lower quality of care for their diabetes than patients without SMI, thereby placing them at increased risk for hospital readmission.[10,11] To the authors knowledge, the impact of SMI on hospital readmission has not been assessed in this patient population. As a secondary objective, they aimed to identify other factors associated with 30-day hospital readmissions for this patient population.

Methods

The authors conducted a retrospective cohort study that included all adult (≥18 years of age) admissions with diabetes to the University of Maryland Medical Center (UMMC) between February 1, 2005, and January 31, 2009. UMMC is a 656-bed, urban, tertiary care referral center in Baltimore, Maryland. An admission of a patient with diabetes was defined as an admission with *International Classification of Diseases, Ninth Revision* (ICD-9) code 250.xx included as a discharge diagnosis. Patients admitted to UMMC receive a primary diagnosis, designating the primary reason for admission, as well as up to 15 additional codes for contributing or comorbid conditions. Data were collected from the UMMC Clinical Data Repository, a relational database that included patients' administrative, demographic, and outcome data, that has been used extensively in published epidemiological studies.[12,13] In addition, a random sample of 50 adult admissions with diabetes identified in the Clinical Data Repository was validated against the patients' medical records for this study. This validation study suggested that study data had positive and negative predictive values exceeding 90%.

The primary exposure variable of interest was a co-occurring diagnosis of SMI, as defined by the presence of the following ICD-9 codes: schizophrenia and schizoaffective disorders (295.0x-295.4x, 295.6x, 295.7x, and 295.9x), bipolar and manic disorders (296.0x, 296.1x, 296.4x-296.7x, 296.80, 296.81, and 296.89), major depressive disorder (296.24 and 296.34), and other psychoses (297.1x, 298.0x-298.4x, 298.8x, and 298.9x).

The study outcome was hospital readmission to the index facility (ie, UMMC) within 30 days of discharge. Therefore, patients who died during their index hospitalization were excluded because they were no longer at risk of readmission. In addition, readmissions that occurred less than 24 hours after discharge were excluded from the index admission to account for transfer between services within the hospital that may have been registered as separate admission events in the database. Each readmission was listed in the database as a new index admission. As such, a patient could have contributed multiple admission-readmission pairs during the study period.

Demographic and clinical characteristics of the sample were examined using univariate and bivariate analysis. Discrete covariates were analyzed for association with both exposure and primary outcome using a χ^2 analysis. Continuous covariates were analyzed for association with both exposure and primary outcome using the Wilcoxon rank sum test and Student t tests. Distributions of certain continuous covariates, such as length of stay, Charlson comorbidity index score (Charlson score), and number of previous admissions in the past 12 months were highly skewed and, therefore, were dichotomized for the multivariable analysis. The Charlson score was dichotomized at 3, which was slightly over the mean and 1 point over the median. This was to account for the fact that all individuals with diabetes have a Charlson score of at least 1 and may have a score of 2 if they have any complications of diabetes. Previous admissions in the past 12 months and length of stay were dichotomized about the median. Age was examined as both a continuous and a categorical variable. The 6 age categories were: <35, 35 to <45, 45 to <55, 55 to <65, 65 to <75, and ≥75. Discharge location was dichotomized as home or not home.

Generalized estimating equations were used in a logistic regression model to account for repeated outcomes and model the log odds of 30-day readmission for individuals with diabetes and SMI. Variables considered for inclusion in the multivariable models were based on biological plausibility or were significantly associated (P < .05) with SMI or 30-day hospital readmission in the bivariate analyses. Individual covariates were added one at a time. Covariates were kept in the model if their associated P value was <.05 or if their inclusion resulted in a greater than 10% change to the parameter estimate of SMI. Following this, the authors examined interactions with SMI. Interaction terms were kept in the model if their associated 2-sided P values were <.05. The final model contained terms for SMI, age categories, SMI–age interactions, Charlson score >3, sex, and length of stay >4 days. Previous admissions in the past year caused other variables in the model to be inestimable, so it was not possible to include it. Age was modeled initially as a continuous variable. Nonlinearity was examined by both adding an age-squared term and by examining age as a categorical variable. The age-squared term, the categorical age terms, and each of their interactions were significant and provided a better fit to the data than a continuous age term while not differing significantly from each other. Therefore, categorical age terms were used for ease of interpretation. Odds ratios (ORs) with 95% confidence intervals (CIs) were generated. Contrasts were used to calculate ORs and CIs for the effect modification of age on the association of SMI with readmission. All analyses were performed using SAS version 9.2 (SAS Institute

Table 1. Characteristics of Adults With Diabetes by Serious Mental Illness Status, N = 26 878

Characteristic	Serious Mental Illness, n = 1652	No Serious Mental Illness, n = 25 226	Total, N = 26 878	P Value[a]
Male, n (%)	766 (46)	13 049 (52)	13 815 (51)	<.0001
Age, mean (SD)	52 (12)	58 (14)	58 (14)	<.0001
Age group categories, n (%)				<.0001
<35	117 (7)	1299 (5)	1417 (5)	
35-45	338 (21)	2757 (11)	3095 (12)	
45-55	554 (34)	5474 (22)	6028 (22)	
55-65	387 (23)	6959 (27)	7346 (27)	
65-75	172 (10)	5448 (22)	5620 (21)	
>75	83 (5)	3289 (13)	3372 (13)	
Charlson comorbidity index, mean (SD)	2.2 (1.7)	2.6 (1.8)	2.6 (1.9)	<.0001
Previous admission in past 12 months, M (IQR)	0 (2)	0 (1)	0 (1)	<.0001
Length of stay, days, M (IQR)	5 (9)	4 (6)	4 (6)	<.0001
Discharged home, n (%)	1242 (75)	18 560 (74)	19 802 (75)	.15
Readmission within 30 days, n (%)	247 (15)	4066 (16)	4313 (16)	.21

Abbreviations: IQR, interquartile range; SD, standard deviation; M, mean.
[a]P values from χ^2 test for proportions, *t* test for means, and Wilcoxon rank sum test for medians.

Inc, Cary, NC). This study was approved by the University of Maryland, Baltimore, Institutional Review Board.

Results

The initial study sample included 27 479 adults with diabetes (16% of all adult admissions) who were admitted to the index facility between February 1, 2005, and January 31, 2009. Of these, 601 (2%) died during their index admission and were excluded, leaving a final sample of 26 878 patients. Characteristics of the study group are presented in Table 1.

Approximately 6% (n = 1652) of patients were identified as having SMI. Of these, 759 (3%) had schizophrenia or schizoaffective disorders, 866 (3%) had bipolar or manic disorders, 96 (0.4%) had major depressive disorder, and 311 (1%) had other psychoses. Discharge disposition can be seen in Table 1.

Patients with diabetes and SMI differed significantly from those without SMI in our study population (Table 1; *P* < .0001, unless indicated otherwise). Those patients with diabetes and SMI were more likely to be female, younger, to have a lower mean Charlson score, and to have spent more time in the hospital during their index admission.

Prior to adjustment for confounding, adults with diabetes and SMI were not at increased odds of 30-day hospital readmission. Rather, male sex was identified as a potential risk factor for 30-day readmission, and patients discharged to their homes were less likely to be readmitted within 30 days (Table 2).

Although the unadjusted analysis suggested that SMI was not associated with 30-day hospital readmission, results of our adjusted model suggested that adults with diabetes and SMI who were younger than 35 years of age were at significantly decreased risk of 30-day hospital readmission compared with those without SMI. However, among patients aged 35 years and older, SMI was not significantly associated with 30-day hospital readmission. Table 3 presents the results from the unadjusted and adjusted models. Although there was no significant effect of SMI on 30-day hospital readmission in the other age groups, a trend of increasing odds of readmission with increased age was observed. Additionally, male sex, Charlson score >3, and length of stay >4 days were all significant predictors of 30-day hospital readmission in the study population.

Discussion

In this large cohort of adult patients with comorbid diabetes, we observed varying relationships between SMI and incidence of 30-day hospital readmission. Individuals younger than 35 years of age who had SMI were less likely to be readmitted to the hospital within 30 days; however, we did not observe a significant association between SMI and 30-day hospital readmission in any other age group. Despite this lack of association, we observed a nonsignificant trend of increasing odds of readmission with increased age. We also identified several characteristics that may predict 30-day readmission in this population, including male sex, index admission length of stay longer than 4 days, and a Charlson score greater than 3.

Table 2. Characteristics of Adults With Diabetes by 30-Day Hospital Readmission Status, N = 26 878

Characteristic	30-Day Readmission, n = 4313	No 30-Day Readmission n = 22 565	Total	P Value[a]
Male, n (%)	2382 (55)	11 433 (51)	13 815 (51)	<.0001
Age, mean (SD)	57 (13)	58 (14)	58 (14)	<.0001
Age group categories, n (%)				<.0001
<35	244 (6)	1173 (5)	1417 (5)	
35-45	521 (12)	2574 (12)	3095 (12)	
45-55	1022 (24)	5006 (22)	6028 (22)	
55-65	1312 (30)	6034 (27)	7346 (27)	
65-75	832 (19)	4788 (21)	5620 (21)	
>75	382 (9)	2990 (13)	3372 (13)	
Charlson comorbidity index, mean (SD)	3.0 (1.8)	2.5 (1.8)	2.6 (1.8)	<.0001
Previous admission in past 12 months, M (IQR)	1 (3)	0 (1)	0 (1)	<.0001
Discharged home, n (%)	3070 (71)	16 732 (74)	19 802 (74)	<.0001
Length of stay, days, M (IQR)	5 (8)	4 (6)	4 (6)	<.0001

Abbreviations: IQR, interquartile range; SD, standard deviation; M, mean.
[a]*P* values from χ^2 test for proportions, *t* test for means, and Wilcoxon rank sum test for medians.

Table 3. Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) of 30-Day Hospital Readmission in Patients With Diabetes, N = 26 878

	OR	95% CI
Unadjusted OR	0.92	0.80, 1.05
Serious mental illness, age <35 years	0.39	0.17, 0.91
Serious mental illness, age ≥35 years	1.11	0.86, 1.42
Serious mental illness, age 35-<45 years	0.60	0.31, 1.14
Serious mental illness, age 45-<55 years	1.39	0.96, 2.03
Serious mental illness, age 55-<65 years	0.84	0.53, 1.36
Serious mental illness, age 65-<75 years	1.28	0.69, 2.39
Serious mental illness, age >75 years	1.59	0.52, 4.89
Male	1.21	1.11, 1.31
Charlson comorbidity index >3	1.38	1.20, 1.57
Length of stay >4 days	1.38	1.22, 1.56

Although to our knowledge no previous studies have assessed the effect of SMI on hospital readmission in patients with diabetes, the relationship between SMI and health outcomes has been examined in other patient populations. Our findings are consistent with those of Abrams et al,[14,15] who observed that comorbid psychiatric conditions identified using hospital inpatient records were not associated with 30-day mortality in Veterans Health Administration hospital patients admitted for acute myocardial infarction or nonsurgical intensive care. Furthermore, Blecker et al[16] observed no association between SMI and quality of care, including hospital readmission, for disabled Medicaid recipients with heart failure.

The results of the current study are consistent with many of the studies conducted on hospital readmission with regard to length of stay, Charlson score, and male sex.[1,3-6,17-19] Length of stay for the index admission has been identified previously as a predictor of hospital readmission for Medicare enrollees and adults seen in the emergency department and admitted to general medicine services.[4,18,19] Consistent with our results, an elevated Charlson score has been reported to predict hospital readmission in multiple studies.[3-6,17,18] Finally, male sex also has been associated with hospital readmissions in previous studies.[1,6,19]

Age greater than 35 years was not a significant predictor of hospital readmission among individuals with diabetes and SMI. This is in contrast to previous studies that observed an increased risk of hospital readmission in adults aged 65 years and older.[3,5,6,19] There are several possible explanations for this observation. Individuals with SMI die, on average, 25 years earlier than people who do not have SMI.[7] Thus, older and potentially sicker patients with SMI who may have been at greater risk for hospital readmission may have died already. Results presented in Table 1 are consistent with this explanation. Individuals with SMI were younger and had a lower Charlson score compared with those without SMI. Another explanation is that patients with diabetes who begin to receive Medicare at age 65 years may visit a primary care physician rather than returning to the hospital for care, which could have the effect of decreasing readmissions in those aged 65 years and older. This could be especially important in our urban, economically disadvantaged patient population, a large percentage of whom lack health care insurance.

Our observation of no association between a diagnosis of SMI and 30-day hospital readmissions in adults with diabetes older than age 35 contrasts with the positive associations reported by Saravay et al[20] and Rathore et al.[21] Saravay et al[20] examined the association between psychiatric symptoms and 4-year hospital readmissions for 273 medical and surgical inpatients. Differences in study population and methods used to ascertain SMI may explain the differences in our results. Rathore et al[21] examined a national sample of more than 53 000 Medicare beneficiaries, who are generally elderly or disabled, who were hospitalized for heart failure. Our study differed in methods of SMI documentation; differences in demographics and lower prevalence of SMI also were seen. Finally, Borckardt et al[22] reported a positive association between outpatient psychiatric visits and hospital admissions in a retrospective study of a single hospital population. The prevalence of SMI in our study population (6%) was low compared with that of other studies, in which the reported prevalence of SMI ranges from 8.2% to 34%.[8,15,16,23,24] This may be because of our dependence on discharge diagnosis codes to verify mental illness diagnoses. As demonstrated by Abrams et al,[14,15,25] the method used to identify mental illness can have a significant impact on observed results. Using outpatient records resulted in a significant association between SMI and 30-day mortality in Veterans Health Administration hospital patients, whereas using inpatient records did not. However, it is also important to note that many previous studies examining outcomes of patients with SMI were conducted in different study populations. Abrams et al,[15] Frayne et al,[8] and Kilbourne et al[10] relied on Veterans Administration populations. Blecker et al[16] examined the records of disabled Medicare recipients. These populations differ from ours in terms of demographic and comorbidity status.

Although race, socioeconomic status, and health insurance may play a role in the association between SMI and 30-day hospital readmission, our use of administrative data hindered our ability to examine these variables because of a large amount of missing data for all these variables. Previous studies have been inconclusive on the role of race.[1,4] However, an association between health insurance and readmission has been observed.[4]

On the other hand, our use of administrative hospital data to identify patients with SMI establishes a benchmark for a tertiary care facility in an urban setting. Furthermore, as the first to examine 30-day hospital readmission in adults with diabetes and SMI, our study adds to the literature on factors influencing hospital readmissions for this population.

The majority of the existing medical literature suggests that patients with SMI experience excess morbidity, mortality, poorer quality of care, and increased rates of hospital readmission.[7,9,20,21,23,26-30] We have discussed some possible explanations for the lack of support for an increased hospital readmission rate observed in our study. In addition, patients with diabetes may be less likely to be readmitted, regardless of SMI status, because of increased physician and self-monitoring. This may be especially true for patients who take atypical antipsychotics, which are known to cause weight gain and are associated with increased risk of obesity and diabetes.[7] In contrast to previous studies of SMI and health services outcomes, we examined a chronic disease that can be well controlled with medication and diet.[21,23] Well-controlled diabetes may be less likely to affect health than previously studied diseases such as acute myocardial infarction or congestive heart failure.

In conclusion, although we did not observe a significant positive association between SMI and hospital readmission, our study highlights the importance of expanding research on the seriously mentally ill into different patient populations and of continued exploration of the relationship between mental illness and health outcomes. Future research should continue to identify opportunities to reduce hospital readmissions and other poor outcomes for these high-risk patient populations.

Authors' Note

Declaration of Conflicting Interests

Funding

References

1. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *N Engl J Med*. 2009;360:1418-1428.

2. MedPAC. *Report to the Congress: Reforming the Delivery System*. Washington, DC: Medicare Payment Advisory Commission; 2008.

3. Simonet ML, Kossovsky MP, Chopard P, Sigaud P, Perneger TV, Gaspoz JM. A predictive score to identify hospitalized patients' risk of discharge to a post-acute care facility. *BMC Health Serv Res*. 2008;8:154.

4. Hasan O, Meltzer DO, Shaykevich SA, et al. Hospital readmission in general medicine patients: a prediction model. *J Gen Intern Med*. 2010;25:211-219.

5. Kossovsky M, Perneger T, Sarasin F, Bolla F, Borst F, Gaspoz J. Comparison between planned and unplanned readmissions

to a department of internal medicine. *J Clin Epidemiol*. 1999;52:151-156.

6. Marcantonio ER, McKean S, Goldfinger M, Kleefield S, Yurkofsky M, Brennan TA. Factors associated with unplanned hospital readmission among patients 65 years of age and older in a Medicare managed care plan. *Am J Med*. 1999;107:13-17.

7. Parks J, Svendsen D, Singer P, Foti ME. *Morbidity and Mortality in People With Serious Mental Illness*. Alexandria, VA: National Association of State Mental Health Program Directors (NASMHPD) Medical Directors Council; 2006.

8. Frayne SM, Miller DR, Sharkansky EJ, et al. Using administrative data to identify mental illness: what approach is best? *Am J Med Qual*. 2010;25:42-50.

9. Daumit GL, Pronovost PJ, Anthony CB, Guallar E, Steinwachs DM, Ford DE. Adverse events during medical and surgical hospitalizations for persons with schizophrenia. *Arch Gen Psychiatry*. 2006;63:267-272.

10. Kilbourne A, Welsh D, McCarthy JF, Post EP, Blow FC. Quality of care for cardiovascular disease-related conditions in patients with and without mental disorders. *J Gen Intern Med*. 2008;23:1628-1633.

11. Goldberg R, Kreyenbuhl J, Medoff D, et al. Quality of diabetes care among adults with serious mental illness. *Psychiatr Serv*. 2007;58:536-543.

12. Furuno J, McGregor J, Harris A, et al. Identifying groups at high risk for carriage of antibiotic-resistant bacteria. *Arch Intern Med*. 2006;166:580-585.

13. McGregor J, Kim P, Perencevich E, Bradham D, Furuno J, Kaye K. Utility of the chronic disease score and Charlson comorbidity index as comorbidity measures for use in epidemiologic studies of antibiotic-resistant organisms. *Am J Epidemiol*. 2005;161:483-493.

14. Abrams TE, Vaughan-Sarrazin M, Rosenthal GE. Preexisting comorbid psychiatric conditions and mortality in nonsurgical intensive care patients. *Am J Crit Care.* 2010;19:241-249.

15. Abrams TE, Vaughan-Sarrazin M, Rosenthal GE. Psychiatric comorbidity and mortality after acute myocardial infarction. *Circ Cardiovasc Qual Outcomes*. 2009;2:213-220.

16. Blecker S, Zhang Y, Ford DE, et al. Quality of care for heart failure among disabled Medicaid recipients with and without severe mental illness. *Gen Hosp Psychiatry*. 2010;32:255-261.

17. Muzzarelli S, Leibundgut G, Maeder M, Rickli H, Handschin R, Gutmann M. Predictors of early readmission or death in elderly patients with heart failure. *Am Heart J*. 2010;160:308-314.

18. van Walraven C, Dhalla IA, Bell C, et al. Derivation and validation of an index to predict early death or unplanned

readmission after discharge from hospital to the community. *CMAJ*. 2010;182:551-557.

19. Gorman J, Vellinga A, Gilmartin JJ, O'Keeffe ST. Frequency and risk factors associated with emergency medical readmissions in Galway university hospitals. *Ir J Med Sci*. 2010;179:255-258.

20. Saravay S, Pollack S, Steinberg M, Weinschel B, Habert M. Four-year follow-up of the influence of psychological comorbidity on medical rehospitalization. *Am J Psychiatry*. 1996;153:397-403.

21. Rathore S, Wang Y, Druss B, Masoudi F, Krumholz H. Mental disorders, quality of care, and outcomes in older patients hospitalized with heart failure: an analysis of the national heart failure project. *Arch Gen Psychiatry*. 2008;65:1402-1408.

22. Borckardt J, Madan A, Barth K, et al. Excess health care service utilization and costs associated with underrecognition of psychiatric comorbidity in a medical/surgical inpatient setting. *Qual Manag Health Care*. 2011;20:98-102.

23. Kilbourne A, Morden N, Austin K, Ilgen M, McCarthy J, Dalack G. Excess heart disease-related mortality in a national study of patients with mental disorders: identifying modifiable risk factors. *Gen Hosp Psychiatry*. 2009;31:555-563.

24. Frayne S, Halanych J, Miller D, et al. Disparities in diabetes care: impact of mental illness. *Arch Intern Med*. 2005;165:2631-2638.

25. Abrams TE, Vaughan-Sarrazin M, Rosenthal GE. Variations in the associations between psychiatric comorbidity and hospital mortality according to the method of identifying psychiatric diagnoses. *J Gen Intern Med*. 2008;23:317-322.

26. Jiang W, Alexander J, Christopher E, Kuchibhatla M, Gaulden L, Cuffe M. Relationship of depression to increased risk of mortality and rehospitalization in patients with congestive heart failure. *Arch Intern Med*. 2001;161:1849-1856.

27. Daumit GL, Anthony CB, Ford DE, et al. Pattern of mortality in a sample of Maryland residents with severe mental illness. *Psychiatry Res*. 2010;176:242-245.

28. Druss BG, Bradford WD, Rosenheck RA, Radford MJ, Krumholz HM. Quality of medical care and excess mortality in older patients with mental disorders. *Arch Gen Psychiatry*. 2001;58:565-572.

29. Hamer M, Stamatakis E, Steptoe A. Psychiatric hospital admissions, behavioral risk factors, and all-cause mortality the Scottish health survey. *Arch Intern Med*. 2008;168:2474-2479.

30. Himelhoch S, Lehman A, Kreyenbuhl J, Daumit G, Brown C, Dixon L. Prevalence of chronic obstructive pulmonary disease among those with serious mental illness. *Am J Psychiatry*. 2004;161:2317-2319.