



## Serious mental illness and medical comorbidities: Findings from an integrated health care system



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### ABSTRACT

**Objective:** To examine the odds associated with having medical comorbidities among patients with serious mental illness (SMI) in a large integrated health system.

**Method:** In a secondary analysis of electronic health record data, this study identified 25,090 patients with an ICD-9 SMI diagnosis of bipolar disorder ( $n = 20,308$ ) or schizophrenia ( $n = 4782$ ) and 25,090 controls who did not have a SMI, matched on age, gender, and medical home facility. Conditional logistic regressions compared the odds associated with having nine medical comorbidity categories and fifteen chronic or serious conditions among patients with SMI versus controls.

**Results:** Results showed having a SMI was associated with significantly higher odds of each medical comorbidity examined ( $p$ 's  $< 0.001$ ), except no evidence of a significant association was found between having schizophrenia and musculoskeletal diseases. A similar pattern was found regarding the chronic or severe conditions, where having schizophrenia or bipolar was associated with  $> 1.5$  times the odds of each condition ( $p$ 's  $< 0.001$ ).

**Conclusions:** In an integrated health system where patients may have fewer barriers to care, SMI patients are likely to present for treatment with a range of medical comorbidities, including chronic and severe conditions. SMI patients may need outreach strategies focused on disease prevention, screening and early diagnosis, and treatment to address medical comorbidities and associated poor health outcomes.

### 1. Introduction

Serious mental illnesses (SMI), which typically include bipolar disorders and schizophrenia, are characterized as chronic and debilitating conditions that place significant burdens on patients, as well as their families and society. Despite the marked improvement in managing destabilizing symptoms that followed the introduction of psychotropic medications [1], most patients who suffer from a SMI continue to have a limited recovery and experience poor physical health [2–5]. Fifty to 80% [6–8] of individuals with SMI have one or more comorbid medical conditions that may worsen prognosis and contribute to high morbidity and premature mortality [3,9–10]. More concerning is that over 60% of the medical comorbidities observed among persons with SMIs are non-fatal and preventable, yet these persons have 15 to 25 years shorter expectancy relative to the general population [11]. Unfortunately, the medical needs of those with SMI are often neglected [12], which may partly explain the reason for why their morbidity and mortality are

elevated.

Studies of modifiable risk factors suggest that risky sexual behaviors and poor hygiene [13,14], are linked with higher risk of genitourinary, infectious, and blood borne diseases among individuals with SMIs. Increased rates of alcohol and illicit drug use [13], smoking [14–17], poor nutrition and lack of exercise [18], may be associated with higher rates of cardiovascular and respiratory [8,10,13,15,19] conditions; and genitourinary and metabolic [8,10,13,16,19–20] diseases. Patients with SMI also present for treatment with a number of serious and chronic medical conditions (i.e., hypertension, asthma, obesity, chronic obstructive pulmonary disease, epilepsy) [2,4,21], and these conditions can onset up to 10 years earlier in this population compared to age-matched controls [22]. In addition, having medical comorbidities place SMI patients at risk of repeat hospital visits that raise health care costs and increase the burden of disease [4,23–24]. Not surprisingly, the problem of medical comorbidities in SMI is now considered a major public health issue due to its destabilizing effects and high cost to

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families and society [12].

Patients with SMI continue to experience elevated morbidity despite the identification of several preventable and modifiable risk factors for poor health. Thus, a study that seeks to examine associations among patients with SMI and odds of having medical comorbidities in a large integrated health system is important to inform patient care. In this study, we examined associations among 25,090 patients with a SMI diagnosis of bipolar disorder or schizophrenia and odds of having medical comorbidities relative to 25,090 patients without an SMI in a large health system. Importantly, to inform patient care planning we examined acute conditions, which are more likely to require immediate medical attention as well as severe or chronic conditions necessitating ongoing monitoring and management.

## 2. Methods

### 2.1. Setting

Kaiser Permanente of Northern California (KPNC) is a nonprofit, integrated health care delivery system providing health care services to > 4 million members, serving 45% of the commercially insured population in the region. KPNC consists of a health care plan, a sole medical group, and a hospital system. Specialty health services, such as psychiatry, substance use treatment, and other specialty care, are available to all members internally. To facilitate integrated health care services, providers have access to a mature electronic health record (EHR) system with each member's medical history, including primary care, emergency department, ambulatory, hospital and specialty health care encounters. In KPNC, about 88% of members are commercially insured, 28% have Medicare and 10% have Medicaid coverage. All patients were selected from the KPNC membership for this study. Institutional review board approval was obtained from the Kaiser Foundation Research Institute.

### 2.2. Participants

We used EHR data for this secondary, database study. These data were used to identify all health system members who 1) were at least 18 years of age, 2) had a visit to a KPNC facility in 2010, and 3) had a recorded ICD-9 diagnosis of schizophrenia or bipolar disorder in 2010. The first mention of each ICD-9 diagnosis of schizophrenia or bipolar recorded from January 1, 2010 to December 2010 were included; patients in the sample could have multiple diagnoses (e.g., the SMI groups were not mutually exclusive). We also included all current or existing behavioral health diagnoses that were additionally documented for patients with schizophrenia or bipolar during health system visits in 2010 (see Appendix A for a complete list of ICD-9 codes).

EHR data were also used to identify control patients without current or existing behavioral health diagnoses. Control patients were selected for all unique patients with bipolar disorder or schizophrenia, and matched one-to-one on gender, age, and medical home facility (e.g., the medical center where they typically receive care). This method accounted for any differences in services, types of conditions, or unobservable differences by geographic location.

The final analytical sample consisted of 50,180 patients: 20,308 with bipolar disorder, 4782 with schizophrenia, and 25,090 controls. Institutional review board approval was obtained from the Kaiser Foundation Research Institute.

### 2.3. Measures

#### 2.3.1. Patient characteristics

Age, gender, race/ethnicity, patient medical home facility, census based median neighborhood household income, and ICD-9 psychiatric and medical diagnoses were extracted from the EHR. Race/ethnicity consisted of five categories: white, Black, Hispanic, Asian, and other.

Psychiatric and medical diagnoses were determined based on ICD-9 diagnoses noted during visits made over the study period and included current and existing diagnoses.

#### 2.3.2. Medical comorbidities

Medical ICD-9 diagnoses were extracted from the EHR for nine disease categories previously classified as common in SMI populations based on prior research [2–5,13–14]. Dichotomous measures (1 = present; 0 = else) were computed for the nine medical conditions: diseases of the blood/blood and forming organs; diseases of the circulatory system; diseases of the digestive system; endocrine/immunity diseases; genitourinary diseases; infectious/parasitic diseases; diseases of the musculoskeletal system; diseases of the nervous system; and diseases of the respiratory system (see Appendix A).

#### 2.3.3. Severe or chronic medical conditions

Using the EHR, we extracted fifteen ICD-9 disease categories for the severe or chronic medical conditions that are considered prevalent in SMI populations based on prior research [2,4,8,21]. Dichotomous measures (1 = present; 0 = else) were computed for each severe/chronic medical condition: acid-peptic disorders; arthritis; asthma; chronic kidney disease; chronic pain; chronic obstructive pulmonary disease; coronary atherosclerosis; diabetes mellitus; hepatitis C; hypertension; injury poisoning/overdose; ischemic heart disease; pneumonia; obesity; and stroke. An indicator (any severe/chronic medical condition: 1 = present; 0 = else) identified those with  $\geq 1$  of the fifteen chronic conditions.

#### 2.3.4. Analyses

Frequencies and means were used to characterize the sample. We used McNemar's test (categorical) and paired sample *t*-tests (continuous) to determine potential differences between the matched samples of patients with SMI and controls. These analyses proceeded by examining potential differences between patients with SMI (e.g., bipolar and schizophrenia) compared to controls by age, gender, race/ethnicity and income. A series of conditional logistic regressions were then computed, predicting each of nine medical condition categories (1 = present; 0 = else) from bipolar or schizophrenia (reference = controls), to compare the odds associated with having medical comorbidities in patients with SMI compared to controls. We then computed a series of conditional logistic regressions predicting each of fifteen chronic or severe medical conditions (1 = present; 0 = else) from having bipolar or schizophrenia (reference = controls), to compare the odds of having chronic or severe medical comorbidities in SMI patients versus controls. All conditional logistic regressions adjusted for race/ethnicity and income. SMI and control samples were matched 1-to-1 on age and gender; and thus, no significant differences were anticipated or found between matched groups regarding these relationships (all  $p = 1.00$ ). Conditional logistic regressions were computed without controlling for age or gender. The Hochberg [25] method was used to adjust for multiple inference testing within each medical condition category. We report Hochberg adjusted *p*-values for the conditional logistic regressions comparing the odds of having medical comorbidities for patients with SMI and controls. Statistical significance was defined at  $p < 0.05$ ; analyses were performed using R version 2.15.0 [26].

## 3. Results

### 3.1. Patient characteristics

Overall, the sample was 70.0% women, 60.0% White, 15.6% Hispanic, 12.2% Asian, 7.4% Black, 4.8% other race/ethnicity. Patients were 49 years old on average, (not shown). As shown in Table 1, more patients with schizophrenia or bipolar were white compared to controls; fewer controls were Hispanic, Asian, or Black relative to patients

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