

# Pulmonary disease among inpatient decedents: Impact of schizophrenia

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## Abstract

**Objectives:** Determine the risk associated with schizophrenia for common pulmonary illness (pneumonia and chronic obstructive pulmonary disorder (COPD)) during the last year of life.

**Methods:** Inpatient decedents in Veterans (VA) hospitals in 2002 ( $N=27,798$ ) were identified. Logistic regression modeled diagnosis of pulmonary illness in either the final year or final admission as a function of schizophrenia, smoking history and other covariates.

**Results:** Among decedents, 943 (3%) had schizophrenia, 3% were women, most were white (76%) or African-American (18%), and average age at death was 72.4 years (SD 11.5). Three-fifths received VA outpatient care in the year prior to death. Among those with schizophrenia, only two-fifths had outpatient care. Pneumonia was more common among schizophrenia patients (38% vs 31%) as was COPD (46% vs 38%). In models controlling for history of smoking and other covariates, schizophrenia was a risk factor for pulmonary disease in the last year of life (OR=1.9, 95% CI 1.6–2.2) but less so for final-stay pulmonary disease (OR=1.5, 95% CI 1.3–1.7).

**Conclusions:** VA inpatient decedents with schizophrenia were at increased risk for pneumonia and COPD, independent of smoking indicators. Clinicians treating schizophrenia patients need to be especially alert to potential comorbid medical conditions and ensure vulnerable patients receive appropriate care.

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**Keywords:** Health Services; Mortality; Respiratory Disorders; Schizophrenia; Veterans

## 1. Introduction

Patients with schizophrenia are known to be at increased risk for numerous comorbid medical conditions including diabetes, coronary artery disease, and digestive and liver disorders as compared to non-schizophrenia patients (Brown et al., 2000; Curkendall et al., 2004; Daumit et al., 2002; Newman and Bland, 1991). It has been suggested that they are also at

increased risk of some pulmonary disorders such as community-acquired pneumonia and chronic obstructive pulmonary disorder (COPD) (Chafetz et al., 2005; Sokal et al., 2004). Risk may be increased by numerous factors including high rates of lifetime cigarette use (70–80% of schizophrenia outpatients aged <67 smoke) (Brown et al., 2000; de Leon et al., 1995; Goff et al., 2005), poor self-management skills, frequent homelessness, and poor diet (Brown et al., 2000; Casey, 2005; Dalack et al., 1999; Goff et al., 2005; Kermode et al., 1998). In addition, psychotropic medications may increase respiratory irregularities (Nishikawa et al., 1992; Wilcox et al., 1994; Youssef and Waddington, 1989) or risk of respiratory disorders arising from neuroleptic malignant syndrome (Aruna and Murungi, 2005; Liam and Ong, 1990). However, previous studies of pulmonary disease and mortality in patients with schizophrenia have been limited in scope, broadly focused, and set primarily outside the

**Abbreviations:** CI, Confidence interval; COPD, Chronic obstructive pulmonary disorder; ICD-9, International Classification of Diseases, 9th revision; OR, Odds ratio;  $\chi^2$ , Chi-square statistic; VA, Veterans Health Administration.

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United States. It is unknown whether these factors lead to increased pulmonary disease-related mortality among veterans with schizophrenia.

COPD and community-acquired pneumonia are the 4th and 7th leading causes of death in the United States, and are responsible for over 200,000 deaths each year (Anderson and Smith, 2005). Although substantial attention is paid to the psychiatric and behavioral management of patients with schizophrenia, many barriers impede the detection and treatment of their medical conditions, a circumstance that has been implicated in excess unforeseen deaths (Copeland et al., 2006). Patients with schizophrenia often lack insight into their own psychiatric illness (Pedrelli et al., 2004). This limitation may extend to other signs and symptoms of disease that would motivate the non-schizophrenia patient to seek timely and appropriate medical care (Goldman, 1999). Thus, patients with schizophrenia may experience delays in the diagnosis of disease, leading to more acute comorbidity at the time of diagnosis and premature mortality. In addition, at-risk Veterans Health Administration (VA) patients, including those with schizophrenia, have lower adherence to treatment recommendations (Dolder et al., 2003; Valenstein et al., 2002) and may receive fewer preventive measures such as smoking cessation (de Leon et al., 2005) or influenza vaccinations (Weaver et al., 2004; Zimmerman et al., 2003) leading to increased rates of pulmonary-related deaths. Smoking cessation improves survival for persons with chronic lung disease (Pauwels et al., 2001), and community-acquired pneumonia rates have been linked to lower rates of influenza vaccination, especially during influenza season (Nichol et al., 1999). Current smoking may be sharply reduced among older, sicker patients, as suggested by VA surveys reporting overall rates of 35% among younger enrollees vs 11% among older (65+) enrollees (Goldman et al., 2004; Miller et al., 2001). Yet poor pulmonary health from a lifetime of smoking and other factors, combined with impaired self-care, may allow a treatable acute illness to become life-terminating. Therefore, we hypothesized that a diagnosis of schizophrenia would predict increased likelihood of pulmonary disease among VA inpatient decedents, especially during the final inpatient stay in which death occurred. The purpose of this study was to examine in a retrospective observational study whether schizophrenia was associated with increased likelihood of COPD or pneumonia diagnosis in the year prior to death.

## 2. Methods

### 2.1. Sample and source of data

We used administrative data on patients admitted to both regular and extended care facilities recorded in national VA databases. The Veterans Health Administration is the largest integrated health care system in the United States and is publicly funded. It serves veterans of US military service, and among them, preferentially cares for the poorest and most disabled via a priority system. Thus, VA patients are, on average, sicker and poorer than the US general population, even though veterans overall are better off in terms of health and socioeconomic

status, relative to the US general population (Kazis et al., 1998; Morgan et al., 2005). VA patients are predominantly male, reflecting historical trends in military service, and the current cohort is dominated by veterans from the Vietnam and World War II eras, meaning that 60% are over the age of 55. Among 26 million US veterans, approximately 5 million currently receive care in the VA healthcare system. The VA utilizes an all-electronic medical record, from which nightly extracts are processed and sent to a central data repository which can be accessed for research purposes such as the current study. Validity studies of the data relative to full medical chart review report good comprehensiveness regarding care received and diagnoses (Borzecki et al., 2004; Kashner, 1998; Szeto et al., 2002). For this study, patients aged 18 or older who were discharged at death from VA hospitals during fiscal year 2002 (October 1, 2001–September 30, 2002) were identified ( $N=27,798$ ). Subsequently, we extracted inpatient and outpatient records from the last year of life, from which we derived measures as described below. The study was approved by an institutional review board.

### 2.2. Measures

The outcome of interest was having a diagnosis of COPD or pneumonia during the last year of life (or during the last hospitalization). ICD-9 codes recorded in inpatient or outpatient records defined having COPD (ICD-9 codes 490, 491, 492, 493.2, 494, 496) and pneumonia (ICD-9 codes 480, 481, 482, 483, 485, 486). We did not evaluate cause of death because this measure was not included in the databases for this study. On the other hand, it has been demonstrated that cause of death as recorded on death certificates is unreliable for many causes of death especially pneumonia and COPD (Jensen et al., 2006; Smith Sehdev and Hutchins, 2001).

The primary predictor of interest was having a diagnosis of schizophrenia (ICD-9 codes 295 excluding 295.5) in the past year. Schizophrenia was defined by one inpatient diagnosis or two outpatient diagnoses on different dates (Blow et al., 2005). As we were interested in a specific mental illness, schizophrenia, we sought to distinguish its effect from that of other psychiatric conditions. Accordingly, we included indicators for substance abuse (ICD-9 codes 291, 292, 303–305) and for any other mental illness (ICD-9 codes 290, 293, 294, 296–302, 306–312, 331).

Additional covariates included age, race (represented by separate indicators for African-American and for other non-white race; reference category was white), marital status (married vs. other status), gender (reference category was male) and smoking. Because both lung disease and schizophrenia are correlated with smoking status, we investigated several approaches to developing a smoking indicator for this study. First, because smoking status recorded in the electronic medical record is not included in the administrative data extracts available, we used a diagnosis of nicotine dependence (ICD-9 code 305.1) to identify smokers. When the prevalence of this diagnosis proved very low (7%), we examined outpatient prescriptions for nicotine replacement products or smoking-

cessation-formulated bupropion (prescriptions explicitly identified as “Zyban”<sup>®</sup>) and incorporated these with nicotine dependence diagnosis into a single measure of smoking status. We also examined smoking cessation clinic codes but these did not add any information to the smoking status measure just described. Because many providers and facilities do not distinguish between smoking-cessation-specific bupropion and generic bupropion, we also coded an indicator of bupropion prescriptions not further described as “Zyban” so that we could explore whether this potential proxy for smoking status might help disentangle the effects of schizophrenia and smoking.

We also controlled for comorbid illnesses with the Charlson comorbidity score, a scale originally developed to predict mortality from inpatient diagnoses (Charlson et al., 1987). The Charlson score is based only on inpatient diagnoses; we did not use the age-adjusted version so that we could examine the effects of age independently. Charlson scores present a weighted estimate of post-hospitalization risk of death on a scale ranging from 0 to 6. Indexed comorbid conditions include myocardial infarction (scored a 1), diabetes with complications (scored a 2), metastatic cancer (scored a 6), and 16 other conditions. Other predictors included measures of utilization for various types of VA outpatient care. First we cumulated visits to primary care clinics, specialty care clinics, and psychiatric care clinics, as well as Emergency Department use. Because the

percentage of zeros on these measures was high, ranging from 46% to 89%, we dichotomized the four measures, and summarized them as a single measure (any outpatient care vs. none) for use in our multivariable models. Finally, we included a measure of minimal inpatient care, which we defined as having no more than three inpatient days in the last year of life, including the stay during which death occurred. This measure was included because some patients with little outpatient care may have had long inpatient stays, and we wanted to control for receiving little care of any kind in the last year.

### 2.3. Analysis

Descriptive frequencies and means were examined, and bivariate comparisons were conducted using chi-square analysis or Student's *t*-test as appropriate, followed by logistic regression analysis. A base model with no covariates is presented first, to assess the relationship between our outcomes and the diagnosis of schizophrenia. Outcomes analyzed were pulmonary disease (pneumonia or COPD) diagnosed in the final year of life, pulmonary disease diagnosed in the final hospitalization where death occurred, final-year diagnosis of pneumonia, and final-year diagnosis of COPD. Next, the adjusted model is presented with the main predictor (schizophrenia) and the covariates of age, race, sex, marital status,

Table 1  
Characteristics of VA inpatient decedents with and without schizophrenia (*N*=27,798)

	Schizophrenia	No schizophrenia	Total sample
	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)
Female	31 (3.3)	704 (2.6)	735 (2.6)
Race/ethnicity			
White	671 (73.0)	18,998 (75.8)	19,699 (75.7)
Black *	196 (21.3)	4504 (18.1)	4700 (18.1)
Other race	52 (5.7)	1553 (6.2)	1605 (6.2)
Marital status			
Married *	170 (18.1)	12,580 (47.2)	12,750 (46.2)
Never married *	415 (44.3)	2404 (9.0)	2819 (10.2)
Divorced	266 (28.4)	7128 (26.7)	7394 (26.8)
Widowed *	86 (9.2)	4557 (17.1)	4643 (16.8)
Nicotine dependence *	91 (9.7)	1943 (7.2)	2034 (7.3)
Smoker (nicotine-related diagnosis or prescription) *	150 (15.9)	2673 (10.0)	2823 (10.2)
Substance abuse disorder *	117 (12.4)	2644 (9.9)	2761 (9.9)
Schizophrenia diagnosis	943 (100%)	0 (0)	943 (3.4)
Other mental illness *	483 (51.2)	9237 (34.4)	9720 (35.0)
Pulmonary disorder *	587 (62.3)	14,099 (52.5)	14,686 (52.8)
Pneumonia *	355 (37.7)	8214 (30.6)	8569 (30.8)
COPD *	431 (45.7)	10,118 (37.7)	10,549 (38.0)
Any outpatient care *	411 (43.6)	16,928 (63.0)	17,339 (62.4)
Primary care *	289 (30.7)	14,642 (54.5)	14,931 (53.7)
Specialty care *	176 (18.7)	10,695 (39.8)	10,871 (39.1)
Psychiatric care *	285 (30.2)	2791 (10.4)	3145 (11.3)
Inpatient care <4 days *	272 (28.8)	3728 (13.9)	4000 (14.4)
	Mean (SD; range)	Mean (SD; range)	Mean (SD)
Age *	69.7 (12.0; 31–101) <sup>a</sup>	72.5 (11.4; 20–108) <sup>a</sup>	72.4 (11.5) <sup>a</sup>
Charlson score *	2.84 (2.04; 0–6)	3.46 (2.05; 0–6)	3.4 (2.1)
Inpatient days *	65.1 (86.3; 1–365)	45.4 (62.0; 1–363)	46.1 (63.1)

<sup>a</sup> Median age for all patients was 74.8, for those with schizophrenia 72.5 and for other patients 74.9 years.

\* *p*<.05 between patients with and without schizophrenia.

other mental illness, substance abuse, smoking status, Charlson comorbidity score, and inpatient and outpatient care indicators. An exploratory model added the bupropion indicator. Our measure of smoking status included prescription data, but only prescription data from fiscal year 2002 forward were available. Patients who died earlier in the year would therefore have less chance of having a prescription on record than those who died later in the year. To address this issue, we analyzed subsets of decedents: those who died after the first quarter of the year; those who died in each quarter of the year.

**3. Results**

The sample consisted of 27,798 decedents from VA inpatient facilities. Of these, 2.6% were women ( $n=735$ ), most were white (75.7%;  $n=19,669$ ) or African-American (18.1%;  $n=4700$ ), about half were married (46.2%;  $n=12,750$ ), and the average age at death was 72.4 years (SD 11.5) and the median age at death was 74.8 (see Table 1).

Patients with schizophrenia comprised 3.4% of the sample ( $n=943$ ). Overall, half the decedents had a diagnosis of COPD or pneumonia in the year prior to death (53%;  $n=14,686$ ). Among patients with schizophrenia, fully two-thirds ( $n=587$  of 943) had a diagnosis of a pulmonary disease compared to 53% of patients without schizophrenia (see Fig. 1). Pneumonia was more common among schizophrenia patients than other decedents (38% vs 31%; chi-square statistic ( $\chi^2$ )=21.291,  $d.f.$ =1,  $p<.001$ ) as was COPD (46% vs 38%;  $\chi^2$ =24.94,  $d.f.$ =1,  $p<.001$ ). There was considerable overlap between these two conditions, with 42% of COPD patients also incurring

pneumonia in their last year of life. Indicators of smoking (nicotine dependence diagnosis combined with smoking cessation prescriptions) were more common among patients with schizophrenia (16%) than other patients (10%) ( $\chi^2=35.387$ ,  $d.f.$ =1,  $p<.001$ ).

In the bivariate model, schizophrenia was modestly associated with increased odds of pulmonary disorders (odds ratio (OR)=1.5; 95% confidence interval (CI) 1.3–1.7). Additional differences by schizophrenia diagnosis were noted. Patients with schizophrenia were more likely to be African-American, never married, and slightly younger. They had more psychiatric and pulmonary disease but less comorbidity in general as measured by the Charlson index. They were less likely to use outpatient or inpatient care but had longer average inpatient stays.

For the primary outcome in the multivariable model, schizophrenia nearly doubled the odds of pulmonary disease in the last year of life (OR=1.9, 95% CI 1.6–2.2), after controlling for covariable effects (see Table 2). Odds of pulmonary disorders were also greater for patients engaged in outpatient care or diagnosed with tobacco dependence or other mental illness, and increased slightly with age and Charlson comorbidity score. Non-white race, female gender, never-married status, diagnosis with substance abuse disorders, and having minimal hospital days in the last year of life were negatively associated with pulmonary disorder diagnosis. The addition of non-specific bupropion had no effect on the relationship between schizophrenia and lung disease (OR=1.9; 95% CI 1.6–2.2) while bupropion itself was modestly associated with the outcome (OR=1.3, 95% CI 1.1–1.6). In the sub-analyses of patients who

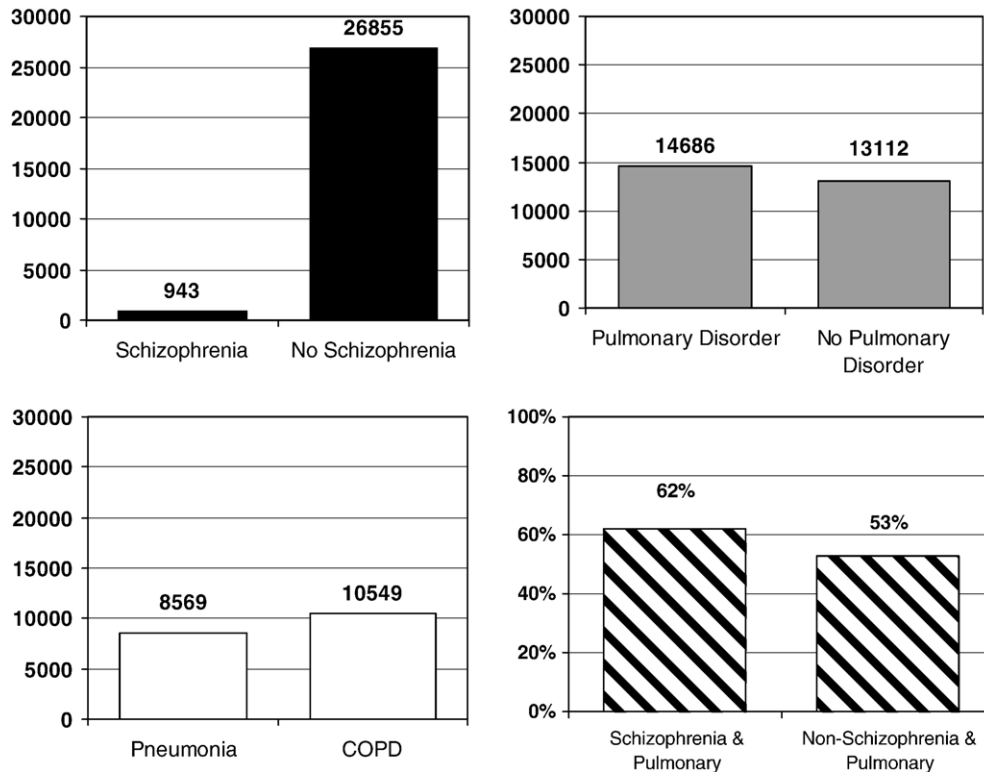


Fig. 1. Characteristics of inpatient decedents (N=27,798).

Table 2  
Multivariable analysis of factors influencing diagnosis with pneumonia or COPD during the last year of life among inpatient decedents ( $N=27,798$ )

	Odds ratio	95% Confidence interval
Schizophrenia	1.87	1.61–2.17
Female	0.70	0.59–0.84
Age (in decades; range 2–11)	1.15	1.11–1.18
African–American	0.69	0.64–0.73
Other non-white race	0.67	0.60–0.75
Currently married	0.92	0.87–0.97
Never married	0.85	0.78–0.94
Smoking history	2.05	1.87–2.25
Substance abuse disorder	0.88	0.80–0.96
Other mental illness	1.11	1.05–1.17
Charlson score (range 0–6)	1.02	1.01–1.03
Any outpatient use	1.86	1.74–1.99
Inpatient care <4 days	0.71	0.65–0.76

died during the second, third, or fourth quarter, or during the last three quarters of the year, the odds ratio for schizophrenia remained 1.9.

We next modeled the outcome of COPD only. The odds ratio for schizophrenia was 1.9 (95% CI 1.7–2.3). When we analyzed the outcome of pneumonia only, the odds ratio for schizophrenia was 1.5 (95% CI 1.3–1.7).

We repeated the analysis predicting the outcome of death with final-stay pulmonary disorder, indicated by having a pulmonary disorder diagnosed during the hospitalization when death occurred. The effect of schizophrenia was modest for this outcome (OR = 1.5; 95% CI 1.3–1.7).

#### 4. Discussion

Among VA inpatient decedents, we found several factors associated with increased odds of carrying a diagnosis of a pulmonary illness during the last year of life, notably a diagnosis of schizophrenia. We found weaker support for an increased risk of carrying a diagnosis of a pulmonary illness during the last inpatient stay. We tested an indicator for other mental illness, to determine whether the effects were general for mental illnesses or specific to schizophrenia, and found only a modest and independent association with other mental illnesses, suggesting a specific effect of schizophrenia. All models controlled for demographic covariates, minimal inpatient and outpatient use, severity of illness, substance abuse and a history of smoking. The independent associations with little inpatient care and no outpatient care suggest that VA hospitalists may often be faced with acutely ill psychosis patients with sparse medical histories.

Lifestyle issues such as smoking and poor self-care put schizophrenia patients at increased risk for pulmonary disease. Studies of clinical populations consistently find that the majority (68%–90%) of schizophrenia patients under the age of 67 smoke, but while interventions have been shown to be feasible (Dalack et al., 1999; Evins et al., 2005; George et al., 2002) quitting may not be a priority among patients (Esterberg and Compton, 2005). Smoking certainly may cause COPD and increase vulnerability to pneumonia (Shapiro and Ingenito,

2005; Sherman, 1992). This study found that decedents identified as smokers were twice as likely to be diagnosed with pulmonary disease as non-smokers. After controlling for this predictor, patients with schizophrenia were still two times as likely to have pulmonary disease as non-schizophrenia patients. Considering the low prevalence of smoking found here, our measure of smoking exposure probably did not capture all smokers, even though smoking rates drop with age and deteriorating health. VA enrollees have self-reported rates of 35% under the age of 65 vs only 11% age 65 or older (Miller et al., 2001). Even given under-reporting, it seems unlikely to have been differentially under-reported by schizophrenia diagnosis. VA enrollees smoke more than the US population per age- and sex-adjusted rates and smoke more heavily (Goldman et al., 2004). The risk of pulmonary disease among patients with schizophrenia is high, whether solely because of their smoking behavior or in part because of other unidentified factors, such as a genetic predisposition or frequent homelessness, specific to these patients.

Surprisingly, the effect of schizophrenia was reduced when we examined death with final-stay pulmonary disorder as an outcome, rather than diagnosis with pulmonary disorders at any time during the final year. The pulmonary disorders may contribute to a general state of poor health in schizophrenia patients who are near death, thereby giving an opportunity to a competing illness. Alternatively, the terminal hospitalization for a patient with multiple symptoms, especially if the stay was very short and the patient had little contact with the healthcare system in the prior year (sparse records of recent conditions), might not have allowed diagnosis of all co-occurring illnesses, leading to under-diagnosis of pulmonary disorders on the patient's final medical record.

Frayne et al. (2005) reported persistent disparities in meeting diabetes-related performance measures among veterans with mental illnesses, in spite of high use of outpatient services. Yet Dixon et al. (2004) have demonstrated that, when engaged in care in a diabetes clinic, patients with schizophrenia and diabetes do at least as well as their diabetic counterparts without schizophrenia. Together these studies seem to suggest that patients with serious mental illness can benefit from focused medical care but in fact often do not. Perhaps this is because of, as Dixon put it, “the typical segmentation of the mental health and primary care systems” (p.899) which may limit the extent to which patients engage in their non-psychiatric medical care. Are these veterans with schizophrenia victims of a system unable to cope with their complex comorbidity profiles? Possibly the issue is that, absent a serious mental illness, the average VA patient is his own case manager, but with it, no one fills this role. The case management of health care for a patient with multiple disorders entails choosing among numerous symptoms to identify those most urgently in need of attention. When the disorders are severe, the cost of choosing unwisely may be high.

Patients with schizophrenia may use little outpatient or inpatient care in spite of poor physical health (Druss and Rosenheck, 1997). A recent study noted decreasing consistency in reporting comorbid conditions among prostate cancer patients as age, general ill health, and mental ill health increased

(Klabunde et al., 2005). A large study of VA patients receiving care in the year 2000 found less frequent medical visits for those patients with serious mental illnesses (Cradock-O'Leary et al., 2002). Altogether, while their lifestyle and mental illness may render them more susceptible to pulmonary disease, schizophrenia patients may also be diagnosed at a relatively later stage of pulmonary ill health. Decreased opportunities to treat schizophrenia patients in an outpatient setting may contribute further to this phenomenon while simultaneously increasing the need for vigilance and coordination with other care providers. Significantly, while 60% of other decedents had outpatient care in the last year of life, only 40% of patients with schizophrenia did. Delayed care-seeking may result in hospitalization only when death is imminent. Finally, the ability to comply with recommended medication regimens and self-management may be poor. These factors tend to increase transfer of responsibility for the vulnerable patient's well-being from the patient to the healthcare system.

#### 4.1. Limitations

Our study is restricted to VA patients who died in VA facilities, and the study results may not be generalizable to all VA decedents or to non-VA populations. VA patients are mostly male, more ethnically diverse, poorer, and in worse health than the US population (Agha et al., 2000) but have commonalities with other publicly funded indigent patient populations such as Medicaid recipients (Kazis et al., 1998, 1999; Morgan et al., 2005). We were not able to compare decedents to survivors, and had only limited pharmaceutical data available, although our exploration of this issue led us to conclude that no bias resulted from it.

## 5. Conclusion

Clinicians need to be especially alert to the risk of pneumonia and COPD among patients with schizophrenia. Although patients with schizophrenia comprise about 2% of the VA patient population overall, they consume a disproportionate amount of VA healthcare resources (8%) (Blow et al., 2005) and are more likely to die as inpatients than patients without schizophrenia (Copeland et al., 2006). Patients with a diagnosis of schizophrenia may require outreach efforts to address pulmonary health earlier in their lives.

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## References

- Agha Z, Lofgren RP, VanRuiswyk JV, Layde PM. Are patients at Veterans Affairs medical centers sicker? A comparative analysis of health status and medical resource use. *Arch Intern Med* 2000;160(21):3252–7 [Nov].
- Anderson RN, Smith BL. Deaths: leading causes for 2002. *National Vital Statistics Report*, vol. 53(17). 2005. p. 1–90. Mar.
- Aruna AS, Murungi JH. Fluphenazine-induced neuroleptic malignant syndrome in a schizophrenic patient. *Ann Pharmacother* 2005;39(6):1131–5 [Jun].
- Blow FC, McCarthy JF, Valenstein M, Austin K, Gillon L. Care for Veterans with Psychosis in the VHA, FY04: 6th Annual National Psychosis Registry Report. Ann Arbor, MI: VA National Serious Mental Illness Treatment Research and Evaluation Center (SMITREC), Health Services Research and Development Center of Excellence 2005.
- Borzecki AM, Wong AT, Hickey EC, Ash AS, Berlowitz DR. Identifying hypertension-related comorbidities from administrative data: what's the optimal approach? *Am J Med Qual* 2004;19(5):201–6.
- Brown S, Inskip H, Barraclough B. Causes of the excess mortality of schizophrenia. *Br J Psychiatry* 2000;177:212–7 [Sep].
- Casey DE. Metabolic issues and cardiovascular disease in patients with psychiatric disorders. *Am J Med* 2005;118(Suppl 2):15S–22S [Apr].
- Chafetz L, White MC, Collins-Bride G, Nickens J. The poor general health of the severely mentally ill: impact of schizophrenic diagnosis. *Community Ment Health J* 2005;41(2):169–84 [Apr].
- Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 1987;40(5):373–83.
- Copeland LA, Zeber JE, Rosenheck RA, Miller AL. Unforeseen inpatient-mortality among veterans with schizophrenia. *Med Care* 2006;44(2):110–6.
- Cradock-O'Leary J, Young AS, Yano EM, Wang M, Lee ML. Use of general medical services by VA patients with psychiatric disorders. *Psychiatr Serv* 2002;53(7):874–8 [Jul].
- Curkendall SM, Mo J, Glasser DB, Rose Stang M, Jones JK. Cardiovascular disease in patients with schizophrenia in Saskatchewan, Canada. *J Clin Psychiatry* 2004;65(5):715–20 [Jun].
- Dalack GW, Becks L, Hill E, Pomerleau OF, Meador-Woodruff JH. Nicotine withdrawal and psychiatric symptoms in cigarette smokers with schizophrenia. *Neuropsychopharmacology* 1999;21(2):195–202 [Aug].
- Daumit GL, Pratt LA, Crum RM, Powe NR, Ford DE. Characteristics of primary care visits for individuals with severe mental illness in a national sample. *Gen Hosp Psychiatry* 2002;24(6):391–5 [Nov–2002 Dec].
- de Leon J, Dadvand M, Canuso C, White A, Stanilla J, Simpson G. Schizophrenia and smoking: an epidemiological survey in a state hospital. *Am J Psychiatry* 1995;152(3):453–5 [Mar].
- de Leon J, Diaz FJ, Josiassen RC, Cooper TB, Simpson GM. Does clozapine decrease smoking? *Prog Neuro-Psychopharmacol Biol Psychiatry* 2005;29(5):757–62 [Jun].
- Dixon LB, Kreyenbuhl JA, Dickerson FB, Donner TW, Brown CH, Wolheiter K, et al. A comparison of Type 2 diabetes outcomes among persons with and without severe mental illnesses. *Psychiatr Serv* 2004;55(8):892–900 [Aug].
- Dolder CR, Lacro JP, Jeste DV. Adherence to antipsychotic and nonpsychiatric medications in middle-aged and older patients with psychotic disorders. *Psychosom Med* 2003;65(1):156–62 [Jan–2003 Feb].
- Druss BG, Rosenheck RA. Use of medical services by veterans with mental disorders. *Psychosomatics* 1997;38(5):451–8 [Sep–1997 Oct].
- Esterberg ML, Compton MT. Smoking behavior in persons with a schizophrenia-spectrum disorder: a qualitative investigation of the transtheoretical model. *Soc Sci Med* 2005;61(2):293–303 [Jul].
- Evins AE, Cather C, Deckersbach T, Freudenreich O, Culhane MA, Olm-Shipman CM, et al. A double-blind placebo-controlled trial of bupropion sustained-release for smoking cessation in schizophrenia. *J Clin Psychopharmacol* 2005;25(3):218–25 [Jun].

- Frayne SM, Halanych JH, Miller DR, Wang F, Lin H, Pogach L, et al. Disparities in diabetes care: impact of mental illness. *Arch Intern Med* 2005;165(22):2631–8 [Dec].
- George TP, Vessicchio JC, Termine A, Bregartner TA, Feingold A, Rounsaville BJ, et al. A placebo controlled trial of bupropion for smoking cessation in schizophrenia. *Biol Psychiatry* 2002;52(1):53–61 [Jul].
- Goff DC, Sullivan LM, McEvoy JP, Meyer JM, Nasrallah HA, Daumit GL, et al. A comparison of ten-year cardiac risk estimates in schizophrenia patients from the CATIE study and matched controls. *Schizophr Res* 2005;66(2):183–94 [Sep].
- Goldman LS. Medical illness in patients with schizophrenia. *J Clin Psychiatry* 1999;60(Suppl 21):10–5.
- Goldman R, Craig TJ, Lance T. Smoking cessation treatment among a national sample of veteran outpatients. Washington, DC: VHA Office of Quality and Performance; 2004. Dec.
- Jensen HH, Godtfredsen NS, Lange P, Vestbo J. Potential misclassification of causes of death from COPD. *Eur Respir J* 2006;28(4):781–5 [Oct].
- Kashner TM. Agreement between administrative files and written medical records: a case of the Department of Veterans Affairs. *Med Care* 1998;36(9):1324–36 [Sep].
- Kazis LE, Miller DR, Clark J, Skinner K, Lee A, Rogers W, et al. Health-related quality of life in patients served by the Department of Veterans Affairs: results from the Veterans Health Study. *Arch Intern Med* 1998;158(6):626–32 [Mar].
- Kazis LE, Ren XS, Lee A, Skinner K, Rogers W, Clark J, et al. Health status in VA patients: results from the Veterans Health Study. *Am J Med Qual* 1999;14(1):28–38 [Jan–1999 Feb].
- Kermode M, Crofts N, Miller P, Speed B, Streecon J. Health indicators and risks among people experiencing homelessness in Melbourne, 1995–1996. *Aust N Z J Public Health* 1998;22(4):464–70 [Jun].
- Klabunde CN, Reeve BB, Harlan LC, Davis WW, Potosky AL. Do patients consistently report comorbid conditions over time? Results from the Prostate Cancer Outcomes Study. *Med Care* 2005;43(4):391–400 [Apr].
- Liam CK, Ong SB. Neuroleptic malignant syndrome with renal and respiratory complications—a case report. *Singapore Med J* 1990;31(2):182–4 [Apr].
- Miller DR, Kalman D, Ren XS, Lee AF, Niu Z, Kazis LE. Health Behaviors of Veterans in the VHA: Tobacco Use. Washington DC: Office of Quality and Performance (10Q), Veterans Health Administration, Department of Veterans Affairs, and Center for Health Quality, Outcomes, and Economic Research, Veterans Affairs Medical Center, 2001 Dec. Report No.: 1999 Large Health Survey of VHA Enrollees.
- Morgan RO, Teal CR, Reddy SG, Ford ME, Ashton CM. Measurement in Veterans Affairs Health Services Research: veterans as a special population. *Health Serv Res* 2005;40(5 Pt 2):1573–83 [Oct].
- Newman SC, Bland RC. Mortality in a cohort of patients with schizophrenia: a record linkage study. *Can J Psychiatry* 1991;36(4):239–45 [May].
- Nichol KL, Baken L, Nelson A. Relation between influenza vaccination and outpatient visits, hospitalization, and mortality in elderly persons with chronic lung disease. *Ann Intern Med* 1999;130(5):397–403 [Mar].
- Nishikawa T, Kaneda W, Uegaki A, Koga I, Uchida Y, Tanaka M. Respiratory dyskinesia: a variety of clinical forms differentially diagnosed by using a spirometer. *Clin Neuropharmacol* 1992;15(4):315–21 [Aug].
- Pauwels RA, Buist AS, Ma P, Jenkins CR, Hurd SS. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: National Heart, Lung, and Blood Institute and World Health Organization Global Initiative for Chronic Obstructive Lung Disease (GOLD): Executive Summary. *Respir Care* 2001;46(8):798–825 [Aug].
- Pedrelli P, McQuaid JR, Granholm E, Patterson TL, McClure F, Beck AT, et al. Measuring cognitive insight in middle-aged and older patients with psychotic disorders. *Schizophr Res* 2004;71(2–3):297–305 [Dec].
- Shapiro SD, Ingenito EP. The pathogenesis of chronic obstructive pulmonary disease: advances in the past 100 years. *Am J Respir Cell Mol Biol* 2005;32(5):367–72 [May].
- Sherman CB. The health consequences of cigarette smoking. *Pulmonary diseases. Med Clin North Am* 1992;76(2):355–75 [Mar].
- Smith Sehdev AE, Hutchins GM. Problems with proper completion and accuracy of the cause-of-death statement. *Arch Intern Med* 2001;161(2):277–84 [Jan].
- Sokal J, Messias E, Dickerson FB, Kreyenbuhl J, Brown CH, Goldberg RW, et al. Comorbidity of medical illnesses among adults with serious mental illness who are receiving community psychiatric services. *J Nerv Ment Dis* 2004;192(6):421–7 [Jul].
- Szeto HC, Coleman RK, Gholami P, Hoffman BB, Goldstein MK. Accuracy of computerized outpatient diagnoses in a Veterans Affairs general medicine clinic. *Am J Manag Care* 2002;8(1):37–43 [Jan].
- Valenstein M, Copeland LA, Blow FC, McCarthy JF, Zeber JE, Gillon L, et al. Pharmacy data identify poorly adherent patients with schizophrenia at increased risk for admission. *Med Care* 2002;40(8):630–9 [Aug].
- Weaver FM, Hatzakis M, Evans CT, Smith B, LaVela SL, Wallace C, et al. A comparison of multiple data sources to identify vaccinations for veterans with spinal cord injuries and disorders. *J Am Med Inform Assoc: JAMIA* 2004;11(5):377–9 [Sep–2004 Oct].
- Wilcox PG, Bassett A, Jones B, Fleetham JA. Respiratory dysrhythmias in patients with tardive dyskinesia. *Chest* 1994;105(1):203–7 [Jan].
- Youssef HA, Waddington JL. Characterization of abnormal respiratory movements in schizophrenic, bipolar and mentally handicapped patients with typical tardive dyskinesia. *Int Clin Psychopharmacol* 1989;4(1):55–9 [Jan].
- Zimmerman RK, Santibanez TA, Janosky JE, Fine MJ, Raymond M, Wilson SA, et al. What affects influenza vaccination rates among older patients? An analysis from inner-city, suburban, rural, and Veterans Affairs practices. *Am J Med* 2003;114(1):31–8 [Jan].