Factors associated with co-occurring medical conditions among adults with serious mental disorders

Lisa A. Razzano [a,*], Judith A. Cook [a], Chantelle Yost [a], Jessica A. Jonikas [a], Margaret A. Swarbrick [b], Tina M. Carter [a], Alberto Santos [c]

[a] Center on Mental Health Services Research and Policy, Department of Psychiatry, University of Illinois at Chicago, 1601 West Taylor Street, M/C 912, Chicago, IL 60612, United States
[b] Collaborative Support Programs of New Jersey, Rutgers, The State University of New Jersey, Department of Psychiatric Rehabilitation and Counseling Professions, 8 Spring Street, Freehold, NJ 07728, United States
[c] Georgia Regents University, Department of Psychiatry and Health Behavior, 1120, 15th Street, Augusta, GA 30912, United States

ARTICLE INFO

ABSTRACT

Background: This study examined the prevalence and treatment of 17 co-occurring physical health conditions among adults with serious mental health disorders, and factors associated with prevalence of the 5 most common medical co-morbidities.

Methods: Data were collected from 457 adults attending publicly funded mental health programs who participated in community health screenings held in 4 U.S. states. Face-to-face interviews included standardized items from the National Health Interview Survey and the National Health and Nutrition Examination Survey. Ordinary least squares regression analysis examined associations between prevalence of the 5 most common co-morbid conditions and respondents' demographic, clinical, attitudinal, and health insurance statuses.

Results: Compared to the U.S. population, prevalence was significantly higher for 14 out of 17 medical conditions assessed. The 5 most common were hyperlipidemia (45%), hypertension (44%), asthma (28%), arthritis (22%), and diabetes (21%). Controlling for age, study site, and Medicaid status, racial/ethnic minorities were almost twice as likely as Caucasians to be diagnosed with hypertension and diabetes; women were almost twice as likely as men to be diagnosed with diabetes; and people with schizophrenia were around half as likely as those with other disorders to be diagnosed with hypertension and arthritis. Age was positively related to all conditions except asthma. Treatment prevalence was below 70% for approximately half of ongoing conditions.

Conclusions: These results suggest a high level of medical vulnerability and need for coordination of health and mental health services in this population. Associations with age, minority status, and gender point to the need for targeted health care strategies.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

Compared to the general U.S. population, people with serious mental health conditions experience higher prevalence of many chronic medical conditions, and this difference has increased over the past decade (Saha et al., 2007). Beginning in the 1990s, studies have documented a host of health disparities among people with schizophrenia (Dixon et al., 1999), those receiving publicly financed healthcare such as Medicaid (Dickey et al., 2002; Jones et al., 2004), and persons in outpatient treatment settings (Dickerson et al., 2003; Sokal et al., 2004). Despite this burgeoning literature, large-scale surveys of adult populations with serious mental disorders have been relatively rare, due to expense and logistical challenges

(Sorel, 2010). The purpose of this study was to assess the prevalence and treatment of 17 medical conditions among community mental health clients in 4 states, and to identify factors associated with occurrence of the most common conditions.

While higher levels of morbidity and mortality are well-documented (Scott et al., 2009), less well established is the range of medical conditions that are more prevalent among people with serious mental disorders. A recent review of the literature (De Hert et al., 2011) concluded that "very good" evidence supports greater risk for the occurrence of stroke, myocardial infarction, hypertension, other cardiac and vascular diseases, hyperlipidemia, and obstetric complications. "Good" evidence was found for the greater likelihood of illness such as diabetes mellitus, HIV, Hepatitis B/C, tuberculosis, osteoporosis, and impaired lung function (De Hert et al., 2011). Since most studies address the impact of specific comorbid conditions, such as schizophrenia and cardiovascular disease, or diabetes and depression (Druss and Walker, 2011),

comprehensive assessments of diagnostically heterogeneous cohorts are needed.

One set of factors associated with co-occurring physical and mental health disorders are features of the individual such as demographic and clinical characteristics. Some research has suggested that racial and ethnic minorities with mental disorders are more likely to have co-morbid medical conditions than their non-minority counterparts (Mezuk et al., 2010). For example, minority race, ethnicity, and psychiatric disorders were found to be associated with the prevalence of multiple chronic health conditions in a study using data from the National Epidemiologic Survey of Alcohol and Related Conditions (Cabassa et al., 2013). In addition, research on a cohort of 1.7 million patients of Scottish medical practices found that the prevalence of physical and mental health comorbidity was significantly higher among women than men, and among older versus younger people (Barnett et al., 2012).

Some studies document a higher prevalence of medical comorbidities among individuals with specific psychiatric diagnoses. For example, people with schizophrenia have been shown to be especially vulnerable to medical co-morbidities (McEvoy et al., 2005). One comprehensive review of prior research estimated that prevalence was higher for those with schizophrenia versus bipolar disorder for diabetes mellitus, dyslipidemia, and metabolic syndrome, and lower for hypertension (De Hert et al., 2011). Data from the National Hospital Discharge Study found that, compared to patients with other psychiatric conditions and medical diagnoses, those with a primary diagnosis of schizophrenia showed significantly higher proportions of hypothyroidism, hypertension, epilepsy, diabetes type II, contact dermatitis and other eczema, viral hepatitis, and chronic obstructive pulmonary disease (Weber et al., 2009).

A factor found to be associated with mental and physical health co-morbidity is source of healthcare coverage, with rates of co-morbid conditions being especially high among Medicaid recipients. A study of national Medicaid claims data (Kronick et al., 2009) found that half of disabled Medicaid enrollees with psychiatric conditions also had claims for diabetes, cardiovascular illness, or pulmonary disease, and that proportions were substantially higher among beneficiaries with psychiatric conditions versus those without. Among NY State Medicaid beneficiaries, compared to those without a mental disorder, those with mental health conditions had a 57% higher prevalence of asthma/COPD, 54% higher prevalence of arthritis, 47% higher prevalence of heart disease, 32%/higher prevalence of hypertension, and 27% higher prevalence of diabetes (Coughlin and Shang, 2011).

Research also has identified the importance of attitudes and skills regarding health care self-efficacy and illness management for people with chronic health conditions. Higher self-efficacy levels are connected with better self-care and consequently superior health outcomes, but this relationship is moderated by co-occurring health and mental health conditions (Tovar et al., 2013). For example, compared to those with type 2 diabetes mellitus alone, those with co-occurring schizophrenia and diabetes had significantly lower self-efficacy and poorer self-care behaviors, and these were related to poorer hemoglobin A1C outcomes (Chen et al., 2014).

A smaller literature has addressed treatment prevalence for co-occurring medical and physical health conditions. A study of the CATIE schizophrenia trial cohort at baseline found that rates of treatment were low for diabetes (30%) and hypertension (62%), but higher for dyslipidemia (88%) (Nasrallah et al., 2006). Other studies have found low rates of diabetes care among those with severe mental disorders (Kreyenbuhl et al., 2006), under-treatment of arthritis among individuals with psychosis (Redelmeier et al., 1998), and under-treatment of cardio-vascular disease among people with bipolar disorder (Smith et al., 2013). Adults with schizophrenia spectrum, major depressive, and bipolar disorders also report significantly more barriers to health care in the past year compared to those reported by the general population (Dickerson et al., 2003).

The high prevalence and low rates of treatment for co-occurring medical conditions presents formidable barriers to the mental health recovery of individuals with psychiatric disabilities. Thus, the focus of the present analysis is to broaden our knowledge by examining the lifetime prevalence and current treatment likelihood of co-occurring medical conditions in this group. Our first hypothesis was that a significantly higher prevalence of all 17 medical conditions would be found in the study population compared to the general U.S. population. Our second hypothesis predicted significant associations between lifetime prevalence and a model including respondents' age, sex, minority status, psychiatric diagnosis, Medicaid beneficiary status, and health self-efficacy.

2. Methods

2.1. Study population and procedures

Study participants (N = 457) were members of publicly funded community mental health programs in four states. Eligibility criteria included serious mental illness as defined by U.S. Public Law 102–321 (Epstein et al., 2002) to include a DSM-IV-TR (American Psychiatric Association, 2000) diagnosis of mental illness accompanied by moderate to severe functional impairment; age 18 years or older; status as a client of the participating program; and ability to provide informed consent. This group includes individuals with the most severe mental health conditions such as schizophrenia and mood disorders. Among individuals in the study, just over 41% (n = 179) were diagnosed with schizophrenia, 24% (n = 106) with depression, 23% (n = 100) with bipolar disorder, and 4% (n = 19) with anxiety disorders. Approximately 8% (n = 37) reported other types of mental health conditions. The participants were recruited with the help of program staff and peers who distributed flyers describing the research, discussed it during group and individual meetings, and arranged transportation for participants to and from data collection locations.

Data were collected at 3-day health screenings convened by a university research center and peer-run program, using a standardized administration manual (Swarbrick et al., 2014). The first screening was held at a peer-operated center in New Brunswick, NJ and attended by members of the NJ statewide network of peer-run programs. The second was held in a university gymnasium in Chicago, IL and attended by clients from a psychiatric rehabilitation program with locations across the city and suburbs. The third was held at an Elk's Club Lodge in Frederick, MD and a Church auditorium in Rockville, MD and attended by clients of 2 local community mental health programs. The fourth was held at a community mental health agency in Smyrna, GA and attended by its clients.

All participants provided written informed consent using procedures approved by the university's Institutional Review Board (IRB) and the IRBs of participating community mental health programs. They then completed face-to-face interviews with trained research staff using a computer-assisted personal interview protocol, prior to beginning health screening. Only 2% (7 of 464) of those attending the screenings refused participation.

2.2. Measures

Prevalence of medical conditions and treatment prevalence were assessed using items from the National Health Interview Survey (NHIS) (Centers for Disease Control and Prevention [CDC], 2007) and the National Health and Nutrition Examination Survey (NHANES) (CDC, 2010). Queries about each medical condition began with the question, "Have you ever been told by a doctor or other health professional that you had [name of condition and description]." Follow-up items asked participants whether they still had the condition, and whether they were currently receiving treatment for it. Health conditions assessed in this study were chosen based on previous

research regarding health disparities among individuals with mental health disorders (Dickerson et al., 2003; Sokal et al., 2004; Druss and Walker, 2011). Following criteria used by Nasrallah et al. (2006) treatment prevalence of <70% was considered low, and we defined treatment prevalence of half or less (≤50%) as very low. Participants' self-perceived ability to manage their physical health was assessed using the Perceived Competence for Health Scale (Williams et al., 1998), a 4-item measure adapted from a scale measuring self-management of diabetes, with a Cronbach's alpha of .82 for pre-test and .86 for post-test scores in the current study. Also collected was information about participants' demographic characteristics, health insurance coverage, and psychiatric diagnosis.

2.3. Analyses

Descriptive statistics were used to calculate the lifetime and current treatment prevalence of 17 different medical conditions. The z-ratio test for differences between two independent proportions was used to compare lifetime prevalence found in this study with that found in population-based studies in order to evaluate the first study hypothesis. As noted by Lowry (2013), this statistic takes n_1 and n_2 to represent the total number of observations in two independent samples (i.e., total comparison sample sizes), with k_1 and k_2 representing the number of observations within each sample that are of particular interest (i.e., proportion diagnosed with each health condition); and p_1 and p_2 to represent the proportions k_1/n_1 and k_2/n_2, respectively (Lowry, 2013). Finally, in order to evaluate our second hypothesis, ordinary least squares regression analysis (Rao, 1973) was used to test for associations between the 5 most prevalent medical conditions and a model including participant background characteristics (age, sex, race/ethnicity), health insurance status (Medicaid vs. other),

DSM-IV diagnosis of schizophrenia, and health self-efficacy, controlling for study site.

3. Results

3.1. Background characteristics and representativeness

Table 1 presents participants' demographic and clinical characteristics. When these were compared with the background characteristics of populations at the participating agencies, there were no significant differences by sex, race, Hispanic/Latino ethnicity, education, age, diagnosis, and health insurance status with two exceptions. In NJ, a smaller proportion of males were screened (46%) than in the agency population (59%) (Z = −2.1, p < .05). In GA, more screening participants reported schizophrenia (40%) than the agency population (25%) (Z = 3.3, p < .001). Otherwise, screening participants were representative of each population targeted.

3.2. Prevalence of co-morbid health conditions

Table 2 presents the prevalence of 17 co-occurring medical conditions reported by participants. The prevalence of many of these health conditions was high, with over two-fifths reporting diagnoses of hyperlipidemia (45%) and hypertension (44%); around a fifth reporting asthma (28%), arthritis (22%), and diabetes (21%); and more than a tenth reporting chronic bronchitis (15%), ulcer (12%), or any heart condition (17%). Lower prevalence rates of ≥5% were observed for stroke, emphysema, cancer, hepatitis A, B or C, tuberculosis, congestive heart failure, and HIV/AIDS. The mean number of co-morbid conditions per person was 2.8 (SD = 2.2). Eighty seven percent (n = 395) reported at least one of the 17 conditions, with

Table 1
Characteristics of individuals with serious mental disorders screened for common health conditions.

	Total[a] (N = 457)		New Jersey (n = 121)		Illinois (n = 122)		Maryland (n = 106)		Georgia (n = 108)	
	N	%	N	%	N	%	N	%	N	%
Female	221	48.7	65	53.7	41	33.9	46	44.2	69	63.9
Hispanic/Latino ethnicity	32	7.1	13	10.8	13	10.8	5	4.8	1	0.9
Race										
White/Caucasian	221	48.8	62	51.2	34	28.1	67	65.0	58	53.7
Black/African American	175	38.6	41	33.9	69	57.0	25	24.3	40	37.0
Asian/Pacific islander	8	1.8	2	1.7	2	1.7	3	2.9	1	0.9
American Indian/Alaskan native	2	0.4	0	0.0	2	1.7	0	0.0	0	0.0
Multi-racial	17	3.8	6	5.0	3	2.5	4	3.9	4	3.7
Other	30	6.6	10	8.3	11	9.1	4	3.9	5	4.6
Education										
<High school	89	20.0	16	13.8	38	32.2	18	17.1	17	16.2
High school/GED	138	31.1	30	25.9	34	28.8	30	28.6	44	41.9
Some college/advanced degree	217	48.9	70	60.3	46	39.0	57	54.3	44	41.9
Marital status										
Married/cohabiting	35	7.9	8	6.8	3	2.5	8	7.6	16	15.4
Never married	292	65.8	67	57.3	92	78.0	88	83.8	45	43.3
Widowed/separated/divorced	117	26.4	42	35.9	23	19.5	9	8.6	43	41.3
Mean (SD) age, years	46.5 (12.1)		49.1 (13.4)		47.1 (11.1)		44.6 (12.3)		44.7 (11.0)	
Health insurance type										
Medicaid	130	29.2	37	31.6	42	35.6	34	32.4	17	16.2
Medicare	82	18.4	28	23.9	18	15.3	20	19.0	16	15.2
Dual	137	30.7	31	25.6	43	36.4	42	40.0	21	20.0
Private	43	9.7	21	17.9	6	5.1	14	13.3	2	1.9
Veteran's	11	2.5	4	3.4	2	1.7	1	1.0	4	3.8
Other	22	5.2	7	6.0	9	7.6	5	4.8	2	1.9
None	62	13.9	6	5.1	7	5.9	3	2.9	46	43.8
DSM-IV diagnosis										
Schizophrenia	179	40.6	26	21.8	63	53.8	48	48.5	42	39.6
Bipolar disorder	100	22.7	31	26.1	17	14.5	24	24.2	28	26.4
Depression	106	24.0	34	28.6	31	26.5	19	19.2	22	20.8
Anxiety disorder	19	4.3	4	3.4	2	1.7	4	4.0	9	8.5
Personality disorder	4	0.9	2	1.7	0.	0.0	2	2.0	0	0.0
Other	33	7.5	22	18.5	4	3.4	2	2.0	5	4.7

[a] Variations in sample sizes are due to missing data.

Table 2
Prevalence of medical co-morbidities reported for U.S. nationally representative populations, lifetime prevalence[1] and current treatment prevalence[2] among study participants (N = 457).

Medical condition	Prevalence in national cohorts,[a–f] % with condition	Lifetime prevalence[1] in study population, % (n) and significance	Current treatment prevalence[2] in study population, % (n)
Arthritis[3]	22.7[a]	22.1 (100) ns	52.7 (48)
Asthma	2.7[a]	28.0 (127)***	81.1 (77)
Stroke	2.7[a]	4.4 (20)*	42.1 (8)
Chronic bronchitis	4.3[a]	15.0 (68)***	71.1 (27)
Emphysema	1.9[a]	4.0 (18)**	61.5 (8)
Diabetes	8.3[b]	21.3 (96)***	94.5 (86)
Ulcer	6.5[a]	11.8 (53)***	55.5 (10)
Weak/failing kidneys	1.7[a]	7.3 (33)***	66.6 (18)
Non-viral liver problems	1.4[a]	6.8 (31)***	30.0 (6)
Cong. heart failure	1.0[a]	2.6 (12)***	100.0 (11)
Other heart conditions [4]	11.5[a]	17.3 (79)***	93.1 (54)
Hypertension	25.9[a]	44.1 (197)***	89.2 (150)
Any cancer	8.5[a]	5.1 (23)**	50.0 (3)
Hyperlipidemia	38.4[c]	45.0 (198)*	82.8 (135)
Hepatitis A, B or C	1.9[d]	5.5 (25)***	33.3 (5)
Tuberculosis	3.4[e]	3.1 (14) ns	100.0 (1)
HIV/AIDS	0.6[f]	0.7 (3)****	100.0 (3)

[a] National Health and Nutrition Examination Survey Data (CDC, 2007); N = 195,850,985.
[b] Centers for Disease Control and Prevention (2011a). N = 195,850,985.
[c] Centers for Disease Control and Prevention (2011b); N = 350,000.
[d] Centers for Disease Control and Prevention (2011c); N = 5870.
[e] Centers for Disease Control and Prevention (2012); N = 10,528.
[f] World Health Organization, UNAIDS (2013); N = 1,200,000.
[1] Lifetime prevalence defined by NHANES item, "Have you ever been told by a physician or other health professional that you had [medical condition]."
[2] Current treatment prevalence defined as affirmative response to both NHANES items: a) "Do you still have [medical condition]"; and b) "Are you currently being treated for [medical condition]".
[3] Arthritis includes rheumatoid arthritis and osteoarthritis.
[4] Other heart condition includes coronary heart disease, myocardial infarction, angina, and heart condition.
 * p < .05.
 ** p < .01.
 *** p < .001.
 **** n < 5 — not calculated due to low sample size.

18% (n = 83) reporting only one, 36% (n = 166) reporting 2–3, and 33% (n = 146) reporting 4 or more.

3.3. Comparison with national prevalence rates

Table 2 also shows the prevalence for these conditions found in prior U.S. population-based studies. A significantly higher prevalence was found in the present study than in the general population for 14 out of 17 conditions, and the prevalence of some conditions was exponentially higher. For example, the prevalence of liver disease was nearly six times that found in the general population (i.e., 6.8% vs. 1.4%); the prevalence of diabetes and chronic bronchitis was nearly three times higher (i.e., 21.3% vs. 8.3% and 15% vs. 4.3% respectively); the prevalence of viral hepatitis was just over two times higher (i.e., 5.5% vs. 1.9%) as was the prevalence of ulcer (i.e., 11.8% vs. 6.5%); and the prevalence of hypertension was over one-and-one-half times that found in the general population (44% vs. 26%). The only conditions for which prevalence was not significantly higher in the study population were arthritis, tuberculosis (TB), and HIV/AIDS.

3.4. Treatment prevalence of co-morbid health conditions

Also shown in Table 2 are the number and proportion reporting current treatment for conditions that were characterized by participants as ongoing. Treatment prevalence was low (<70%) for around half of the conditions (8 out of 17), and extremely low (≤50%) for cancer (50%), stroke (42%), non-viral liver disease (30%), and hepatitis A/B/C (33%). On the other hand, higher proportions (≥70%) reported receiving treatment for diabetes (94%), hyperlipidemia (83%), hypertension (89%), and asthma (81%), as well as congestive heart failure, TB, and HIV/AIDS (all at 100%).

3.5. Associations with co-morbid health conditions

Next, analyses examined relationships between participants' characteristics and their likelihood of being diagnosed with the five most commonly occurring health conditions, controlling for study site (Table 3). In the multivariable analysis, asthma was more likely to be diagnosed among younger participants, Medicaid beneficiaries, and participants with lower health self-efficacy, and less likely among those with schizophrenia. The likelihood of a hypertension diagnosis was greater among participants who were members of minority racial and ethnic groups, and those who were older, and less likely among those with schizophrenia. The likelihood of diabetes was greater among members of minority racial and ethnic groups, women, and older participants. Hyperlipidemia was more likely among older participants and less likely among Medicaid beneficiaries. Finally, arthritis was more likely among older participants, and less likely among those with schizophrenia.

The same model was used to examine associations with treatment for the 5 conditions among participants who characterized them as ongoing (not shown). With the exception of positive associations between age and treatment likelihood, none of the variables were consistently significant, possibly due to small sample sizes for the untreated groups.

4. Discussion

The results of this multi-site study confirm the high rate of health and mental health co-morbidity found in prior research on people with serious mental disorders, with 87% reporting at least one, 82% two or more, and 69% three or more co-occurring medical conditions. Moreover, the prevalence of 14 of the 17 conditions assessed in our study was significantly higher (and in many cases exponentially higher)

Table 3
Bivariate and multivariate odds-ratios, factors associated with lifetime prevalence[a] of common medical co-morbidities with serious mental disorders, controlling for study site (N = 457).

Model variables	Asthma (18% N = 127)		Hypertension (44% N = 197)		Diabetes (21% N = 96)		Hyperlipidemia (45% N = 198)		Arthritis (20% N = 92)	
	Bivariate odds-ratio (95% CI)	Multivariate odds-ratio (95% CI)	Bivariate odds-ratio (95% CI)	Multivariate odds-ratio (95% CI)	Bivariate odds-ratio (95% CI)	Multivariate odds-ratio (95% CI)	Bivariate odds-ratio (95% CI)	Multivariate odds-ratio (95% CI)	Bivariate odds-ratio (95% CI)	Multivariate odds-ratio (95% CI)
Race/ethnicity										
Caucasian	Reference		Reference		Reference		Reference		Reference	
Minority	1.4 (.95, 2.2)	1.5 (.95, 2.4)	1.6** (1.1, 2.4)	1.8** (1.2, 2.8)	1.9** (1.3, 3.2)	1.9* (1.1, 3.2)	.72 (.49, 1.0)	.77 (.50, 1.2)	1.1 (.70, 1.8)	1.4 (.81, 2.4)
Gender										
Male	Reference		Reference		Reference		Reference		Reference	
Female	1.5 (.99, 2.3)	1.3 (.86, 2.1)	1.2 (.81, 1.9)	1.1 (.72, 1.7)	1.6* (1.0, 2.5)	1.9** (1.2, 3.2)	1.0 (.69, 1.5)	1.0 (.66, 1.5)	1.6* (1.0, 2.6)	1.5 (.91, 2.6)
Diagnosis										
All others	Reference		Reference		Reference		Reference		Reference	
Schizophrenia	.59* (.38, .92)	.64* (.39, 1.1)	.85 (.58, 1.3)	.65* (.42, 1.0)	1.3 (.84, 2.1)	1.2 (.75, 2.1)	1.3 (.91, 2.0)	1.4 (.89, 2.1)	.55* (.33, .90)	.48* (.28, .85)
Insurance										
All others	Reference		Reference		Reference		Reference		Reference	
Medicaid only	1.8* (1.2, 2.8)	1.6* (1.0, 2.6)	.91 (.60, 1.4)	.93 (.59, 1.5)	.76 (.46, 1.3)	.67 (.38, 1.2)	.48** (.31, .74)	.49** (.30, .78)	1.8* (1.0, 3.1)	1.4 (.78, 2.4)
Age in years	.98* (.96, 1.0)	.98 (.97, 1.1)	1.1** (1.0, 1.1)	1.1** (1.0, 1.1)	1.0*** (1.0, 1.1)	1.0*** (1.0, 1.1)	1.0*** (1.0, 1.1)	1.1*** (1.0, 1.1)	1.1* (1.0, 1.1)	1.1*** (1.0, 1.1)
Health self-efficacy	.96* (.93, 1.0)	.96* (.92, .99)	.99 (.96, 1.1)	.98 (.95, 1.1)	1.0 (.97, 1.1)	1.0 (.96, 1.1)	.99 (.95, 1.1)	.97 (.93, 1.1)	1.0 (.97, 1.1)	.98 (.93, 1.0)

a Lifetime prevalence defined by NHANES item, "Have you ever been told by a physician or other health professional that you had [medical condition]."
* p < .05.
** p < .01.
*** p < .001.

than the prevalence found in studies of the non-institutionalized U.S. adult population. Treatment prevalence for almost half (47%) of the conditions was below 70%. These results suggest a high degree of medical vulnerability and the need for coordination of multiple physical health conditions in addition to mental health care.

Ours is one of the first studies to document racial/ethnic disparities in physical health among people with mental disorders. Racial and ethnic minority group members were almost twice as likely as non-minority participants to be diagnosed with hypertension and diabetes, controlling for study site and other individual and system-level factors. These findings are mirrored by surveillance data in the general population showing a high prevalence of these two conditions in African American (Liao et al., 2002) and Latino communities (Fryar et al., 2010). Much has been written recently about the high rates of unhealthy behaviors among minorities (smoking, overeating, sedentary behaviors, alcohol use) viewed as a response to chronic stress and poor environments that protects against depression yet silently contributes to physical health morbidities and early mortality (Jackson et al., 2010; Mezuk et al., 2010). With this in mind, interventions aimed at improving the health of racial and ethnic minorities with serious mental disorders should consider the stressful nature of their low-resourced environments as well as how coping strategies arise from living in neighborhoods characterized by poor infrastructure and limited access to healthy foods and recreational activities (Auchinclose et al., 2008). For those living under chronically stressful conditions, it may not be sufficient to prevent or reduce unhealthy behaviors without addressing these structural factors as well (Cook and Mueser, 2013). Interventions must offer reasonable alternatives to material and emotional coping strategies forged by disadvantaged environments if they are to be effective.

A consistent if not surprising finding was the association of age with the likelihood of 4 common co-morbid health conditions in this study population. Controlling for all other factors, older individuals were more likely to be diagnosed with diabetes, hypertension, high cholesterol, and arthritis. APA guidelines for psychological practice with older adults (Izutsu, 2004) direct mental health clinicians to educate themselves about common medical co-morbidities and become competent to conduct screening and make effective medical referrals in older populations. Coupled with our findings regarding race/ethnicity, at routine visits, both behavioral health and medical providers should offer culturally competent, targeted education about illness self-monitoring and self-management, while using motivational interviewing techniques (Martins and McNeil, 2009) to help clients develop feasible goals for healthier lifestyles. Health and mental health providers might benefit from partnering with neighborhood senior centers, age- and ethnic-specific community organizations, and places of worship to improve health care access and health literacy among older culturally diverse individuals, prompting them to seek treatment and natural supports earlier and more regularly (Gehlert et al., 2008).

This study also found that women were more likely then men to report a diagnosis of diabetes, a finding reported in prior studies of psychiatric cohorts (Banerjea et al., 2007; Vinogradova et al., 2010). Given evidence that depression accelerates the development of coronary heart disease in women with diabetes (Clouse et al., 2003), and findings that women with co-occurring depression and diabetes have twice the risk of death from cardiovascular disease compared to women with neither condition (Pan et al., 2011), there is a need to provide gender-sensitive integrated health and mental health care for these women. This involves addressing psychosocial treatment barriers, including the struggles many women have in reconciling their family responsibilities with their health appointments and treatment regimens (Emslie, 2005), embarrassment at being weighed at health visits (Amy et al., 2006), and diminished vision and bodily pain among older women impeding ability to exercise, read food labels, and cook at home (Schoenberg and Drungle, 2001).

These results also revealed that, all other things being equal, participants with lower levels of health self-efficacy were more likely to be diagnosed with asthma, as were Medicaid beneficiaries receiving publicly funded health services. Patients who feel unable to care for their health as well as those who are affected by poverty and lack material resources to do so require additional support to successfully manage their respiratory health (Canino et al., 2009). The association of asthma with mood and anxiety disorders is well-established (Goodwin et al., 2003; Ortega et al., 2006) and the high rate of smoking among people with serious mental disorders (Lasser et al., 2000; Lawrence et al., 2009) can cause or exacerbate asthma, pointing to the need for both care coordination and preventive services around these interconnected issues.

Finally, our results regarding individuals with schizophrenia were somewhat contradictory. On the one hand, they were less likely to report being diagnosed with hypertension, consistent with some prior studies (De Hert et al., 2011) but not others (Weber et al., 2009). On the other hand, they were not more likely to be diagnosed with diabetes or dyslipidemia as others have found (Weber et al., 2009), and they were less likely to report being diagnosed with arthritis. It may be that schizophrenia acted as a proxy for other unmeasured influences in prior studies, or that its significance in prior studies was actually due to other variables in our model such as race/ethnicity, age, or gender. Cognitive impairments experienced by some people with this diagnosis also may have affected their reporting of co-morbid medical conditions.

A number of caveats apply to our study findings. First, participants were not a nationally representative sample of adults with serious mental disorders since they were recruited from selected community mental health programs in only four U.S. states. Second, information regarding physical and mental health conditions was collected via participant self-report, and did not include follow-up chart review or medical tests for independent verification. Third, self-report also was used to assess treatment for medical conditions, and did not include confirmation with Medicaid claims or other administrative utilization data. We also lacked specific information about treatment such as access to care, locus of care, medications being taken, and types of services received. Fourth, comparisons of health disparities between individuals with mental health conditions in our study and those in the general population did not control for demographic factors. Fifth, the mental health programs that collaborated in the research may have been especially "health-conscious" and, thus, not representative of other agencies in their state. Sixth, clients who participated in the research were self-selected and may not have represented larger agency populations (although statistical tests did confirm their representativeness on a number of background variables).

More research is needed on the prevalence and paths to successful treatment of health co-morbidities among women, racial and ethnic minorities, and older adults. Additionally, intake protocols for both medical and behavioral health programs should include assessment of co-occurring medical conditions in order to deliver person-centered services that take account of the whole person. Providers and patients alike should be incentivized to use existing guidelines for improved identification, monitoring, and management of co-occurring conditions. Finally, the positive interplay between mental and physical health should serve as the foundation for empowering service users to maintain an active life, increase their health literacy, and access information on lifestyle modifications and best practice treatments.

Contributors

L Razzano and J Cook designed the study and wrote the protocol. C Yost and J Jonikas managed the literature searches and analyses. L Razzano undertook the statistical analysis, and M Swarbrick, A Santos and T Carter assisted with the writing of the manuscript. All authors contributed to and have approved the final manuscript.

References

American Psychiatric Association, 2000. Diagnostic and Statistical Manual of Mental Disorders. Revised 4th ed. Author, Washington, DC.

Amy, N.K., Aalborg, A., Lyons, P., Keranen, L., 2006. Barriers to routine gynecological cancer screening for White and African–American obese women. Int. J. Obes. 30, 147–155.

Auchinclose, A.H., Diez Roux, A.V., Brown, D.G., Erdmann, C.A., Bertoni, A.G., 2008. Neighborhood resources for physical activity and healthy foods and their association with insulin resistance. Epidemiology 19 (1), 146–157.

Banerjea, R., Sambamoorthi, U., Smelson, D., Pogach, L.M., 2007. Chronic illness with complexities: mental illness and substance use among Veteran clinic users with diabetes. Am. J. Drug Alcohol Abuse 33 (6), 807–821.

Barnett, K., Mercer, S.W., Norbury, M., et al., 2012. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. Lancet 380 (9836), 37–43.

Cabassa, L.J., Humensky, J., Druss, B., et al., 2013. Do race, ethnicity and psychiatric diagnoses matter in the prevalence of multiple chronic medical conditions? Med. Care 51 (6), 540–547.

Canino, G., McQuaid, E.L., Rand, C.S., 2009. Addressing asthma health disparities: a multilevel challenge. J. Allergy Clin. Immunol. 123 (6), 1209–1217.

Centers for Disease Control and Prevention (CDC), 2011a. Vital signs: prevalence, treatment, and control of high levels of low-density lipoprotein cholesterol. United States, 1999–2002 and 2005–2008. Morb. Mortal. Wkly Rep. 60 (4), 109–114.

Centers for Disease Control and Prevention (CDC), 2011b. Viral Hepatitis Surveillance United States. Retrieved from http://www.cdc.gov/hepatitis/Statistics/index.htm.

Centers for Disease Control, Prevention (CDC), 2007. National Center for Health Statistics (NCHS). National Health and Nutrition Examination Survey Data. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Hyattsville, MD (Retrieved from: http://www.cdc.gov/nchs/surveys.htm).

Centers for Disease Control, Prevention (CDC), 2010. National Center for Health Statistics (NCHS). National Health and Nutrition Examination Survey Questionnaire (or Examination Protocol, or Laboratory Protocol). U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Hyattsville, MD (Retrieved from: http://www.cdc.gov/nchs/surveys.htm).

Centers for Disease Control, Prevention (CDC), 2011. National Diabetes Fact Sheet: National Estimates and General Information on Diabetes and Prediabetes in the United States. (Retrieved from http://www.cdc.gov/diabetes/pubs/factsheet11.htm).

Centers for Disease Control, Prevention (CDC), 2012. Reported tuberculosis in the United States. (Retrieved from: http://www.cdc.gov/tb/statistics/reports/2012/default.htm).

Chen, S.-R., Chien, Y.-P., Kang, C.-M., Jeng, C., Chang, W.-Y., 2014. Comparing self-efficacy and self-care behaviours between outpatients with comorbid schizophrenia and type 2 diabetes and outpatients with only type 2 diabetes. J. Psychiatr. Ment. Health Nurs. 21 (5), 414–422.

Clouse, R.E., Lustman, P.J., Freedland, K.E., Griffith, L.S., McGill, J.B., Carney, R.M., 2003. Depression and coronary heart disease in women with diabetes. Psychosom. Med. 65 (3), 376–383.

Cook, J.A., Mueser, K.T., 2013. The challenge of obesity. Psychiatr. Rehabil. J. 36 (3), 129–132.

Coughlin, T., Shang, B., 2011. New York's Medicaid Beneficiaries with Mental Health and Substance Abuse Conditions. United Hospital Fund, New York.

De Hert, M., Correll, C.U., Bobes, J., Cetkovich-Bakmas, M., Cohen, D., et al., 2011. Physical illness in patients with severe mental disorders. 1. Prevalence, impact of medications and disparities in health care. World Psychiatry 10, 52–77.

Dickerson, F.B., McNary, S.W., Brown, C.H., Kreyenbuhl, J., Goldberg, R.W., Dixon, L.B., 2003. Somatic healthcare utilization among adults with serious mental illness who are receiving community psychiatric services. Med. Care 41 (4), 560–570.

Dickey, B., Normand, S.L., Weiss, R.D., Drake, R.E., Azeni, H., 2002. Medical morbidity, mental illness, and substance use disorders. Psychiatr. Serv. 53 (7), 861–867.

Dixon, L., Postrado, L., Delahanty, J., Fisher, P.J., Lehman, A., 1999. The association of medical comorbidity in schizophrenia with poor physical and mental health. J. Nerv. Ment. Dis. 187 (8), 496–502.

Druss, B.G., Walker, E.R., 2011. Mental disorders and medical comorbidity. The Synthesis Project: Research Synthesis Report Number 21. Robert Wood Johnson Foundation, Princeton, NJ (Retrieved from http://www.rwjf.org/content/dam/farm/reports/issue_briefs/2011/rwjf69438/subassets/rwjf69438_1).

Emslie, C., 2005. Women, men and coronary heart disease: a review of the qualitative literature. J. Adv. Nurs. 51 (4), 382–395.

Epstein, J., Barker, P., Vorburger, M., Murtha, C., 2002. Serious mental illness and its co-occurrence with substance use disorders. DHHS Publication No. SMA 04-3905, Analytic Series A-24 Substance Abuse and Mental Health Services Administration, Office of Applied Studies, Rockville, MD.

Fryar, C.D., Hirsch, R., Eberhardt, M.S., Yoon, S.S., Wright, J.D., 2010. Hypertension, high serum total cholesterol, and diabetes: racial and ethnic prevalence differences in U.S. adults, 1999–2006. 36. NCHS Data Brief, pp. 1–8.

Gehlert, S., Sohmer, D., Sacks, T., Mininger, C., McClintock, M., Olopade, O., 2008. Targeting health disparities: a model linking upstream determinants to downstream interventions. Health Aff. 27 (2), 339–349.

Goodwin, R.D., Jacobi, F., Thefeld, W., 2003. Mental disorders and asthma in the community. Arch. Gen. Psychiatr. 60 (11), 1125–1130.

Izutsu, S., 2004. Guidelines for psychological practice for older adults. Am. Psychol. 59 (4), 236–260.

Jackson, J.S., Knight, K.M., Rafferty, J.A., 2010. Race and unhealthy behaviors, chronic stress, the HPA axis, and physical and mental health disparities over the life course. Am. J. Public Health 100 (5), 933–939.

Jones, D.R., Macias, C., Barreira, P.J., Fisher, W.H., Hargreaves, W.A., Harding, C.M., 2004. Prevalence, severity, and co-occurrence of chronic physical health problems of persons with serious mental illness. Psychiatr. Serv. 55 (11), 1250–1257.

Kreyembuhl, J., et al., 2006. Extent and management of cardiovascular risk factors in patients with type 2 diabetes and serious mental illness. J. Nerv. Ment. Dis. 194 (6), 404–410.

Kronick, R.G., Bella, M., Gilmer, T.P., 2009. The Faces of Medicaid III: Refining the Portrait of People With Multiple Chronic Conditions. Center for Health Care Strategies, Inc.

Lasser, K., et al., 2000. Smoking and mental illness: a population-based prevalence study. J. Am. Med. Assoc. 284 (20), 2606–2610.

Lawrence, D., Mitrou, F., Zubrick, S.R., 2009. Smoking and mental illness: results from population surveys in Australia and the United States. BMC Public Health 9, 285–299.

Liao, Y., Tucker, P., Okoro, C.A., Giles, W.H., Mokdad, A.H., Harris, V.B., 2002. REACH 2010 surveillance for health status in minority communities, United States, 2001–2002. Morb. Mortal. Wkly Rep. 53 (6), 1–36.

Lowry, R., 2013. The significance of the difference between two independent proportions. Retrieved from http://vassarstats.net/.

Martins, R.K., McNeil, D.W., 2009. Review of motivational interviewing in promoting health behaviors. Clin. Psychol. Rev. 29 (4), 283–293.

McEvoy, J.P., Meyer, J.M., Goff, D.C., Nasrallah, H.A., Davis, S.M., Sullivan, L., et al., 2005. Prevalence of the metabolic syndrome in patients with schizophrenia: baseline results from the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) schizophrenia trial and comparison with national estimates from NHANES III. Schizophr. Res. 80 (1), 19–32.

Mezuk, B., Rafferty, J.A., Kershaw, K.K., Hudson, D., Abdou, C.M., et al., 2010. Reconsidering the role of social disadvantage in physical and mental health: stressful life events, health behaviors, race, and depression. Am. J. Epidemiol. 172 (11), 1238–1249.

Nasrallah, H.A., Meyer, J.M., Goff, D.C., et al., 2006. Low rates of treatment for hypertension, dyslipidemia and diabetes in schizophrenia: data from the CATIE schizophrenia trial sample at baseline. Schizophr. Res. 86, 15–22.

Ortega, A., Feldman, J., Canino, G., Steinman, K., Alegria, M., 2006. Co-occurrence of mental and physical illness in US Latinos. Soc. Psychiatry Psychiatr. Epidemiol. 41, 927–934.

Pan, A., Lucas, M., Sun, Q., van Dam, R.M., Franco, O.H., Willett, W.C., Manson, J.E., Rexrode, K.M., Ascherio, A., Hu, F.B., 2011. Increased mortality risk in women with depression and diabetes mellitus. Arch. Gen. Psychiatr. 68 (1), 42–50.

Rao, C.R., 1973. Linear Statistical Inference and Its Applications. Wiley, New York.

Redelmeier, D.A., Tan, S.H., Booth, G.L., 1998. The treatment of unrelated disorders in patients with chronic medical diseases. N. Engl. J. Med. 338, 1516–1520.

Saha, S., Chant, D., McGrath, J., 2007. A systematic review of mortality in schizophrenia: is the differential mortality gap worsening over time? Arch. Gen. Psychiatr. 64, 1123–1131.

Schoenberg, N.E., Drungle, S.C., 2001. Barriers to non-insulin dependent diabetes mellitus (NIDDM) self-care practices among older women. J. Aging Health 13 (4), 443–466.

Scott, K.M., Von Korff, M., Alonso, J., Angermeyer, M.C., Bromet, E., Fayyad, J., et al., 2009. Mental-physical co-morbidity and its relationship with disability: results from the World Mental Health Surveys. Psychol. Med. 39 (1), 33–43.

Smith, D.J., Martin, D., McLean, G., Langan, J., Guthrie, B., Mercer, S.W., 2013. Multimorbidity in bipolar disorder and undertreatment of cardiovascular disease: a cross sectional study. BMC Med. 11, 263.

Sokal, J., Messias, E., Dickerson, F.B., Kreyenbuhl, J., Brown, C., Goldberg, R.W., et al., 2004. Comorbidity of medical illnesses among adults with serious mental illness who are receiving community psychiatric services. J. Nerv. Ment. Dis. 192 (6), 421–427.

Sorel, E., 2010. The WHO world mental health surveys: global perspectives on the epidemiology of mental disorders. Am. J. Psychiatr. 167, 354–355.

Swarbrick, M.A., Jonikas, J.A., Yudof, Y., Kenny, M., Cohn, J., Serrano, C., et al., 2014. Promoting Wellness for People in Mental Health Recovery A Step-by-Step Guide to Planning and Conducting a Successful Health Fair. Retrieved from http://www.cmhsrp.uic.edu/download/UIC_CSPNJ_Health_Fair_Manual.pdf.

Tovar, E., Rayens, M.K., Gokun, Y., Clark, M., 2013. Mediators of adherence among adults with comorbid diabetes and depression: the role of self-efficacy and social support. J. Health Psychol. http://dx.doi.org/10.1177/1359105313512514.

Vinogradova, Y., Coupland, C., Hippisley-Cox, J., Whyte, S., Penny, C., 2010. Effects of severe mental illness on survival of people with diabetes. Brit. J. Psychiatry 197, 272–277.

Weber, N.S., Cowan, D.N., Millikan, A.M., Niebuhr, D.W., 2009. Psychiatric and general medical conditions comorbid with schizophrenia in the National Hospital Discharge Survey. Psychiatr. Serv. 60 (8), 1059–1067.

Williams, G., Freedman, Z.R., Deci, E., 1998. Supporting autonomy to motivate patients with diabetes for glucose control. Diabetes Care 21 (10), 1644–1651.

World Health Organization, 2013. Global Report: UNAIDS report on the global AIDS epidemic. Retrieved from: http://www.unaids.org/sites/default/files/en/media/unaids/contentassets/documents/epidemiology/2013/gr2013/UNAIDS_Global_Report_2013_en.pdf).