Association Between Nonspecific Severe Psychological Distress as an Indicator of Serious Mental Illness and Increasing Levels of Medical Multimorbidity

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Objectives. We sought to determine whether severe psychological distress (SPD) and serious mental illnesses (SMIs) are associated with a specific set of chronic medical conditions (CMCs) and the association between SPD–SMIs and increasing levels of medical multimorbidity and complexity (i.e., from 1 to 3 or more CMCs).

Methods. We used data from 3 administrations (2008–2010) of the National Survey on Drug Use and Health collected from 110 455 adult participants. We used binary and ordinal logistic regressions adjusting for sociodemographics and substance abuse to examine the associations between SPD–SMIs and increasing levels of multimorbidity.

Results. SPD–SMI was associated with higher probabilities for many CMCs generally, but we found no specific pattern for any class of conditions for SPD–SMIs and multimorbidity. The association between SPD–SMIs and multimorbidity strengthened as the number of CMCs increased.

Conclusions. The finding of no discernible risk pattern for any specific CMC grouping supports broad medical assessment strategies and closely coordinated primary and behavioral health care for those with SPD–SMIs, as called for in the Patient Protection and Affordable Care Act. (*Am J Public Health.* 2014;104:2350–2358. doi:10.2105/AJPH.2014.302165)

Medical multimorbidity, most commonly defined as having 2 or more chronic medical conditions (CMCs), is of increasing importance for health care practice, policy, and research.[1,2] Several potential reasons motivate this interest. When multimorbidity is present, provision of care is difficult and expensive. Medical care tends to focus on treatment of single conditions.[3] This focus may result in unnecessary or poorly coordinated care, both of which potentially inflate costs.[4–6] Evidence-based clinical practice guidelines have started to address care in the presence of comorbidity, especially when disorders have similar pathogenesis and care requirements.[7] There is a dearth of sound guidance, however, when pathogenesis is discordant or when there are multiple co-occurring conditions.[8]

Medical multimorbidity is relatively common. Recent general population surveys have estimated a prevalence between 10% and 20%.[9,10] Within specific subpopulations, the prevalence is much higher. For instance, studies of patients in general medical practice and of older adults have reported multimorbidity prevalence rates of 29% and as high as 55%.[11–13]

Because of treatment complexity and high prevalence rates, identification of risk factors for medical multimorbidity has become increasingly emphasized. One cofactor consistently linked to medical multimorbidity is serious mental illnesses (SMIs) such as bipolar disorder, major depressive disorder, or schizophrenia.[13,14] This association has important repercussions, one of which is that the increased rate of medical multimorbidity among those with SMIs results in a substantially diminished life expectancy. Individuals with SMIs are estimated to live 13 to 30 years less than those who do not have SMIs.[15]

The higher mortality rates owing to the co-occurrence of SMIs and medical multimorbidity are attributable to a number of factors. People with SMIs tend to lead unhealthy lifestyles characterized by substance use, poor diet, and physical inactivity.[16] They are disproportionately more likely to commit suicide, be victims of violence, and engage more frequently in risky sexual behavior, increasing the likelihood of sexually transmitted infections.[17–19] In addition, some psychiatric medications, most notably atypical antipsychotics, are associated with iatrogenic medical complications such as type 2 diabetes, hyperglycemia, and obesity.[20] As a result of these and lifestyle factors, heart disease is of particular concern among those with an SMI. If multimorbidity develops, diminished access to financial resources and health insurance reduce the likelihood that those with an SMI will obtain medical care, potentially compounding the deleterious effects of multimorbidity.[21] Even when people with SMIs obtain medical care, it is often inadequate.[22] Moreover, people with SMIs who have cognitive and emotional impairments have difficulty adhering to complex, often poorly coordinated medical care and complicated medication regimens, vitiating the benefits of clinical intervention.[15]

Because of the widely recognized importance of SMI as a risk factor for multimorbidity and the need to develop better-coordinated treatment strategies, we sought to study the relationship between medical multimorbidity and SMIs further. For the purposes of this study, we used nonspecific severe psychological distress (SPD) as a proxy indicator of a probable SMI. First, we examined associations between SPD–SMI and the individual prevalences of 14 CMCs in a general population sample.[22] We also attempted to determine whether those with medical multimorbidity and SPD–SMI had higher prevalence rates of specific clusters of CMCs than those with multimorbidity but no SPD–SMI. Last, we examined the association of SPD–SMI with multimorbidity across increasing levels of multimorbidity. To date, most research has

assumed that the relationship between SPD–SMI and multimorbidity is constant as medical conditions accumulate.[23] We tested that assumption to determine whether people with SPD–SMI are at increasing risk for experiencing a higher number of concurrent CMCs relative to the risk of fewer CMCs.

METHODS

Data for this study were collected during the 2008, 2009, and 2010 administrations of the National Survey on Drug Use and Health (NSDUH). Implemented periodically since 1972 and annually since 1991, the NSDUH collects information from the civilian noninstitutionalized US population on drug use and associated factors. Details on the full NSDUH protocol are available from the US Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Office of Applied Studies, through the Inter-University Consortium for Political and Social Research.[24–26] We selected the NSDUH data set to address the associations between SPD–SMI and medical multimorbidity because of the survey's national scope; the inclusion of a validated, population-based indicator of SPD–SMI; included questions on prevalent chronic health conditions; and detailed information on substance use disorders.

A total of 169 384 participants aged 12 and older completed interviews during the 3 administrations, with response rates ranging from 74.4% to 75.7%. We excluded 54 161 participants who were younger than 18 and an additional 4768 participants (4.1%) with missing data on any covariate, yielding an analytic sample of 110 455 participants.

Measures

Severe psychological distress—serious mental illnesses. Adult participants (aged 18 years and older) complete the 6-item K6 screen embedded in the NSDUH. The K6 assesses the degree of nonspecific psychological distress predictive of SMIs.[27] Six questions address past-year symptoms of anxiety and depression during the month when symptoms were the worst. For example, nervousness is assessed with the question "During that same month (of the past 12 months) when you were at your worst emotionally . . . how often did you feel so nervous that nothing could calm you down?" Response options range from "none of the time," scored as 0, to "all of the time," scored as 4.

Summing across items yields scores ranging from 0 to 24. Scores 13 and higher are associated with a high likelihood of an SMI as indicated by a *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*) Axis I diagnosis and at least moderate functional impairment (i.e., a global assessment of functioning score of ≤ 60).[27,28] In general population studies, this threshold has identified those in the highest 5% to 10% in terms of level of past-year psychological distress.[28] Studies of the K6 have reported high reliability and criterion validity for SMIs.[28–30] We used this threshold to dichotomize K6 scores of 13 and higher as indicating SPD associated with the likely presence of SMI.[31]

Chronic medical conditions and multimorbidity. The NSDUH collects information on lifetime prevalence of 14 CMCs: hypertension, asthma, bronchitis, sinusitis, pneumonia, diabetes, ulcers, sleep apnea, heart disease, tinnitus, stroke, pancreatitis, cirrhosis, and lung cancer. Expert consultants recommended these health conditions for inclusion in the NSDUH because they were thought to be the most prevalent illnesses related to substance use (Art Hughes, personal communication, May 13, 2014). For some analyses, we used the presence or absence of each condition as the dependent variable in separate models. Operationalization of multimorbidity entailed summing all conditions each participant reported into an index score. The majority (60.7%) reported never having any of the medical conditions; 25% reported 1 condition; and about 15% of the unweighted sample reported having had 2 or more CMCs, meeting the most commonly used criterion for multimorbidity. Although comparisons across studies are difficult because of the differing number of conditions assessed, populations, and means of determining multimorbidity,[12] this distribution approximates results from other general population-based studies.[9,10]

To assess the adjusted association between SPD and medical multimorbidity, we collapsed each participant's index score into 1 of 4 ordered categories: no CMC, 1 CMC, 2 CMCs, or 3 or more CMCs. This ordered representation of multimorbidity was the dependent variable in a multivariable logistic ordinal regression, which allowed for assessment of changes in the strength of association between SPD and multimorbidity as the number of medical conditions increases.

Demographic, socioeconomic, and substance use disorder covariates. A review of existing research on correlates of multimorbidity guided covariate selection, resulting in the inclusion of the following covariates in the multivariable models: gender (male, female), race/ethnicity (Black, White, Hispanic, other), age in years (18–25, 26–34, 35–49, ≥ 50), health insurance status (currently insured, uninsured for < 3 years, uninsured for ≥ 3 years), education (college graduate, some college, high school graduate, no high school diploma), employment status (full time, part time, unemployed, not labor force), marital status (married, widowed, divorced, never married), poverty status (> 199%, 100%–199%, or < 100% of the federal poverty level based on the US Census definition), past-year abuse or dependence on alcohol on the basis of *DSM-IV-TR* criteria (absent or present), past-year abuse or dependence on marijuana (absent or present), and past-year abuse or dependence on any of 8 other illicit drugs assessed for the NSDUH (absent or present).[10,32] Past-month nicotine dependence was assessed with the Nicotine Dependence Syndrome Scale and the Fagerström Test of Nicotine Dependence.[33,34]

Analysis

We first screened covariates for inclusion in the multivariable models by examining their bivariate relationships with the primary independent variable (SPD–SMI) and primary dependent variables (14 CMCs) and included covariates associated at the $P < .1$ level. To assess which CMCs are more likely to occur among individuals with SPD–SMI and the magnitude of the association, we conducted 14 binary logistic regressions. Each model related the likelihood of having a specific CMC to the presence of SPD–SMI after covariate adjustment. All models were assessed post hoc for misspecification error and goodness of fit.[35]

To assess differential patterns of medical multimorbidity related to SPD–SMI, we ran a second set of binary logistic regressions. These regressions used number of CMCs as

the dependent variables and were restricted to participants reporting 1 or more lifetime CMCs. Participants reporting 2 or 3 or more CMCs were the comparison groups representing increasing multimorbidity and were assessed for the odds of having each condition compared with the odds for the reference group, composed of those reporting only 1 CMC. We generated adjusted odds ratios (AORs) for those with and without SPD in separate logistic regression models and then compared them using seemingly unrelated estimates. We compared AORs for those with and without SPD–SMI within each multimorbidity category and tested them for interactions between SPD–SMI and degree of multimorbidity for each medical condition across categories of SPD–SMI.

The last multivariable model assessed the extent to which the association between SPD–SMI and medical multimorbidity remained constant or changed over increasing categories of multimorbidity using a 4-category index score (0, 1, 2, or 3 or more CMCs) as the dependent variable. For this analysis, we estimated the generalized ordered logit with partial proportional odds to test the proportional odds assumption for all covariates and evaluate their effects at each level of increasing multimorbidity.[36] If the assumption for a predictor is satisfied, 1 coefficient is estimated, indicating a constant effect across all levels of the ordinal dependent variable. If violated, a unique coefficient at each level of the ordinal is fitted to reflect a predictor's changing effects at different thresholds in the ordered categories.

We conducted all analyses using Stata version 12.0 (StataCorp LP, College Station, TX), which allowed inclusion of variables representing sample weights, strata, and clustering, and we used Taylor series linearization to estimate standard errors and confidence intervals corrected for multistage sampling design effects.[37] We assessed statistical significance using an α of $P < .01$ instead of $P < .05$ to reduce type I error rates attributable to running multiple statistical tests.

RESULTS

We first present the results for the bivariate analyses that show the associations between covariates used in the multivariable models and SPD-SMI. These results are followed by logistic regression results that show the adjusted odds ratios for each CMC and SPD-SMI. The last results presented are the ordinal regression models where we assessed the adjusted odds of having 2 or 3 or more CMCs for participants with SPD-SMI relative to those who did meet criteria for an SPD-SMI.

Bivariate Analyses

Table 1 presents percentages and design-effect adjusted standard errors for all multivariable model covariates, disaggregated by SPD–SMI status. Participants with SPD–SMI

TABLE 1—Demographics, Socioeconomics, Substance Use Disorders, and Medical Conditions by Severe Psychological Distress: National Survey on Drug Use and Health, United States, 2008–2010

Variables	No SPD (n = 94 291), % (SE)	SPD[a] (n = 16 164), % (SE)	Total (n = 110 455), % (SE)
Gender			
Female	50.6 (0.27)	62.8 (0.70)	51.9** (0.25)
Race/ethnicity			
White	68.6 (0.29)	70.7 (0.66)	68.8* (0.26)
African American	11.6 (0.22)	10.8 (0.44)	11.5 (0.20)
Hispanic	13.6 (0.23)	13.2 (0.41)	13.6 (0.21)
Other	6.3 (0.16)	5.3 (0.30)	6.2 (0.15)
Age group, y			
18–25	13.0 (0.16)	24.4 (0.47)	14.2 (0.17)
26–34	15.4 (0.16)	20.5 (0.53)	15.9 (0.17)
35–49	28.0 (0.26)	30.1 (0.67)	28.2 (0.24)
≥ 50	43.6 (0.33)	25.0 (0.83)	41.7 (0.31)
Education level			
< high school	14.7 (0.24)	18.4 (0.60)	15.1** (0.23)
High school graduate	30.8 (0.33)	31.6 (0.67)	30.8 (0.32)
Some college	25.1 (0.23)	28.5 (0.61)	25.5 (0.22)
≥ college graduate	29.5 (0.40)	21.5 (0.57)	28.7 (0.38)
Marital status			
Married	56.5 (0.32)	38.0 (0.67)	54.5** (0.31)
Widowed	6.3 (0.16)	4.8 (0.48)	6.1 (0.15)
Divorced	12.8 (0.24)	18.7 (0.60)	13.4 (0.23)
Never married	24.4 (0.25)	38.5 (0.66)	25.9 (0.23)
Employment status			
Full time	52.8 (0.32)	43.7 (0.73)	51.8** (0.31)
Part time	13.6 (0.16)	15.8 (0.42)	13.8 (0.16)
Unemployed	5.2 (0.10)	9.1 (0.37)	5.6 (0.10)
Other (including not in labor force)	28.4 (0.35)	31.5 (0.55)	28.8 (0.33)
Federal poverty level[b]			
< 100%	11.0 (0.18)	20.2 (0.54)	11.9** (0.18)
100%–199%	18.9 (0.24)	24.8 (0.69)	19.5 (0.23)
> 199%	70.1 (0.32)	55.0 (0.76)	68.6 (0.31)
Health insurance coverage			
Insured	84.8 (0.20)	79.2 (0.52)	84.2** (0.18)
Uninsured < 3 y	7.1 (0.13)	12.2 (0.45)	7.6 (0.12)
Uninsured ≥ 3 y	8.1 (0.13)	8.6 (0.33)	8.2 (0.13)

Continued

TABLE 1—*Continued*

Past-month dependence on nicotine	12.9 (0.19)	28.2 (0.66)	14.5** (0.18)
Past-year abuse or dependence on			
Alcohol	6.3 (0.11)	18.2 (0.59)	7.6** (0.13)
Marijuana	1.1 (0.04)	5.0 (0.22)	1.5** (0.05)
Cocaine	0.3 (0.02)	2.2 (0.19)	0.5** (0.03)
Heroin	0.1 (0.01)	0.8 (0.09)	0.1** (0.02)
Analgesics	0.4 (0.03)	3.3 (0.21)	0.7** (0.03)
Hallucinogens	0.1 (0.01)	0.5 (0.05)	0.1** (0.01)
Inhalants	< 0.1 (0.00)	0.2 (0.04)	< 0.1** (0.01)
Sedatives	< 0.1 (0.00)	0.4 (0.08)	0.1** (0.01)
Stimulants	< 0.1 (0.00)	0.7 (0.09)	0.1** (0.01)
Tranquilizers	< 0.1 (0.00)	1.0 (0.12)	0.2** (0.01)
Any drug other than alcohol or marijuana	0.8 (0.04)	6.1 (0.31)	1.4** (0.05)
Any drug including alcohol and marijuana	7.3 (0.12)	23.2 (0.63)	9.0** (0.14)
Medical multimorbidity			
1 chronic medical condition	29.0 (0.25)	28.4 (0.54)	29.0** (0.24)
2 chronic medical conditions	12.3 (0.19)	13.1 (0.42)	12.4 (0.17)
≥ 3 chronic medical conditions	9.0 (0.17)	15.5 (0.63)	9.7 (0.16)

Note. SPD = severe psychological distress. All percentages are based on the combined weighted data from 2008, 2009, and 2010 National Survey on Drug Use and Health participants aged ≥ 18 years. The sample sizes are based on the unweighted data and exclude 4768 cases with missing information on chronic medical conditions, insurance coverage, and federal poverty level. The standard errors are based on data weighted for sampling probabilities and controlling for design effects from stratification and clustering. Significance tests compare demographics by past-year severe psychological distress status and are based on a likelihood ratio χ^2.

[a]Based on a score of ≥ 13 on the K6 screening scale indicating severe psychological distress associated with a high likelihood of a serious mental illness and at least moderate functional impairment.

[b]Federal poverty level is based on US Census definition.

*P < .01; **P < .001.

were more likely than those with lower levels of distress to be female, White, aged 34 years or younger, have less than a college education, and single. Those with SPD–SMI were more likely to report less than full-time employment, household incomes 199% below the federal poverty level, and no health insurance in the past year. Consistent with an extensive research literature, those with SPD–SMI had higher rates of substance abuse or dependence for every class of drug assessed, including alcohol.[38] Overall, 23.2% of those with SPD–SMI met *DSM-IV-TR* criteria for any past-year substance abuse or dependence compared with 7.3% of those without SPD–SMI. Also consistent with existing research, those with SPD–SMI had a much higher rate of past-month nicotine dependence (28.2% vs 12.9%).[16]

Table 1 also shows prevalence rates for the number of lifetime CMCs and medical multimorbidity by SPD–SMI status. Of the sample, 51% reported having had at least 1 medical condition. Twenty-two percent reported ever having had 2 or more CMCs. Defining multimorbidity as 2 or more CMCs, those with SPD–SMI were more likely to be multimorbid (28.6%) than those without SPD (21.3%). The majority of this statistically significant difference (P< .001) was attributable to the prevalence of having 3 or more CMCs among those with SPD–SMI (15.5%) relative to those without SPD–SMI (9.0%). We observed only small differences for those reporting a single CMC (29.0% vs 28.4% for SPD–SMI) and those reporting 2 CMCs (12.3% vs 13.1% for SPD–SM).

Multivariable Analyses

As depicted in Table 2, with the exception of lung cancer and stroke, those with SPD–SMI had significantly higher adjusted odds for CMCs. AORs ranged from 1.35 for heart disease to 3.12 for sleep apnea. No discernible pattern of CMCs was associated with SPD–SMI because the 5 CMCs with the highest AORs were spread across different disorder classes: sleep apnea (AOR = 3.12), cirrhosis (AOR = 2.16), pancreatitis (AOR = 1.90), ulcers (AOR = 1.89), and sinusitis (AOR = 1.87).

We next attempted to determine whether SPD–SMI related to prevalence of different CMCs for those with 2 conditions and those with 3 or more conditions. That is, we wanted to assess whether those who were medically multimorbid experienced a different pattern of disorders depending on whether they met study criteria for a likely SMI. We ran separate binary logistic regression models for each of the 14 lifetime medical conditions by SPD–SMI status and multimorbidity category using participants reporting 1 CMC as the reference group. Postestimation contrasts of the AORs compared those with and without SPD–SMI in the 2-conditions category with those with and without SPD–SMI in the 3-or-more-conditions category. Postestimation comparisons also assessed differences in the change in AORs (i.e., difference in differences) for each medical condition for those reporting 2 conditions and those reporting 3 or more conditions for both those with and without SPD–SMI.

Table 3 presents the results of these analyses. The Wald test of the AORs found few statistically significant differences among those with and without SPD–SMI within each multimorbidity index category and no significant differences when comparing the change in AORs across multimorbidity index categories. Overall, the pattern of individual medical conditions did not vary by SPD–SMI status. Relative to those with a single CMC, multimorbid participants tended to have similar medical conditions regardless of SPD–SMI status. We found some indication, however, that respiratory conditions such as bronchitis and sinusitis, as well as heart disease, could be more prevalent among those with the highest levels of medical multimorbidity (3 or more co-occurring conditions).

Last, we ran an ordinal logistic regression to test the effect of SPD–SMI across increasing levels of multimorbidity. As seen in Table 4, SPD–SMI violated the proportional odds assumption. Consequently, we estimated unique regression coefficients for SPD–SMI for each ordinal category. As the number of medical conditions increased, the AORS for SPD–SMI increased nonlinearly from 1.78 higher odds

TABLE 2—Adjusted Odds Ratios for Lifetime Chronic Medical Conditions by SPD: National Survey on Drug Use and Health, United States, 2008–2010

Medical Condition	SPD,[a] OR (95% CI)	Model Fit Statistics	
		Squared Residuals[b]	Goodness of Fit[c]
Asthma	1.61** (1.49, 1.75)	−1.79	0.81
Sinusitis	1.87** (1.71, 2.04)	−1.12	1.32
Bronchitis	1.69** (1.51, 1.89)	1.29	1.29
Pneumonia	1.67** (1.48, 1.91)	1.40	1.62
Lung cancer	0.73 (0.37, 1.43)	0.68	3.35*
Diabetes	1.42** (1.23, 1.63)	−0.33	0.70
Heart disease	1.35* (1.14, 1.60)	0.66	2.48
Hypertension	1.36** (1.25, 1.47)	−1.90	1.59
Stroke	1.45 (0.95, 2.20)	0.85	1.77
Pancreatitis	1.90* (1.33, 2.72)	0.39	0.67
Cirrhosis	2.16* (1.25, 3.75)	1.43	1.59
Ulcers	1.89** (1.62, 2.19)	0.59	1.16
Sleep apnea	3.12** (2.73, 3.57)	−0.17	0.40
Tinnitus	1.8** (1.33, 2.45)	0.34	0.90
Medical multimorbidity			
≥ 2 medical conditions	1.98** (1.84, 2.14)	−0.03	1.18
≥ 3 medical conditions	2.47** (2.18, 2.80)	−0.04	1.07

Note. CI = confidence interval; OR = odds ratio; SPD = severe psychological distress. Analyses are based on the full analytic sample of 110 455 participants in the National Survey on Drug Use and Health aggregated across survey years 2008, 2009, and 2010. ORs shown are adjusted for the following covariates: age; gender; race/ethnicity; marital status; education level; employment status; poverty level; insurance coverage over the past 3 years; past-year abuse or dependence on alcohol, marijuana, or any other illicit drug; and past month dependence on nicotine. The reference category is no past-year severe psychological distress.

[a]Based on a score of ≥ 13 on the K6 screening scale indicating severe psychological distress associated with a high likelihood of a serious mental illness and at least moderate functional impairment.

[b]Reflects a *t* test of the squared residuals term after fitting the model and obtaining estimated residual scores. Significance indicates unexplained residual variance and possible nonlinear effects.

[c]Based on a the Hosmer-Lemeshow goodness-of-fit test using deciles of risk and evaluated by an $F(9,52)$. Significance indicates possible misfit.

*$P < .01$; **$P < .001$.

of having 1 versus no medical condition to 1.99 higher odds of having 2 or more CMCs versus 1 or no CMCs and to 2.47 higher odds of having 3 or more CMCs relative to fewer than 3 CMCs. Those with an SPD–SMI had the highest odds of having 3 or more CMCs, corresponding to a high degree of medical complexity.

DISCUSSION

These findings suggest that SPD–SMI confers a higher risk of having 1 or more comorbid CMCs and is consistent with the findings of studies of clinical and nonclinical samples.[13] Cross-study comparisons are difficult because of differences in methods of assessing and counting CMCs. Nevertheless, we suggest that our assessment of multimorbidity is relatively conservative. Our determination of CMCs excluded substance use disorders, unlike several other studies, and used only 14 CMCs.[13,39] Inclusion of substance use disorders as a CMC would have increased multimorbidity prevalence for those with SPD–SMI from 29% to 35%. Similarly, if SPD–SMI were included in the definition, 69% of those with SPD–SMI would have had at least 1 additional disorder (substance use or CMC) and could be considered multimorbid. This latter figure underscores the notion that multimorbidity is the norm for those with SPD–SMI.[40–42]

In our multivariable analyses, the elevated risk for multimorbidity for those with SPD–SMI persisted after adjustment for smoking, substance use, health insurance, age, and income. These factors have been independently associated with multimorbidity and are thought to explain at least some of the higher prevalence of CMCs among those with SPD–SMI. The remaining elevated risk suggests additional factors are associated with SPD–SMIs, such as iatrogenic health complications, obesity, diet, and physical inactivity. Unfortunately, the NSDUH does not assess these factors. A direction for future research would be to compile a list of prominent contributory factors identified in the research literature and assess the independent and synergistic contributions of each, leading to the development and testing of a broad conceptual model specifying the linkages between SPD–SMI and multimorbidity.

We believe a unique contribution of this study is modeling the association of SPD–SMIs across increasing levels of multimorbidity, above and beyond demonstrating the association with individual conditions. Our ordinal logistic model showed that having SPD–SMI was most strongly associated with having 3 or more CMCs. Hence, we found that individuals with SPD–SMIs had especially high odds not only of being medically multimorbid but of having 3 or more CMCs in addition to their psychiatric disorder.

As noted, we did not include substance use disorders in our definition of medical multimorbidity but instead chose to model them as covariates. We tested inclusion of substance use disorders in the definition of SPD–SMIs in ordinal models not shown and found slight attenuation in the AORs although they remained significant and in the same pattern. We believe this could be because the highest levels of substance use have a strong association with younger age, which is in turn inversely related to having a CMC. Data that capture chronicity of substance use over the life course might show a stronger association of SMI with co-occurring substance use disorders and CMC than our data allowed.[43] Although not examined in this study, there is also compelling evidence that co-occurring substance use disorders contribute to much higher suicide rates among those with SMIs.[44]

These findings suggest that individuals with SPD–SMIs are likely to present a clinically

TABLE 3—Adjusted Odds Ratios for Lifetime Chronic Medical Disorders by Multimorbidity Category and Severe Psychological Distress: National Survey on Drug Use and Health, United States, 2008–2010

	Comorbidity (2 Conditions; n = 36 512)		Multimorbidity (≥ 3 Conditions; n = 6390)	
Lifetime Chronic Medical Conditions	No SPD, OR (95% CI)	SPD,[a] OR (95% CI)	No SPD, OR (95% CI)	SPD,[a] OR (95% CI)
Asthma	1.97 (1.76, 2.20)	2.01 (1.63, 2.48)	5.71 (5.08, 6.42)	5.01 (4.01, 6.28)
Sinusitis	3.12 (2.85, 3.41)	3.55 (2.80, 4.51)	9.52 (8.44, 10.73)	7.13* (5.76, 8.83)
Bronchitis	3.87 (3.51, 4.26)	3.63 (2.91, 4.52)	14.10 (12.85, 15.47)	9.96* (7.83, 12.68)
Pneumonia	3.46 (3.02, 4.00)	2.56 (1.78, 3.69)	13.89 (11.83, 16.32)	11.74 (8.07, 17.07)
Lung cancer	2.34 (1.08, 5.11)	1.91 (0.24, 15.06)	4.20 (1.88, 9.37)	3.52 (0.65, 18.95)
Diabetes	3.47 (3.05, 3.96)	2.22 (1.45, 3.39)	6.66 (5.91, 7.49)	7.07 (5.27, 9.48)
Heart disease	2.58 (2.17, 3.07)	1.82 (1.15, 2.88)	6.83 (5.74, 8.13)	9.38** (6.31, 13.92)
Hypertension	1.98 (1.81, 2.17)	2.37 (1.93, 2.91)	3.48 (3.09, 3.92)	5.03 (3.99, 6.34)
Stroke	2.88 (2.03, 4.09)	2.92 (1.19, 7.17)	8.72 (6.52, 11.67)	15.71 (7.83, 31.52)
Pancreatitis	3.20 (2.20, 4.64)	1.24 (0.44, 3.50)	5.94 (4.07, 8.69)	4.40 (2.72, 7.09)
Cirrhosis	1.62 (0.95, 2.76)	0.64 (0.14, 2.85)	4.23 (2.44, 7.33)	2.02 (0.83, 4.90)
Ulcers	2.22 (1.91, 2.57)	2.07 (1.45, 2.95)	5.29 (4.63, 6.04)	5.83 (4.31, 7.88)
Sleep apnea	3.32 (2.73, 4.05)	2.67 (1.97, 3.61)	10.8 (8.92, 13.08)	7.40* (5.66, 9.68)
Tinnitus	3.47 (2.69, 4.47)	4.06 (2.00, 8.19)	8.26 (6.45, 10.58)	13.95 (9.14, 21.3)

Note. CI = confidence interval; OR = odds ratio; SPD = severe psychological distress. All analyses are based on the combined weighted data from 2008, 2009, and 2010 National Survey on Drug Use and Health participants aged ≥ 18 years, excluding those cases that did not report any lifetime chronic medical condition. The analyses incorporated survey weights, stratification, and clustering to control for the multistage sampling design. The ORs shown adjusted for the following covariates: age; gender; race/ethnicity; marital status; education level; employment status; poverty level; insurance coverage over the past 3 years; past-year abuse or dependence on alcohol, marijuana, or any other illicit drug; and past-month dependence on nicotine. The reference category is participants who reported having only 1 chronic medical condition. Significance tests are based on a Wald statistic comparing the interaction between severe psychological distress and multimorbidity category for each chronic condition listed.

[a]Based on a score of ≥ 13 on the K6 screening scale, indicating a severe psychological distress or a serious mental illness and at least moderate functional impairment.

*$P < .01$; **$P < .001$.

challenging picture from a screening, assessment, diagnostic, and treatment standpoint. SPD–SMI confers heightened risk of multimorbidity, a risk that increases as individuals develop more medical complexity. As demonstrated in our second model, this risk appears to be nonspecific with respect to kinds of CMCs. Thus, although SPD–SMI is positively associated with accruing CMCs, its effect appears unrelated to accumulation patterns. Rather than offering specific guidance to direct the health evaluation of those with SPD–SMIs, this finding suggests broad based and thorough screening and assessment are needed. This is especially important because of the prevalence of multimorbidity in this population. It appears, however, that just the opposite has been the case for individuals with an SPD–SMI. In fact, research has suggested that diagnostic and treatment overshadowing leads to missed diagnosis, misdiagnosis, and substandard treatment of physical health problems for those with SPD–SMI.[45] Though not entirely understood, some combination of fragmented care systems, medical professionals' lack of training or experience in treating individuals with SPD–SMI, and the profound and deleterious consequences of SPD–SMI for cognition and health-related behaviors seems to contribute to this deficiency.[15] Indeed, it is perhaps plausible that these systemic problems, in and of themselves, could contribute to the high rate of medical morbidity for those with SPD–SMIs.

A strength of this study was the use of a general population sample. Samples drawn from clinical practices have the potential bias of overestimating the association between SPD–SMIs and multimorbidity because those seeking health care are more likely to be multimorbid than those who do not seek care.

Limitations

Among the study's limitations are several important issues, most of which, we believe, are related to measurement and the cross-sectional nature of the study. Technically, multimorbidity is the co-occurrence of 2 or more conditions. However, the NSDUH is cross-sectional and does not assess when a person experienced a given medical condition. It assesses only lifetime prevalence. Participants, then, could have experienced multimorbidity many years before the survey or their CMCs could have developed and resolved sequentially without overlap, therefore not meeting the definition of multimorbidity. Lacking temporal data, we could not make these distinctions. All data in the NSDUH are self-reported. Although research has demonstrated at least moderate agreement between self-reported health conditions and those documented from medical examinations, there is the risk of both over- and underreporting of medical conditions.[46–48]

The measure of SPD–SMI in the study was a brief screening scale that asks about symptoms of nonspecific psychological distress associated with a broad range of psychiatric disorders. Although the K6 screen has excellent validity and reliability, it is a screening instrument, and misclassifications occur in the direction of false positives as well as false

TABLE 4—Generalized Ordinal Logistic Regression Results for Medical Index Score Categories: National Survey on Drug Use and Health, United States, 2008–2010

Medical Index Score Comparison	≥1 vs 0, AOR (95% CI)	≥2 vs 0-1, AOR (95% CI)	≥3 vs 0-2, AOR (95% CI)
Gender			
Male (Ref)	0.00	0.00	0.00
Female	1.02 (0.98, 1.10)	1.16** (1.10, 1.23)	1.16** (1.07, 1.27)
Race/ethnicity			
White (Ref)	0.00	0.00	0.00
African American	1.13* (1.05, 1.23)	0.82** (0.75, 0.91)	0.65** (0.56, 0.76)
Hispanic	0.59** (0.55, 0.64)	0.46** (0.41, 0.52)	0.40** (0.34, 0.46)
Other	0.69** (0.63, 0.75)	0.61** (0.53, 0.70)	0.57** (0.47, 0.68)
Age group, y			
18–25 (Ref)	0.00	0.00	0.00
26–34	1.27** (1.19, 1.35)	1.59** (1.47, 1.72)	1.84** (1.61, 2.10)
35–49	2.05** (1.91, 2.19)	2.67** (2.45, 2.92)	3.95** (3.49, 4.47)
≥50	4.61** (4.29, 4.96)	5.35** (4.90, 5.84)	8.06** (7.26, 8.94)
Education level			
<high school (Ref)	0.00	0.00	0.00
High school graduate	1.04 (0.97, 1.11)	. . .	. . .
Some college	1.11* (1.03, 1.21)	1.30** (1.21, 1.40)	1.38** (1.22, 1.56)
≥college graduate	0.98 (0.91, 1.06)	1.12 (1.02, 1.22)	1.14 (1.02, 1.28)
Marital status			
Married	0.00	0.00	0.00
Widowed	1.39** (1.20, 1.61)	1.11 (0.97, 1.27)	1.06 (0.90, 1.25)
Divorced	1.08 (1.01, 1.14)	. . .	. . .
Never married	0.92* (0.88, 0.97)	. . .	. . .
Employment status			
Full time	0.00	0.00	0.00
Part time	1.05 (1.00, 1.11)	. . .	. . .
Unemployed	1.05 (0.97, 1.14)	. . .	. . .
Other (including not in labor force)	1.45** (1.36, 1.54)	1.51** (1.39, 1.64)	1.73** (1.58, 1.89)
Federal poverty level[a]			
<100%	0.00	0.00	0.00
100%-199%	1.00 (0.92, 1.08)	. . .	. . .
>199%	0.98 (0.92, 1.06)	0.96 (0.89, 1.05)	0.83* (0.73, 0.93)
Health insurance coverage			
Insured (Ref)	0.00	0.00	0.00
Uninsured <3 y	0.85** (0.79, 0.91)	. . .	. . .
Uninsured ≥3 y	0.65** (0.60, 0.72)	0.58** (0.51, 0.66)	0.51** (0.40, 0.64)
SPD[b]			
No SPD (Ref)	0.00	0.00	0.00
Past year	1.78** (1.68, 1.89)	1.99** (1.86, 2.14)	2.47** (2.20, 2.78)
Dependence on nicotine			
No dependence (Ref)	0.00	0.00	0.00
Past month	0.93 (0.87, 1.00)	1.05 (0.97, 1.15)	1.00 (0.89, 1.13)
Alcohol abuse or dependence			
No abuse or dependence (Ref)	0.00	0.00	0.00
Past-year abuse or dependence	0.98 (0.91, 1.05)	. . .	. . .

Continued

negatives. The K6 asks about symptoms in the past year and is therefore subject to the same temporal limitations and potential lack of co-occurrence as noted for the way in which CMCs are assessed in the NSDUH. As a partially mitigating factor, however, we note that a recent study of the K6 found that those who screened positive were very likely to have had an SMI for at least several years previous.[49] Finally, the NSDUH instrument asks about a limited set of CMCs, which could have resulted in an underestimation of medical multimorbidity.

The K6 is also a general measure and cannot specify particular SMIs, nor can it assess for the presence of multiple, co-occurring psychiatric disorders, which are common (approximately 45%) among those with 1 such disorder.[50] Consequently, although we examined the association between SPD–SMI and medical multimorbidity in a very general way, owing to the limitations of the data set just described, the analyses do not address the likely complexities of the causal pathways, multiple additional risk factors, and varying strength of associations between specific psychiatric, medical, and substance use comorbidities over the life course. For instance, there are likely differences in the rate of medical multimorbidity between conditions such as schizophrenia and generalized anxiety disorder and for those with multiple, co-occurring psychiatric disorders—all excellent areas for future investigation.

Conclusions

These limitations notwithstanding, we believe this study adds to the literature on medical multimorbidity and SPD–SMI, underscoring that multimorbidity is common and that those with SPD–SMI are likely to have a high degree of medical complexity. Because the Patient Protection and Affordable Care Act has provisions to encourage the clinical community to look for innovative ways to provide better integrated, comprehensive care such as experimenting with health homes and variations on different case management strategies, the issue of multimorbidity will only become more important in the next few years.[51–54] It most certainly should and will continue to challenge the notion that behavioral health care for substance use and

TABLE 4—*Continued*

Marijuana abuse or dependence			
No abuse or dependence (Ref)	0.00	0.00	0.00
Past-year abuse or dependence	0.94 (0.80, 1.10)	. . .	. . .
Abuse or dependence on other drugs[c]			
No abuse or dependence (Ref)	0.00	0.00	0.00
Past-year abuse or dependence	1.07 (0.91, 1.27)	0.99 (0.80, 1.22)	1.48* (1.11, 1.99)

Note. CI = confidence interval; OR = odds ratio; SPD = severe psychological distress. Analyses are based on the combined data from 110 455 participants in the 2008, 2009, and 2010 National Survey on Drug Use and Health who were aged ≥ 18 years with complete data on all covariates. Analyses were conducted using the gologit3 add-on program for Stata and incorporated survey weights, stratification, and clustering to control for the multistage sampling design. Dashes indicate that the variable met the parallel lines assumption and that the estimated adjusted OR was the same as at the previous level of the dependent variable. Overall model significance: $F(57,4) = 736.40$, $P < .001$.

[a]Federal poverty level is based on US Census definition.

[b]Based on a score of ≥ 13 on the K6 screening scale, indicating SPD indicative of a serious mental illness and at least moderate functional impairment.

[c]Drug classes included are hallucinogens, inhalants, tranquilizers, cocaine, opiates, analgesics, stimulants, and sedatives. *$P < .01$; **$P < .001$.

psychiatric disorders can be effectively conducted independent of primary medical care and vice versa. ■

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Human Participant Protection

This secondary analysis of deidentified public use data sets was determined exempt from institutional review board review.

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