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HEALTHCARE COST AND UTILIZATION PROJECT

Celebrating 20 Years of Powerful Data

**A SEVERITY-OF-ILLNESS CLASSIFICATION FOR MENTAL AND
SUBSTANCE-USE DISORDERS FOR USE WITH HOSPITAL
ADMINISTRATIVE DATA
DELIVERABLE #480**

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ABSTRACT

Background

Severity classification, based on functional status, is an important concept for understanding hospital utilization by people with M/SU disorders. The research aimed to devise a severity-of-illness classification related to personal and social functioning for mental and substance-use (M/SU) diagnoses for use with administrative hospital data, as a control for M/SU severity in health services research.

Methods

Information on personal-social consequences of M/SU conditions from the National Comorbidity Survey-Replication (NCS-R) was used to develop M/SU-related expected-functioning classes of severity for specific M/SU diagnoses. The NCS-R proportion of respondents identified as having the most severe consequences was used to stratify each M/SU diagnosis into severe, moderate, or mild types of conditions. Data from the 2002 Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) and State Emergency Department Databases (SEDD) for Missouri and South Carolina were used to analyze the validity of the severity measure in predicting hospital utilization decisions. Emergency department inpatient admissions (ED-IP stays) and patients with repeat ED visits were analyzed, controlling for M/SU-related expected functioning, as well as M/SU-related expected resource use based on Disease Staging,TM among other factors.

Results

Derived M/SU functioning classes were strong predictors of IP admission after an ED event, controlling for various patient, hospital, and community characteristics, including expected resource use relative to non-M/SU conditions.

Conclusions

Severity classification, based on functional status, is a valuable concept for predicting hospital utilization by people with M/SU disorders. Functional status should be an area of focus for M/SU severity classifications for application to administrative data so that health policy can be improved through better tools for analysis.

BACKGROUND

Over four decades, many disease classification systems have arisen and evolved in the U.S. to support hospital planning, budgeting, quality assurance activities, and health services research [1]. However, such systems have given little attention to mental and substance-use conditions. For example, Ettner and colleagues found that the Ambulatory Care Groups classification did not perform as well as simple models using demographics and prior utilization measures in explaining expenditures for patients with M/SU conditions [2]. Currently, the All Patient Refined Diagnosis Related Groups (APR-DRGs) specify only 12 mental and 6 substance-use categories for hospital payment [3]. Disease Staging™ has 12 mental and 8 substance-use categories and 3 to 12 stages of illness within each disease category [4]. Some systems that classify comorbidities—such as the Elixhauser comorbidity categories—purposely consider mental and substance-use disorders as secondary conditions [5, 6]. In particular, these systems have not incorporated information on the functional status of the patient.

Day-to-day functioning in social settings is a key determinant of severity for mental and substance-use conditions [7]. Is the person able to avoid violent behaviour, maintain relationships, hold a job, and/or retain a place to live in the community? Because adequate data on functional status have been difficult to obtain, such constructs have generally not been included in disease classification systems. For example, hospital administrative discharge abstracts or medical records typically do not capture a patient's level of functioning at admission or discharge. Some policy analysts argue that incorporating the functional status of patients into uniform data collection and into severity and risk-adjustment systems is essential to appropriately measure and predict outcomes of treatment. One study found that functional measures, including mental state, were not only strong predictors of post-hospitalization 90-day and 2-year mortality among older patients, but also contributed to the prognostic accuracy of burden-of-illness indices [8].

The psychometric literature describes the use of questionnaires, client interviews, and scales for diagnosing mental and substance-use disorders and sometimes the severity of conditions. Examples of diagnostic interviews include the Structured Clinical Interview for DSM-IV (SCID) [9], the Diagnostic Interview Schedule (DIS) [10], the WHO Composite International Diagnostic Interview (CIDI) [11], and the Addiction Severity Index (ASI) [12], among others. These questionnaires determine how a respondent is diagnosed according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)*, the standard developed and maintained by the American Psychiatric Association. Furthermore, DSM-IV diagnoses are incorporated into the standard for all diagnostic coding in U.S. hospitals—the International Classification of Disease, Ninth Edition, Clinical Modification (ICD-9-CM). While the WHO-CIDI and ASI do address severity (the former focusing more on mental and the latter more on substance use disorders), neither DSM-IV nor ICD-9-CM specifies severity of illness for all M/SU diagnoses. Thus, the ICD-9-CM cannot be used directly to classify severity of M/SU conditions in hospital administrative data.

Questions related to diagnosis, social functioning, and severity of mental illness were included in the National Comorbidity Survey–Replication (NCS-R). The NCS-R was a general population household survey which administered the WHO-CIDI [11]. The resulting data allowed Kessler and colleagues to analyze DSM-IV mental and substance-use conditions and the social and functioning consequences of those conditions [7]. Their results

offer the raw material for categorizing DSM-IV and ICD-9-CM M/SU diagnoses according to the severity of probable consequences for nearly all M/SU conditions. This offers a simple construct for assessing the severity of M/SU cases when only ICD-9-CM-coded administrative data are available. To our knowledge, such a construct has not been developed for, nor tested with, administrative data.

Our principal objective was to develop a severity-of-illness classification for M/SU conditions that related to functional status and could be used with hospital- or health-insurance-claims-based diagnostic data. We also wanted to test the classification's predictive validity. Predictive validity was assessed for a visit to a hospital emergency department (ED) with two possible subsequent events—admission as an inpatient and repeat ED visit(s). Our second objective was to assess whether such an M/SU severity classification had predictive power beyond disease severity classification related to expected resource use, typically used in health services research.

METHODS

Data sources

Data for this study came from community hospitals in the State Inpatient Databases (SID) [13] and State Emergency Department Databases (SEDD) [14] of the 2002 Healthcare Cost and Utilization Project (HCUP). Data submitted to HCUP by Missouri and South Carolina were chosen for the study based on the availability of unique, encrypted, and reliably coded person-level indicators. Profiles of the two states are available at HCUP-US [15].

Study population

The study population was comprised of all “ED events,” including the ED visits of patients who were treated and released (reported in the SEDD), as well as the ED-inpatient (ED-IP) stays of ED-evaluated and subsequently admitted patients (reported only in the SID). A state-generated unique person identifier was used to link each individual's ED and inpatient events to develop patient-level outcome measures. ED visits by a patient to different hospitals during the year were counted as multiple visits for those patients. ED visits that resulted in transfers to other short-term hospitals (less than 3 percent) were excluded. The study population was further restricted to patients aged 18 or older with at least one ED visit for one of the following primary study conditions from the SEDD (or principal study conditions from the SID) across the study year: Mental conditions alone (M Only); substance-use conditions alone (SU Only); and both mental and substance-use conditions (M&SU).

Patients diagnosed with *both* M&SU conditions experienced ED visits or ED-IP stays with different primary (ED) or principal (inpatient) diagnoses during the year. Planned hospitalizations that did not originate through the ED were excluded, regardless of diagnosis. Because results presented here are part of a more comprehensive analysis that included specific physical conditions without behavioural health conditions as mutually exclusive comparators, the current study also excluded primary or principal mental M/SU diagnoses with secondary diagnoses of diabetes and chronic respiratory disease.

Outcome measures

Two binary outcome measures of utilization were constructed for each person with an ED visit: 1) whether or not there was an ED-IP stay, and 2) whether or not there were multiple ED visits. Other patient, hospital, and community characteristics (listed in Appendix B) were obtained, respectively, from the 2002 HCUP SID and SEDD, the 2002 American Hospital Association Annual Hospital Survey, the 2002 Area Resource File (ARF), and 2002 Census population data. External data were linked via AHA hospital identifiers, state-county FIPS codes, or patient ZIP Codes, respectively.

Two Measures of M/SU severity

Two measures of M/SU severity were used with the administrative data. *M/SU-related expected functioning* was defined across M/SU conditions. *M/SU-related expected resource use* was defined for M/SU relative to other conditions treated in U.S. hospitals.

M/SU-related-expected-functioning classes were derived to account for differences in severity across M/SU diagnoses relative to expected personal or social consequences—the functional status most relevant to M/SU conditions. Ordinal categories were defined based on NCS-R results from Kessler and colleagues. The survey included responses from more than nine thousand household participants to questions that elicited the degree of disability and impairment associated with DSM-IV diagnoses, and these have been described previously [7].

“Serious” consequences of people with specific DSM-IV diagnoses were associated in the Kessler study with indicators of disrupted social functioning, defined as the number of days a person was unable to carry out normal activities: 88 days on average for the severe, compared to 5 days for moderate and 2 days for mild groups. Cases were classified as serious if they had a suicide attempt with serious intent of lethality; work disability or substantial functional limitation due to M/SU disorders; serious role impairment within a one-year recall period specific to several disorders (bipolar I or II disorder, substance dependence, impulse control disorder with repeated serious violence); a positive result on screening for non-affective psychosis; or any disorder that resulted in a loss of 30 or more days from the normal social role (e.g., work role performance, household maintenance, social life, and intimate relationships).

For this study, ICD-9-CM diagnoses related to M/SU disorders were grouped into three ordinal categories of functional severity for use with administrative discharge data. The grouping was based on the proportion of NCS-R survey respondents with a specific disorder who had serious consequences. Table 1 shows how these were grouped: *mild* (diagnoses with 10 to 30 percent of household respondents experiencing serious consequences), *moderate* (30 to 49 percent), and *severe* (50 to 83 percent) (Table A-1 shows related ICD-9-CM codes). Thus, patients were classified as low, moderate, or high severity based on their condition and the typical proportion of household respondents with that condition who had serious functional problems. The NCS-R excluded schizophrenia and some other non-affective psychoses to avoid confounding by anticipated misdiagnosis through lay-administered questionnaires. In our study, when those diagnoses were found on hospital administrative records, they were classified as “severe.” Individuals with multiple ED events during the year were classified by severity according to the event with the highest severity level.

M/SU-related-expected-resource-use classes were used to account for M/SU expected resource use relative to all clinical conditions treated in U.S. hospitals. These classes were

included to assess whether the M/SU-related-expected-functioning classes added information beyond severity classifications typically used in health services research studies.

The resource-use severity classes across all mental and physical conditions seen in hospitals were defined based on the Medstat Disease Staging™ Resource Demand Scale (RDS) [4]. This measure in our study scales the expected resource use of M/SU conditions/stages (see Appendix A, Table A.2) in relation to all conditions (mental and physical) seen in hospitals. For patients with M/SU conditions, a value of 100 would mean that their expected resource use is comparable to that of the average hospitalized patient. The RDS scores (not shown here) for behavioural conditions were lower on average than physical conditions, because hospital stays for behavioural health conditions rarely involve surgery and other expensive technologies used to treat physical conditions. Distributing cases into four relatively equal-in-size groups, an RDS score of less than 30 was defined as minimal resource use; from 30 to 37.5 was categorized as low; from 37.5 to 45 was moderate, and over 45 was high intensive resource use.

Predictive Validity

The probability of an ED-IP stay was estimated with the ED event as the unit of analysis; the probability of multiple ED visits among patients with at least one ED visit was estimated with the patient as the unit of analysis. Predictive validity of M/SU-expected-functioning classes was assessed against these outcomes measures using multivariate statistics. Predictive validity would be confirmed if inpatient admission and ED-related utilization were greater for higher severity when other factors that influence ED use were controlled.

Modelling

Hierarchical linear modelling (HLM) was used to estimate effects within each state while accounting for the clustering of patients within hospitals and hospitals within communities. Patient, hospital, and community characteristics (shown in Table B.1) were used as controls for estimating the influence of severity of illness on ED-related use. The contribution of the M/SU functioning classes in the full models was assessed against restricted models without M/SU functioning classes. Because HLM does not generate a measure of explained variance (R-square), the contribution was assessed using -2 log likelihood estimates obtained via SAS NLMIXED. Each state was analyzed separately because of different demographic, health system, and regulatory environments with potential to affect resource utilization patterns.

RESULTS

Descriptive statistics of the study population related to severity

In terms of M/SU-related-expected-resource-use severity, ED events (repeat visits and those resulting in inpatient stays combined) were distributed fairly evenly across the severity classes, with one exception. ED events for substance use only (SU Only) were more likely in the minimal intensity resource category. In terms of M/SU-related-expected functioning—expected personal or social consequences—ED events were more likely in the less severe class, including the “none” category. Over 40 percent of the ED events of people with M/SU in the study were for conditions other than M/SU (Table 2). Again, SU Only had a different pattern. Although patients with SU Only had as many ED events in the “none” category as

did those with M Only or M&SU, patients with SU Only had fewer ED events in the mild functioning group and more events in the severe group. All of these patterns were consistent across the two states.

Multivariate statistics related to hospital utilization and expected M/SU functioning

After controlling for various factors, including expected inpatient resource use that could influence use of the ED by people with M/SU (Table 3; see Tables B.1 and B.2 for complete results for each model), expected severe functioning was associated with higher probability of hospital admission compared to expected mild functioning. Those severe effects were nearly always large, were always (in 6 out of 6 tests) in the expected positive direction, and were always statistically significant. Patients with both mental and substance-use disorders during the year (M&SU) that had a condition likely to be associated with severe personal or social consequences were about four times as likely to be hospitalized as people with mild conditions. The effects on admission decisions of likely functional impairment from mild to moderate to severe were monotonically increasing for half of the tests (3 of 6) related to ED-IP stays. Only for mental illness are those in the moderate class less likely to be hospitalized than those in the mild class. Across study conditions, the probability of an ED-IP stay was larger for patients with moderate or severe substance use disorders (SU Only) than for those with moderate or severe mental illness (M Only).

For multiple ED visits per patient, functioning-related severity effects were often positive and statistically significant, but not as large nor as consistently increasing with severity as the ED-IP stay results. For example, patients with moderate functioning and patients with severe functioning M&SU conditions were both two times as likely to make repeat ED visits during the year as those with mild conditions—still large effects, but neither as large as for ED-IP admissions nor always trending upward with functional impairment. For patients with mental disorders only (M Only), the severe group had a rate of multiple ED visits below those with mild M Only. The odds of multiple ED visits did increase monotonically with respect to severity for the group with only substance use (SU Only)—but neither for M Only nor for M&SU. For patients with M&SU, moderate and severe conditions both increased repeat ED visits by the same amount, doubling the odds of having multiple ED visits compared to people with mild M&SU conditions.

The -2 log likelihood ratio testing of the contribution of M/SU-specific expected functioning classes to the overall fit of the models for ED-IP stays and multiple ED visits showed that full models *with* the M/SU functional severity measures had significantly better fit than restricted models *without* them (Appendix B). The fit was better in each context (hospitalization or multiple ED visits), each diagnosis group (M Only, SU Only, and M&SU), and each state.

DISCUSSION

The study has several limitations. First, the M/SU-related-expected-functioning measure of severity is not a direct measure of the functional status of individual patients. Rather, it is an inference from the NCS-R study that classified each ICD-9-CM condition by the probable functional limitations of people with that condition (Table 1). Also, the only functional status that the measure captures is personal and social consequence of addiction and mental illness, not the full spectrum of functional status that can relate to disease (e.g., impairments of mobility, inability to carry out activities of daily living). However, the personal-social

consequences of M/SU disorders can be debilitating and life-threatening and represent an important construct of functioning for this group of patients.

Second, outcomes for this study are measured only for patients who visit the ED at least once during the year. Because data for this study come from administrative claims based on health care utilization, outcomes could not be defined relative to the entire population to test the effectiveness of the severity classes in an unrestricted population. Nevertheless, using severity classes as predictors of inpatient admissions and repeat ED visits for those who use the ED at least once during the year provides a test of the classification approach.

Third, the Resource Demand Scale (RDS), which applies to all types of clinical conditions (not only M/SU conditions), is a scale for measuring relative severity of patients in inpatient settings. The RDS was calibrated on inpatient data. Its use for explaining hospital inpatient utilization is appropriate, but its use for explaining ED visits can be questioned. We used it with ED visits because there is no severity scale that is derived from and spans all types of ED visits.

Fourth, substance-use conditions may be underreported in the data used in the study because private insurance or Medicaid programs may have not covered or may have limited services for substance-use conditions. In addition, model insurance policies which were historically written to limit payers' liability for emergency medical care when substance use was involved [16] may still be influencing clinicians' reluctance to report SU-related diagnoses. To the extent that SU conditions are underreported, severity would be measured with error and findings could be affected in unknown ways.

Fifth, data from only two states were used, and thus, nationwide generalizations cannot be made. Nevertheless, the consistency of results across the two states suggests robustness of the results.

Sixth, community hospital care was studied here, and because hospitals are the appropriate source of care when a condition is life threatening, it is possible that this study captured the setting in which severity impacts are greatest.

Despite these limitations, our results demonstrated that categories of illness severity based on ICD-9-CM diagnosis codes related to mental and substance-use disorders and their implied impact on personal consequences or functioning (derived from a national survey) were strong predictors of hospital inpatient and emergency department use. The categorization of severity-of-illness in terms of functioning enhanced these predictions beyond the clinical disease prognosis algorithms that predict expected resource use across all types of mental and physical conditions treated in U.S. hospitals. Despite the limitation of the construct of expected functioning that we applied in this study, the surprisingly strong results suggest that this type of method may be an important substitute or adjunct to clinicians' judgments about severity of presenting conditions. Given strength of the findings, work should be done to refine M/SU severity classifications for use with administrative data, so that M/SU disorder severity can be controlled in studies of behavioural health service utilization, access, financing, and quality. Better measures may provide significant dividends for improving the understanding of disease impact in people with M/SU conditions.

The association with severe functional problems among patients that visited the ED was greater for people with substance-use only than with mental conditions alone or with both during the year. Although seemingly counterintuitive, the infrequency of severe problems

during hospital events in patients with co-occurring M&SU conditions may be attributable to the relative rarity of both conditions being recorded at one ED event as analyzed by these simple statistics. The stronger impact of severe consequences in predicting hospitalization for substance-use disorders alone may be related to poor insurance coverage for substance use conditions. People with substance-use conditions historically have been more likely to be without insurance and thus may be unwilling to seek care through an ED until they face serious life-threatening events. Starting July 1, 2010, group health insurance plans are required to cover substance abuse as well as mental illness in parity with physical health conditions [17]. This may increase access to community services for people with addictions and may lessen the demand for acute care hospital services.

The stronger relationship of M/SU functional severity with ED-IP admission than with multiple ED visits is consistent with how decisions are made about hospital admission. Physicians make decisions about hospital admissions. Patients or their family members or friends make decisions about seeking ED services. The physician assesses the seriousness of the patient's condition in terms of physical survival and danger to self and society. Patient/family decisions can involve multiple factors, such as self-assessment of symptoms, individual situational and psychosocial factors, insurance coverage, living arrangements, a family member's threshold of concern, and the ability of caregivers to accommodate a patient's mental and physical needs.

The strength of the simple constructs of functional severity for behavioural health from this study have implications for health services research, coding systems, health care, and health policy. Understanding the severity of patients' limitations in social functioning, even as simply defined in this study, should aid in researchers' attempts to control for severity of illness in studies that include patients with behavioural health disorders.

The full results of this study (shown in Appendix B) demonstrated several things for future studies. Patient characteristics were more predictive of utilization than hospital or community services characteristics. M/SU-related-expected-functional severity had more significant effects than other patient characteristics, such as age, gender, ethnicity, payer, income, and location. Thus, studies of cost, access to care, and quality of care could be strengthened by stratifications that incorporate the functional aspects of a patient's behavioural health condition. Analyses that control for the functional severity of M/SU conditions are needed to better understand the limitations of the current treatment system and how to improve it.

Incorporating functional status into coding systems and standard data collection should be investigated. If other studies corroborate these findings about the predictive utility of assessing the functional status of people with behavioural health conditions for health care needs and resource use, the refinement of DSM-IV diagnostic subclasses to account for the functional status of the patient should be considered. Diagnosis and classification of mental illness according to functional severity can be accomplished with existing instruments that use as few as 6 or 10 questions such as the K6/K10 [18-19], the MINI [20], and PRIME-MD [21] (see http://www.hcp.med.harvard.edu/ncs/k6_scales.php).

Questions from these brief instruments are already being used in population surveys, including the National Health Interview Survey and the National Survey of Drug Use and Health. Studies are needed to address the usefulness of these questions to assessing social functioning for patients in behavioural health crisis who present at hospitals for treatment. Routine data collection at intake could incorporate general questions for M/SU diagnosis, as well as questions about functioning over the last year [18-21]. For such an approach to be

practical, it will require development, testing, and convenient data-collection tools. Provider education will also be essential, as it has been shown that physicians prefer to routinely trust their own clinical judgment over validated diagnostic screening questions [22-24].

Policies affecting the delivery of behavioural health care could be improved with the availability of more accurate data on severity of illness. Armed with effective instruments to assess the severity of M/SU conditions, the ability of providers to administer, justify and promote evidence-based treatments would be enhanced and patient safety and well-being improved.

CONCLUSIONS

Functional status of the patient is an important dimension of disease classification and risk adjustment, and is particularly relevant to understanding the care needs of individuals with M/SU disorders. Such information is currently absent from most studies of health policy and services. We found that M/SU-related expected functioning was a strong predictor of a hospital admission after an emergency department visit, and that the probability of inpatient admission increased significantly with increased severity of the M/SU condition. We also found that the severity of M/SU conditions was often positively related to multiple ED visits. Severity-of-illness classification based on the level of personal and social impairment is important for understanding hospital utilization by people with M/SU disorders. It should be an area of focus for developing and validating M/SU clinical detail in administrative data to improve health policy analysis and future policy development.

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Table 1: Mental and Substance Use (M/SU) Functional Severity: Classification of M/SU conditions for this study (column 1), based on percent of survey respondents with specific diagnoses who had serious personal or social consequences in the National Comorbidity Survey Replication (NCS-R)*

Primary diagnoses selected for this study by severity = √	Description	NCS-R evaluation of consequences		
		Percent serious	Percent moderate	Percent serious + moderate
Severe				
√	Psychoses (not in NCS-R)*	--	--	--
√	Bipolar I and II conditions	82.9	17.1	100.0
√	Drug dependence	56.5	43.5	100.0
√	Obsessive-compulsive disorder	50.6	34.8	85.4
	3 or more conditions	49.9	43.1	93.0
√	Dysthymia (chronic depression)	49.7	32.1	81.8
√	Oppositional defiant disorder	49.6	40.3	89.9
√	Related ICD-9-CM codes "severe"	--	--	--
Moderate				
	Any mood disorder	45.0	40.0	85.0
√	Panic disorder	44.8	29.5	74.3
√	Separation anxiety disorder	43.3	24.8	68.1
√	Attention deficit/hyperactivity conditions	41.3	35.2	76.5
√	Agoraphobia without panic	40.6	30.7	71.3
√	Conduct conditions	40.5	31.6	72.1
√	Posttraumatic stress disorder	36.6	33.1	69.7
√	Drug abuse	36.6	30.4	67.0
√	Alcohol dependence	34.3	65.7	100.0
	Any impulse control conditions	32.9	52.4	85.3
√	Generalized anxiety disorder	32.3	44.6	76.9
√	Major depressive disorder	30.4	50.1	80.5
√	Related ICD-9-CM codes "moderate"	--	--	--
Mild				
√	Social phobia	29.9	38.8	68.7
	Any substance disorder	29.6	37.1	66.7
√	Alcohol abuse	28.9	39.7	68.6
	2 conditions	25.5	46.4	71.9
√	Intermittent explosive disorder	23.8	74.4	98.2
	Any anxiety disorder	22.8	33.7	56.5
	Any disorder	22.3	37.3	59.6
√	Specific phobia	21.9	30.0	51.9
	1 disorder	9.6	31.2	40.8
√	Related ICD-9-CM codes "mild"	--	--	--

*Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV conditions in the National Comorbidity Survey Replication. *Arch Gen Psychiatry* 62:617-627, June 2005. The NCS-R excludes questions related to schizophrenia and some other non-affective psychoses because they are "dramatically overestimated in lay-administered interviews" (Kessler et al., 2005). These were included in this current study as "severe."

Table 2: ED utilization, distribution of severity classes, and number of cases for study patients with at least one ED visit, by state and condition, 2002

Type of Utilization	State A			State B		
	M Only	SU Only	M&SU	M Only	SU Only	M&SU
Mean Number of:						
ED-IP stays <i>per person</i>	0.37	0.39	1.12	0.24	0.35	0.71
ED events <i>per person</i>	2.70	2.41	4.27	2.77	2.56	4.38
Percent of ED Users with:						
ED-IP stays (% of events)	13.7	16.3	26.3	8.9	13.5	16.2
Multiple ED events (% of patients)	57.3	51.9	74.6	59.1	54.0	76.5
Expected-Resource-Use Severity: Percent of events (ED-IP stays and ED treat-and-release visits) by maximum Disease Staging Resource Demand Scale						
Minimal	21.09	43.78	22.44	18.52	36.56	20.61
Less intensive	33.44	24.09	28.27	32.49	24.60	28.73
Moderate	22.61	14.70	21.21	24.93	17.68	23.47
Highly intensive	22.85	17.45	28.07	24.06	21.19	27.19
M/SU-Expected-Functioning Severity: Percent of events by maximum severity						
None	48.85	42.26	41.94	49.37	43.87	43.15
Mild	20.16	7.47	29.73	17.40	5.36	23.21
Moderate	23.92	23.62	20.07	23.71	24.86	24.40
Severe	7.07	26.64	8.26	9.52	25.91	9.25
Number of cases						
ED events	51,250	13,316	32,217	38,497	14,371	22,829
Patients	18,944	5,509	7,531	13,782	5,546	5,177

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, State Emergency Department Databases and State Inpatient Databases.

Table 3: Odds of utilization of ED and IP services for M/SU-related expected functioning of moderate and severe compared to mild, controlling for patient and county characteristics, by state, 2002

Condition and Type of Utilization	State A		State B	
	Moderate	Severe	Moderate	Severe
M Only				
Probability of ED-IP stay	0.9	2.8	0.9	2.6
Probability of multiple ED visits	1.9	0.8	2.0	0.7
SU Only				
Probability of ED-IP stay	3.1	3.1	3.8	4.2
Probability of multiple ED visits	1.4	1.6	1.5	1.8
M&SU				
Probability of ED-IP stay	2.1	4.0	2.0	4.6
Probability of multiple ED visits	2.3	1.9	2.2	2.2

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, State Emergency Department Databases.

All regression coefficients for the above measures were statistically significant at $p \leq 0.05$ or better. Results for stay and visit regressions used different reference groups because the stay regression was event-based and the visit regression was person-based. The results are translated here to consistently show odds relative to the mild reference group.

APPENDIX A:

DEFINITIONS OF M/SU – SPECIFIC SEVERITY AND GENERAL SEVERITY

Appendix A:

Hospital coding of the data for this study was based on the International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9-CM).

Table A.1 below provides the ICD-9-CM codes used to define conditions by *M/SU-expected-functioning severity* levels. Table A.2 includes the disease categories and number of stages with each category related to M/SU conditions in the Disease Staging clinical and coded criteria that underlie the Resource Demand Scale, which assesses expected resource use for *M/SU* relative to *all* conditions treated in U.S. hospitals.

Table A.1: Mental and Substance Use (M/SU) Related Functional Severity: Classification of severe, moderate, and mild M/SU functional severity, based on percent of survey respondents with specific diagnosis categories who had serious personal or social consequences in the National Comorbidity Survey Replication (NCS-R)¹

Categories of M/SU disorders	ICD-9-CM Diagnosis Codes ² by Category and Severity Level
	Severe
Psychoses (not in NCS-R) ³	295(all); 297(all); 298(all)
Bipolar I and II conditions	296.00-06, 10-16, 40-46, 50-56, 60-66; 296.7; 296.80-82, 89, 90, 99
Drug dependence	304 (all); 648.3(all); 655.5(all); 760.72, 73, 75; 779.5; 965.0(all)
Obsessive-compulsive disorder	300.3
Dysthymia (chronic depression)	300.4; 309.1; 301.11-12
Oppositional defiant disorder	313.81
Related ICD-9-CM codes "severe"	296.20, 23, 24, 30, 33, 34; 301.20; 312.03, 13, 21; V11.0
	Moderate
Panic disorder	300.01, 21
Separation anxiety disorder	309.21
Attention deficit/hyperactivity conditions	314(all)
Agoraphobia without panic	300.22
Conduct conditions	312.00, 02, 10, 12, 20, 22; 312.4, 8, 9
Posttraumatic stress disorder	309.81
Drug abuse	292(all); 305.20-23, 30-33, 40-43, 50-53, 60-63, 70-73, 80-83, 90-93
Alcohol dependence	303.9(all); 357.5; 425.5; 535.3; 571.0, 1, 2, 3; V11.3
Any impulse control conditions	312.30-33, 39
Generalized anxiety disorder	300.00, 02, 09; 300.1(all); 300.20
Major depressive disorder (except for chronic depression, which is above)	296.22, 25, 32, 35; 311
	Mild
Social phobia	300.23
Alcohol abuse	291(all); 303.00-03; 305.00-03; V79.1; 790.3
Intermittent explosive disorder	312.34, 35
Any anxiety disorder (other anxiety)	300.23, 89; 300.5, 9; 308(all); 313.0, 1, 3; 313.21, 22, 82, 83

Any other disorder (other mental and substance-use disorders)	309.0; 309.22-24, 28, 29, 82, 83, 89; 309.3, 4, 9; 299(all); 307.3, 6, 7; 313.23, 89; 313.9; 307.20-23; 333.92; 301.0, 3, 4, 6, 7, 9; 301.10, 13, 21, 22, 50, 51, 59, 81-84, 89; 300.6, 7; 300.81, 82; 302.0, 1, 2, 3, 4, 6, 9; 302.50-53, 70-76, 79, 81-85, 89; 306.0, 1, 2, 3, 4, 6, 7, 8, 9; 306.50-53, 59; 307.40-49, 80, 81, 89; 648.4(all); V11.1, 2, 8, 9; V15.4, V15.41, 42, 49; V40.2, 3, 9; V66.3; V67.3; V71.01, 02, 09; V79.0, 8, 9; 307.1; 307.50-54, 59
Specific phobia	300.29
Related ICD-9-CM codes specified "mild"	312.01, 11, 23; 296.21, 26, 31, 36; V65.42

¹ Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV conditions in the National Comorbidity Survey Replication. Arch Gen Psychiatry 62:617-627, June 2005.

² Diagnosis codes are from the ICD-9-CM manual effective October 1, 2002 and are represented as: "NNN(all)" when all the subcodes within a level are included in the category of M/SU disorders, "NNN.X-Y" when a range of codes are included in the fourth or fifth digit (after the decimal), and "NNN.X, Z" when selected codes are included (after the decimal).

³ The NCS-R excludes questions related to schizophrenia and some other non-affective conditions because they are "dramatically overestimated in lay-administered interviews" (Kessler et al., 2005). They are included here as severe.

Table A.2: M/SU-Related-Resource-Use Severity: Disease Staging™ categories related to M/SU conditions (with number of distinct stages that underlie the Resource Demand Scale in parentheses).

Antisocial personality disorder (5)
Bipolar disorder – major depressive episode (12)
Bipolar disorder – manic episode (8)
Depression (11)
Drug abuse, dependence, intoxication: Alcohol (13)
Drug abuse, dependence, intoxication: Amphetamine (7)
Drug abuse, dependence, intoxication: Barbiturates (11)
Drug abuse, dependence, intoxication: Cannabis (9)
Drug abuse, dependence, intoxication: Cocaine (12)
Drug abuse, dependence, intoxication: Hallucinogen (10)
Drug abuse, dependence, intoxication: Opioid (11)
Drug abuse, dependence, intoxication: Other (11)
Eating disorders: Anorexia Nervosa (8)
Eating disorders: Bulimia Nervosa (8)
Generalized anxiety disorder (3)
Obsessive-compulsive neurosis (3)
Schizophrenia (8)
Autism (3)
Other neuroses (1)
Other psychoses (3)

Source: Gonnella JS, Louis DZ, Gozum MV, Callahan CA, Barnes CA (Eds). Disease Staging Coded Criteria, V5.24. Thomson Medstat, 2007.

APPENDIX B:

**DETAILED RESULTS OF HIERARCHICAL
LINEAR MODELING LOGISTICS
REGRESSIONS**

Appendix B

Table B.1: Likelihood of an ED-IP Stay Given an ED Visit in State A and State B: Estimated Odds Ratios from the HLM Logistic Regressions, 2002

Variables	SU Only		M Only		M&SU	
	State A	State B	State A	State B	State A	State B
Patient Characteristics						
(Age – 40) / 10 (i.e., centered on 40 and scaled to decades)	1.288***	1.332***	0.992	1.061**	1.132***	1.101***
((Age – 40) / 10) ²	0.956***	0.948***	1.035***	1.048***	1.017*	1.029**
Median ZIP Income / \$10,000	1.087***	1.116***	0.999	1.018	1.050***	1.028
Female (reference = Male)	0.728***	0.956	1.060	1.011	0.889***	0.798***
Ethnicity (reference = White for MO/White and others for SC)						
..Black	1.104	1.123	0.860**	0.739***	0.959	0.831**
..Hispanic	1.092	4.513***	0.427***	1.002	0.651	2.795*
..Asian	0.246		1.889*		0.786	
..Other Race	1.260		1.276		1.422	
..Unknown Race	1.536		0.797		1.398	
Expected payer (reference = Private)						
..Medicare	0.876	0.748*	0.808***	0.601***	0.607***	0.547***
..Medicaid	0.800*	0.714**	0.748***	0.671***	0.638***	0.743***
..Other Government	1.151	2.418***	1.204	1.376**	1.921***	1.852***
..Uninsured	0.827*	0.455***	0.559***	0.356***	0.653***	0.516***
Resource-Use Severity: DS Resource Demand Scale (reference = Minimal <30)						
..Less intensive	2.102***	2.190***	1.342***	1.160	1.318***	1.465***
..Moderate	2.858***	3.924***	3.086***	2.212***	2.008***	2.375***
..Highly intensive	22.087***	30.723***	16.216***	10.507***	8.551***	10.946***
M/SU-Related Functional Severity (reference = None)†						
..Mild	7.933***	3.959***	2.289***	1.514***	7.043***	4.328***
..Moderate	24.264***	14.939***	2.121***	1.303***	14.440***	8.628***
..Severe	24.730***	16.777***	6.521***	3.951***	28.276***	19.727***
Hospital Characteristics						
Hospital Teaching Status	0.984	0.938	1.534	0.367	1.473	0.977
Log of Number of Beds	1.699**	1.556*	2.186***	2.077**	1.598*	1.553
Log of Number of Chemical Dependency Care Beds	0.896	1.079				
Log of Number of Psychiatric Care Beds			0.621	2.746		
Log of Number of Chemical Dependency and Psychiatric Care Beds					0.677	1.293
Hospital Ownership (reference = Public)						
..Private, Not-for-Profit	0.575	1.019	1.029	0.888	1.255	1.150
..Private, For-Profit	0.464	1.318	0.413	1.141	0.368*	1.842
Safety Net Hospital	1.264	1.311	1.307	1.186	1.198	1.380

Variables	SU Only		M Only		M&SU	
	State A	State B	State A	State B	State A	State B
Hospital Location (reference = Large Metropolitan)						
..Small Metropolitan	1.327	0.453	0.572	0.609	0.538	1.276
..Large Rural	1.140	1.092	0.569	0.886	0.770	1.594
..Small Rural	1.126	0.596	1.182	0.972	0.876	1.636
Hospital Inpatient SA Services	0.862	0.674			0.658	0.433
Hospital Outpatient SA Services	2.138	1.946			3.636	1.137
Hospital Outpatient/Inpatient Crisis Prevention Services	1.322	1.188			1.049	1.058
Both Hospital Outpatient SA and Outpatient/Inpatient Crisis Prevention Services	0.566	0.363			0.509	0.328
Hospital Inpatient Psychiatric Services			5.458	0.113	3.611	0.489
Hospital Inpatient/Outpatient Psychiatric Services			2.184	0.660	1.631	1.234
Hospital Outpatient Psychiatric Services			0.869	1.530	1.310	2.373
Community Characteristics						
Number of Community Mental Health Centers in the County	0.910	1.075	0.905**	0.880	1.050	0.760*
Number of Short Term Psychiatric and Chemical Dependency Beds Set Up per Capita in the County	1.139	0.372**	0.921	0.408***	1.001	0.614*
Shortage Area for Mental Health Practitioners	0.956	1.052	1.225*	1.080	1.103	0.978
P-value on -2 log likelihood-ratio test of models without and with M/SU-related functioning classes	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, State Emergency Department Databases.

*** P-value \leq .001

** P-value \leq .01

* P-value \leq .05

† The ED-IP stay analysis is event (stay) based; the sample is based on people with ED visits diagnosed with M/SU conditions sometime during the year; and some hospitalizations may not be M/SU-related. Thus, the reference group for ED-IP stays is events for conditions other than M/SU but who had M/SU diagnoses some time during the year but no M/SU condition and no M/SU severity class for the current stay.

Table B.2: Likelihood of Multiple ED Visits (Given an ED Visit) in State A and State B: Estimated Odds Ratios from HLM Logistic Regressions, 2002

Variables	SU Only		M Only		M&SU	
	State A	State B	State A	State B	State A	State B
Patient Characteristics						
(Age – 40) / 10 (i.e., centered on 40 and scaled to decades)	0.765***	0.759***	0.725***	0.700***	0.819***	0.820***
((Age – 40) / 10) ²	0.979	0.939***	1.011*	1.019**	0.950***	0.967*
Median Zip Income / \$10,000	0.959	0.936*	0.991	0.876***	0.977	0.899**
Female (reference = Male)	1.123	0.987	1.240***	1.223***	1.039	0.893
Ethnicity (reference = White for MO/White and others for SC)						
..Black	1.451***	1.048	1.081	1.106*	1.063	0.843
..Hispanic	1.446	0.279**	1.259	0.544**	0.802	0.573
Expected payer (reference = Private)						
..Medicare	1.701***	1.775***	1.330***	1.645***	1.853***	1.542**
..Medicaid	2.635***	2.004***	1.921***	1.893***	2.083***	1.808***
..Other Government	1.929**	0.866	1.343**	1.138	0.895	0.698
..Uninsured	1.507***	1.298**	1.145**	1.145**	1.314***	1.401***
Patient Location (reference = Large Metropolitan for MO, Urban for SC)						
..Small Metropolitan	1.203		1.063		0.925	
..Large Rural	1.487		1.139		1.091	
..Small Rural	1.077		1.060		1.052	
..Rural (Small + Large Rural)		1.075		0.870		0.907
Resource-Use Severity: DS Resource Demand Scale (reference = Minimal to Less Intensive < 37.5)						
..Moderate	14.296***	15.226***	5.425***	6.160***	4.442***	5.280***
..Highly intensive	13.832***	17.322***	7.996***	10.507***	6.633***	9.679***
M/SU-Related Functional Severity (reference = Mild)†						
..Moderate	1.362***	1.523***	1.937***	2.026***	2.300***	2.168***
..Severe	1.547***	1.809***	0.845**	0.701***	1.937***	2.151***
Community Characteristics						
Number of Community Mental Health Centers in the County	0.993	1.210	0.783***	0.706	0.803*	0.773
Number of Short Term Psychiatric and Chemical Dependency Beds Set Up per Capita in the County	0.852	2.149***	1.161**	3.004***	1.014	2.633**
Shortage Area for Mental Health Practitioners	0.957	0.781**	1.089	1.319	1.176	1.079
P-value on -2 log likelihood-ratio test of models without and with M/SU-related functional severity classes	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, State Emergency Department Databases.

*** P-value ≤ .001

** P-value ≤ .01

* P-value ≤ .05

† The multiple ED visit analysis is person based, severity per person was assigned from the highest M/SU severity among ED events during the year, and thus the reference group for

multiple ED visits is people with mild M/SU severity because everyone had M/SU severity assigned.

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