Variation in Patient Routine Costliness in U.S. Psychiatric Facilities

Jerry Cromwell,[1]* **Edward M. Drozd,**[1] **Barbara Gage,**[1] **Jan Maier,**[2] **Erin Richter,**[3] **Howard H. Goldman**[4]

[1]*Ph.D., Research Triangle Institute, Waltham, MA, USA*
[2]*RN, M.P.H., Research Triangle Institute, Waltham, MA, USA*
[3]*B.A. Research Triangle Institute, Waltham, MA, USA*
[4]*M.D., University of Maryland, Baltimore, MD, USA*

Abstract

Background: The Balanced Budget Refinement Act of 1999 included a Congressional mandate to develop a patient-level case mix prospective payment system (PPS) for all Medicare beneficiaries treated in PPS-exempt psychiatric facilities. Payment levels by case mix category have been proposed by the government based on claims and facility cost reports. Because of claims data limitations, these levels do not account for patient-specific staffing costs within a facility's routine units, nor are certain key patient characteristics considered for higher payment.

Aims of the Study: This study uses novel primary data to quantify heretofore unmeasured differences in daily staffing intensity on routine units among Medicare patients. The data are used to test for compression (or narrowing) in case mix payment weights that would result from using only Medicare claims and facility cost reports to quantify daily routine costliness.

Methods: Primary data on patient and staff times in over 20 activities were collected from 40 psychiatric facilities and 66 psychiatric units, nation-wide. Patient times were reported on all inpatients on each shift over a 7-day study period. A resource intensity measure (in Registered Nurse (RN)-equivalent minutes) was constructed on a daily basis for 4,149 Medicare and 4,667 non-Medicare patient days. The routine measure is converted into daily cost using cost report per diems and ancillary costs added using submitted claims. Descriptive tables isolate key cost drivers for Medicare patients. Classification and Regression Trees (CART) clustering identifies 16 potential case mix groups. Multivariate regression is used to compare case mix, day-of-stay, and facility effects using 4 alternative measures of daily routine and ancillary costs.

Results: Patient daily routine intensity of care is found to vary by a factor of 3 or more between the top and bottom 10% of days. Medicare patient days were 12.5% more staff intensive than non-Medicare days, which may have been due to age and other differences. Older dementia and ''residual diagnosis'' patients are more intensive while schizophrenia and substance-related patients are less intensive. Age, psychiatric and medical severity, deficits in Activities in Daily Living (ADLs), dangerous behaviors, and electroconvulsive therapy (ECT) also contribute substantially to higher staffing intensity. Other patient characteristics were insignificant within broad diagnostic groups. Routine costs based on a single facility per diem produced narrower case mix cost differences – often by a factor of 2 or more – for 10 of 12 groups with significantly higher costs. Adding patient-specific ancillary to uniform per diem costs only marginally decompressed costs. Day of-stay costs were similarly compressed when using only cost reports.

Discussion: Claims-based costing using Medicare cost reports unduly compresses (narrows) estimates of inter-group case mix cost differences. Also, by not capturing ADL deficits and dangerous behaviors, administrative data sets fail to identify small, but very resource intensive, patient groups. ECT treatment regimens, although rare, significantly increase costs on a daily basis.

Implications for Health Policies: Medicare's recently proposed prospective payment system for psychiatric inpatients uses claims-based costing methods based on widely available administrative data. Consequently, fewer high cost groups are identified due to non-reported patient characteristics such as ADL deficits. Moreover, inter-group relative cost differences are likely understated. It is also possible that any standardized dollar amount applied to group relative weights is understated because Medicare patients appear more intensive per day on routine units.

Implications for Future Research: Larger primary samples of special psychiatric units (e.g., med-psych, child/adolescent) could improve estimates of daily routine costliness. Larger samples could also support stronger tests of case mix and cost differences by facility type and teaching status. Medical records information on non-Medicare patients could quantify any systematic differences in average daily costs holding case mix constant. Similar primary studies of psychiatric patients treated outside PPS-exempt units in acute general hospitals could result in a fully integrated payment system for all mentally ill Medicare patients, thereby avoiding payment inefficiencies and inequities.

* **Correspondence to:** Jerry Cromwell, RTI, 411 Waverley Oaks Road, Suite 330, Waltham, Massachusetts, 02452-8414, USA.

Tel.: +1-781-7888100 x 131

Fax: +1-781-788 8101

E-mail: jcromwell@rti.org

Introduction

Since 1982, psychiatric hospitals and distinct part units (DPUs) of acute general hospitals have been paid under the federal Tax Equity and Fiscal Responsibility Act (TEFRA) cost-based system. Provider payments have been limited to a

15

target amount per discharge that does not reflect any changes in case mix or local market practice patterns.[1-3] Following the Balanced Budget Act (BBA) in 1997 that further restricted payments under TEFRA,[4,5] the Congress in the 1999 Balanced Budget Refinement Act (BBRA) mandated the Centers for Medicare & Medicaid Services (CMS) to pursue the feasibility of a per diem prospective payment system for all Medicare psychiatric inpatients treated in PPS-exempt units. In December, 2003, CMS issued a Notice of Preliminary Rule Making (NPRM) that proposed such a system, followed a few months later by a Final Rule.[6,7] Like the precursor American Psychiatric Association study,[8] the system was costed based on submitted claims and Medicare cost reports. Both studies have two major limitations. First, because cost reports provide only a single, constant routine per diem applied to all patients in a given facility, claims-based costing methods must assume identical daily routine costs across all of a facility's psychiatric patients. No distinction for ''special units'' is made analogous to ICUs when costing medical and surgical patients.[9] Ignoring any within-facility and day-to-day differences in routine costs artificially compresses, or narrows, payment differentials based on patient characteristics, such as diagnosis and disruptive behavior. This drawback is especially problematic for inpatient psychiatry as approximately 85 percent of psychiatric inpatient costs are incurred on psychiatric nursing units.[10] Unless the routine unit staffing costs associated with individual psychiatric patients are quantified, payment differentials across very dissimilar illness cost groups will be determined almost exclusively by minor differences in ancillary usage and facility-level characteristics.

A second limitation of claims-based costing is the lack of behavioral (e.g., combative), functional (e.g., Activities of Daily Living deficits (ADLs), or situational characteristics (e.g., involuntary commitment) to explain individual patient cost differences on units. Claims-based costing, we believe, explains a significant part of the limited success of earlier attempts to improve the explanatory power of psychiatric DRGs.[11-13]

Recognizing the limitations of claims, we conducted a broad national survey of psychiatric providers to collect primary data on the times staff spend with patients on routine and special units. While Ashcraft et al.[14] and Fries et al.[15] use primary data to isolate routine costs for VA patients, and Sullivan et al.[16] survey VA staff on how they allocate their time between clinical and non-clinical activities, this paper quantifies the heretofore unknown differences in Medicare and non-Medicare daily routine costs on a national sample of providers. We also collected diagnostic, demographic, admission status, day-of-stay, and individual patient behaviors to test for compression in Medicare payment rates using claims-based costing methods (see also Hirdes et al.[17]).

The rest of the paper is in three parts. First, we present our methods describing site selection, how we collected the primary data, and then how we constructed the key cost and patient characteristics measures. This section also describes our analytic methods. Next, we present our results showing how skewed routine unit costs are across patients followed by a set of descriptive tables that identify patient cost drivers.

Multivariate analyses control for confounding facility factors and compare case mix relative costs using four daily cost measures differing in the way routine costs are quantified. Lastly, we discuss our results and draw implications for Medicare's proposed psychiatric prospective payment system.

Methods

Sample Plan

The unique primary data used in this paper come from a geographically representative sample of psychiatric facilities. A stratified multi-stage hierarchical sampling design was employed. Facilities, stratified by Census division, were the primary sampling units, with sub-sampling of psychiatric units, patients, and patient days. The sampling frame consisted of 1,846 inpatient psychiatric facilities exempt from the Medicare acute inpatient Prospective Payment System (PPS). Probability proportional-to-size sampling (based on each facility's share of Medicare-covered psychiatric days) was conducted to select a final sample of facilities. Facilities with fewer than 10 beds were excluded to assure a minimum number of Medicare observations in each site.

Of the 1,846 facilities, 40 participated on a first-to-agree basis, comprising 2.2 percent of the national facility count and 4.5 percent of all Medicare-covered days. Fewer than 10 sites solicited for the study declined to participate. An upcoming JCAHO visit was the most common reason for not participating, and one site had been damaged in an earthquake. Twenty-seven facilities are acute hospitals operating Medicare Distinct Part Units (DPUs), 10 are private psychiatric hospitals, and three are public (i.e., county, state) psychiatric hospitals. The participation rate is highest for the private psychiatric hospitals (7.0 percent) and lowest for the public psychiatric hospitals (1.6 percent). Of the sample of 40 facilities, 28 are non-teaching and 12 are teaching facilities. Three are in rural localities.

One to three psychiatric units (denoted by lowercase ''u'' versus entire DPU) were selected in each of 40 facilities to produce a representative mix of units. Units where Medicare patients are not treated were excluded (e.g., child and adolescent units) as were units dedicated to detox and admissions intake (e.g., emergency rooms). A total of 66 units within facilities were sampled: 38 general adult, 16 geriatric, 4 med-psych, 1 forensic, and 7 specialty units (e.g., chemical dependency, developmentally disabled, psychiatric trauma). All self-designated med-psych units were included as they are expected to treat the most complex, costly patients. Most (41) of the sampled psychiatric units are in acute general hospital DPUs. The remaining 25 units are split between private psychiatric hospitals (19 units) and public psychiatric hospitals (six units).

Once units were chosen, patient and staff times were collected for all Medicare and non-Medicare patients on every shift during the seven-day data collection period. Between one and seven days of data are available on each patient depending on whether a patient was admitted or discharged during the study period.

16

J. CROMWELL ET AL.

Primary Data

Two-person study teams visited all sites prior to data collection. Direct observation of staff times with patients by the study team was infeasible because of patient confidentiality concerns and disruptions to the process of care. Instead, the study team personally trained most dedicated unit staff (e.g., RNs, caseworkers, psychiatrists) on day, evening, and night shifts on how to complete the forms. A site coordinator, usually a nurse, was trained intensively during the site visit to conduct additional staff trainings, manage data collection, and to ensure quality control and patient confidentiality.

Separate staff, patient, and on-unit consults/crisis forms captured times in over 20 activities (e.g., personal care, medications, group therapy, 1:1 observation). A fourth Patient Characteristics Form (PCF) was collected for every Medicare-eligible patient. No PCFs were collected on non-Medicare patients, and they are excluded from any analyses that stratify patients by diagnostic or behavioral characteristic. The PCF recorded demographic, behavioral, and other patient characteristics that clinicians determined most likely to be associated with high resource intensity (e.g., suicidality, assaultiveness). It also included all five Axes of the DSM-IV multi-axial psychiatric assessment taxonomy.[18] The unit psychiatrist completed the PCF with assistance from the treatment team at the end of the study or upon discharge, whichever came first. (See Other Patient Characteristics section for more details.)

Cleaning and editing procedures addressed problems such as incorrect dates or inconsistent occupation definitions. Six percent of patient days involved imputing one shift's work of a patient time-in-activities, mostly on night shifts. Imputed total staffing minutes per patient day were only 1.8 percent higher than for non-imputed days, thereby justifying the use of all non-imputed and imputed Medicare patient days (4,149 days).

Additional Data Sources

Claims from the 2001 and 2002 Medicare National Claims History inpatient files were matched to 696 of the 834 Medicare patients in the study by their Medicare ID number and dates of service. (Non-matches resulted primarily from delays in submitting hospital claims by sites late in the primary collection phase.) Claims provided information on length of stay and ancillary charges (e.g., radiology, pharmacy). Medicare cost-to-charge ratios were used to convert ancillary charges to costs. Cost reports also provided the uniform, post-stepdown, routine per diem cost for all psychiatric inpatients.

Measures

To decompose each facility's single per diem routine cost, we constructed a patient-specific routine resource intensity measure (RI). The RI is the amount of RN-equivalent minutes staff spend with, or on behalf of, a patient on a particular day. It is based on individual staff daily time with patients weighted by one of 12 hourly wage rates relative to RN's. Occupational relative weights vary from 0.5 for mental health specialists versus RNs (e.g., one-half an RN rate) to 3.6 for psychiatrists. Because staff times are weighted by relative and not absolute hourly wages, the resulting intensity measure is unaffected by geographic and provider-specific wage differences. To derive a patient's daily routine cost, we first divided their own daily RI by the average RI for all Medicare patients in each facility then multiplied the resulting index by the facility's average (constant) routine per diem cost. Consequently, patient days that are twice as staff intensive as the average Medicare day in a facility are assumed to incur twice the routine cost. Separate Medicare Part A (institutional) and Part B (physician) RIs are constructed. Most physicians (except for unit management) and all resident time are excluded from the Part A RI measure because these providers are paid for separately under Medicare Part B and hospital Direct Medical Education (DME), respectively. Yet another more inclusive total cost measure adds ancillary to routine per diem costs. Daily ancillary costs are computed by dividing the patient's total ancillary costs by length of stay. (Ancillary charges are not itemized by day on Medicare claims.)

DSM-IV Axis I principal diagnoses were used to subdivide patients into five major categories: (i) schizophrenia and other psychotic disorders; (ii) dementias and delirium; (iii) mood disorders; (iv) substance-related disorders; and (v) a residual group (including eating disorders, post-traumatic stress disorders, anxiety disorders). Psychiatric severity within category is reflected both in the patient's GAF score (or psychiatric function) as well as an indicator for any one of 26 potentially resource-intensive psychiatric conditions suggested by clinicians. (see **Appendix Table A-1**). Intensive conditions included all DSM-IV codes with "severe," "profound," or "pervasive" qualifiers in the 5th digit augmented by all severe diagnoses with above-average routine intensity, e.g., intermittent explosive disorder, impulse control and eating disorders, and borderline personality. A third psychiatric severity indicator included dual diagnosis patients with both a psychiatric and substance-related diagnosis.

The medical domain was characterized by a list of ICD-9-CM conditions that clinicians hypothesized to be particularly nursing intensive (e.g., insulin-dependent diabetes, chronic renal failure, AIDS, non-healing wounds; see **Appendix Table A-2**). Two procedure codes were also used as indicators of medical severity: morphine pump and peripheral intravenous catheter. A "HiMed" indicator was used to classify patients, in part, according to their routine nursing needs.

Other Patient Characteristics

The behavioral domain included four indicators of safety risk: suicidal, assaultive, elopement, or self-neglect behavior. Suicidal patients are defined as those "hopeless, [wanted] to kill self ASAP, and [made] recent attempts," derived from a patient scale validated and used by one of the teaching

hospitals in the study. Assaultive patients are those on the most-severe level of a three-point scale of physical aggression, lethality of threats, or level of agitation developed and used for staffing psychiatric units in two participating hospitals. Our expert clinical consultants also provided scales for measuring elopement and patient self-neglect. Elopement risk patients are those described as a "serious elopement threat" by clinical staff. Self-neglectful patients are those identified by sites' clinical staff as exhibiting "extreme self-neglect (i.e., not eating)." A "dangerousness" indicator combined the suicidal and the assaultive indicators. Other behavioral indicators included cognitive impairment, "first break" (i.e., first psychiatric admission), and commitment status (voluntary or involuntary). Treatment indicators included number of medications at time of discharge or end of study, detox, and electroconvulsive therapy (ECT).

Patient age, gender, Activities of Daily Living (ADL) deficits,[19,20] and a history of falls were included to capture physical nursing care needs.

Analysis

Descriptive tables show stratifications of daily routine costliness by several patient, day-of-stay, and facility characteristics. Patient days are weighted by inverse sampling probabilities of selection. Bivariate t-tests of differences by patient characteristic are adjusted for the complex sample design using SAS PROC SURVEYREG. Four Ordinary Least Squares (OLS) models with different dependent variables are estimated and compared:

   (i)   Unadjusted Routine facility-wide per diem cost (RC_f);
  (ii) RC_f multiplied by the daily patient-specific intensity index (RI_p);
 (iii)   Total adjusted daily routine cost ($RC_f \times RI_p$) plus average daily patient ancillary costs (A_p);
 (iv)   Total unadjusted RC_f plus A_p.

Each daily cost variant is converted to natural logs because of marked skewness in the data. Model 1 provides benchmark case mix and other effects with no variation in daily routine costliness within a facility. Model 2 creates within-facility variation by adjusting the uniform routine cost by each patient's own daily intensity index. Model 3 expands Model 2 by adding patient-specific ancillary costs. It allows for maximal cost variation across individual patient days. Model 4 expands Model 1 by adding patient-specific ancillary costs to the facility's fixed routine per diem. As such, it represents the claims-based measure used in calibrating CMS' proposed payment system.

Sixteen case mix groups are created using CART (Classification and Regression Trees)[21,22] clustering software algorithms. CART formed these 16 groups by selecting a subset of all 31 patient characteristics with the greatest explanatory power within each of five major DSM-IV illness categories, schizophrenia, dementia, mood disorders, substance abuse, and a residual (all other diagnoses) (e.g., schizophrenia patients over age 65 with high ADL deficits and high medical severity). CART's sequential splitting

algorithm first identified statistically dominant characteristics such as age and ADL deficits, followed by "second order" characteristics, thereby accounting for interactive effects. In addition to case mix, other explanatory variables in the model included day-of-stay (days 1, 2-3, 4-5, . . .), facility ownership (acute hospital DPU, public or private psychiatric hospital), teaching status (more than 1 full-time-equivalent resident in psychiatric unit), average psychiatric daily census, rural location, area wage rates, occupancy rate, and the Medicare disproportionate share ratio (SSI ratio). These variables purge the case mix regression coefficients of any site and day-of-care sampling biases. The day-of-stay indicators also test the appropriateness of "declining block pricing" depending on daily cost trends over the course of a stay.[1,2,13,23]

Statistical tests on each model are conducted using the lowest cost case mix group (schizophrenia under-65, low ADL deficits or low psychiatric severity), day-of-stay (day 15+), or urban DPU categories as reference groups. Coefficient standard errors are adjusted (increased) for the complex sample design using the Taylor linearization method.[24] Regression sample sizes are less (df = 3,346 versus 4,149 total Medicare days) because of non-matches of claims to primary data collected late in the study lifecycle.

Results

Medicare versus Non-Medicare

Table 1 compares routine cost estimates for 4,149 Medicare versus 4,667 non-Medicare inpatient days. Medicare days are almost one-half (6.6 percent) an RN-equivalent hour more staffing intensive on psychiatric units when physician and resident time is included and nearly three-quarters (12.5 percent) of an hour more intensive based on Part A-covered staff time alone. Systematically higher routine costliness of Medicare patients does not necessarily bias any case mix weights applied to Medicare patients alone, but any standardized amount applied to the weights would be biased downwards.

Skewness of Routine Intensity

Table 2 and associated **Figure 1** demonstrate the skewness of daily routine resource intensity for Medicare patients alone. The sample mean for all Medicare Part A&B routine care is 469.3 RN-equivalent minutes per patient day versus 398.0 minutes when limited to Part A-covered staff alone.* Daily Part A intensity ranged from 30 to over 2,300 RN-equivalent minutes per patient, a 76-to-1 ratio. The top and bottom 10 percent thresholds imply that one-in-five patient days differ by at least 7.5 hours of Part A RN-equivalent staff time ((647 – 192)/60). The interquartile range of 230 minutes

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18

J. CROMWELL *ET AL.*

Table 1. Medicare and Non-Medicare Routine Resource Intensity (RI)[a] Per Patient Day

Staff Group	Non-Medicare[b] (Minutes)	Medicare[b] (Minutes)	Difference (Minutes)	P-Value
Total	437	466	29	p < 0.001
Part A Covered	344	387	43	p < 0.001
Part B Covered	110	95	-15	p < 0.001

[a] RI = Reported staff time per patient per day weighted by their occupational hourly wage relative to RN's. Average RI unweighted by sampling proportions due to lack of comparable non-Medicare sample frame. No adjustments made for patient severity differences due to lack of non-Medicare patient characteristics.
[b] 4,667 and 4,149 non-Medicare and Medicare patients days, respectively.

Source: Primary survey of 40 U.S. psychiatric facilities, 2001-2003.

Table 2. Distributional Statistics for Medicare Daily Total and Part A Resource Intensity (RI)[a]

	Total	Part A
Mean	469.3	398.0
Standard deviation	249.1	214.3
Coefficient of variation	53.1	53.8
Quintile thresholds		
Maximum	2,379.2	2,312.6
Top 5%	932.1	794.9
Top 10%	776.0	647.3
Top 25%	591.9	484.3
Median	413.8	350.1
Bottom 25%	292.1	255.4
Bottom 10%	213.4	192.1
Bottom 5%	180.5	162.9
Minimum	29.7	29.7

[a] Resource intensity defined as the number of RN-equivalent staff minutes per patient day. Patient days weighted by sampling probabilities. Means slightly different from Table 1 due to weighting.

Source: Primary survey of 40 U.S. psychiatric facilities, 2001-2003.

(484 – 255) implies that half of patient days differ by at least 3.75 RN-equivalent hours of staff time. At the reported survey average $25 salary per RN hour, excluding fringes and overhead, the two ranges imply direct routine staffing cost differences of at least $94 to $188 per patient day and generally much more. The long right tail of the distribution suggests a set of numerically small, but very costly, patient groups that may be underpaid based on a facility-wide per diem costing methodology.

Psychiatric Effects

Table 3 stratifies the five major DSM-IV categories (four diagnostic groups and a small residual group) by three alternative psychiatric severity measures. Dementia-related diagnoses are the most staff intensive on psychiatric units (499 RN-equivalent minutes/day; 25 percent above the average of 398). Patients with a ''residual'' diagnosis are also quite intensive (473 minutes; 19 percent above average). These include, among others, patients with eating disorders (over 40 percent above average) or those who had an intermittent explosive disorder (30 percent above average). Patients with a principal substance-related diagnosis are least intensive on psychiatric units (317 minutes; 20 percent below average). Schizophrenia patients, often considered severely ill, exhibit slightly below average Part A-covered staffing intensity (362 minutes; 9 percent).

Patients with a severe Axis I or II psychiatric diagnosis are approximately 25 percent more staff intensive (458/368 minutes). Axis I/II psychiatric severity highlights intensity differences primarily among schizophrenia (489/338 = 45 percent) and dementia patients (554/469 = 18 percent; p = 0.11).

Dual diagnosis patients as a whole are 22 percent less intensive (328/420 minutes). This is true within each of the three largest principal diagnostic groups, schizophrenia, dementia, and mood disorders.

Intensity levels are non-monotonic by GAF group. Patients with GAF scores between 21-29 are reportedly most staff intensive (14 percent above average). Poorly functioning patients with scores of 20 or less are slightly less intensive than patients with 21-29 GAF scores while those with GAF scores over 40 are least intensive (10 percent below average). GAF group intensity differences are generally consistent with differences indicated by Axis I/II psychiatric severity; namely, greater severity is associated with higher intensity.

Medical and Demographic Effects

Older Medicare patients experience higher intensity days (**Table 4**). Days of patients 75 and older are 53 percent more intensive than those for patients under age 65 (532/346 minutes). The discrepancy reaches 80 percent among schizophrenia patients (586/326). Male patient days are 15 percent less intensive than those of females, a differential consistent in every major diagnostic group except dementia.

Patient days with *any* reported medical diagnosis are 25 percent more intensive (416/333 minutes), a difference found (approximately) in the three major diagnostic groups as well: schizophrenia, dementia, and mood disorders. Except for schizophrenia, *severe* medical diagnoses do not discriminate among low/high intensity patients as strongly. This is
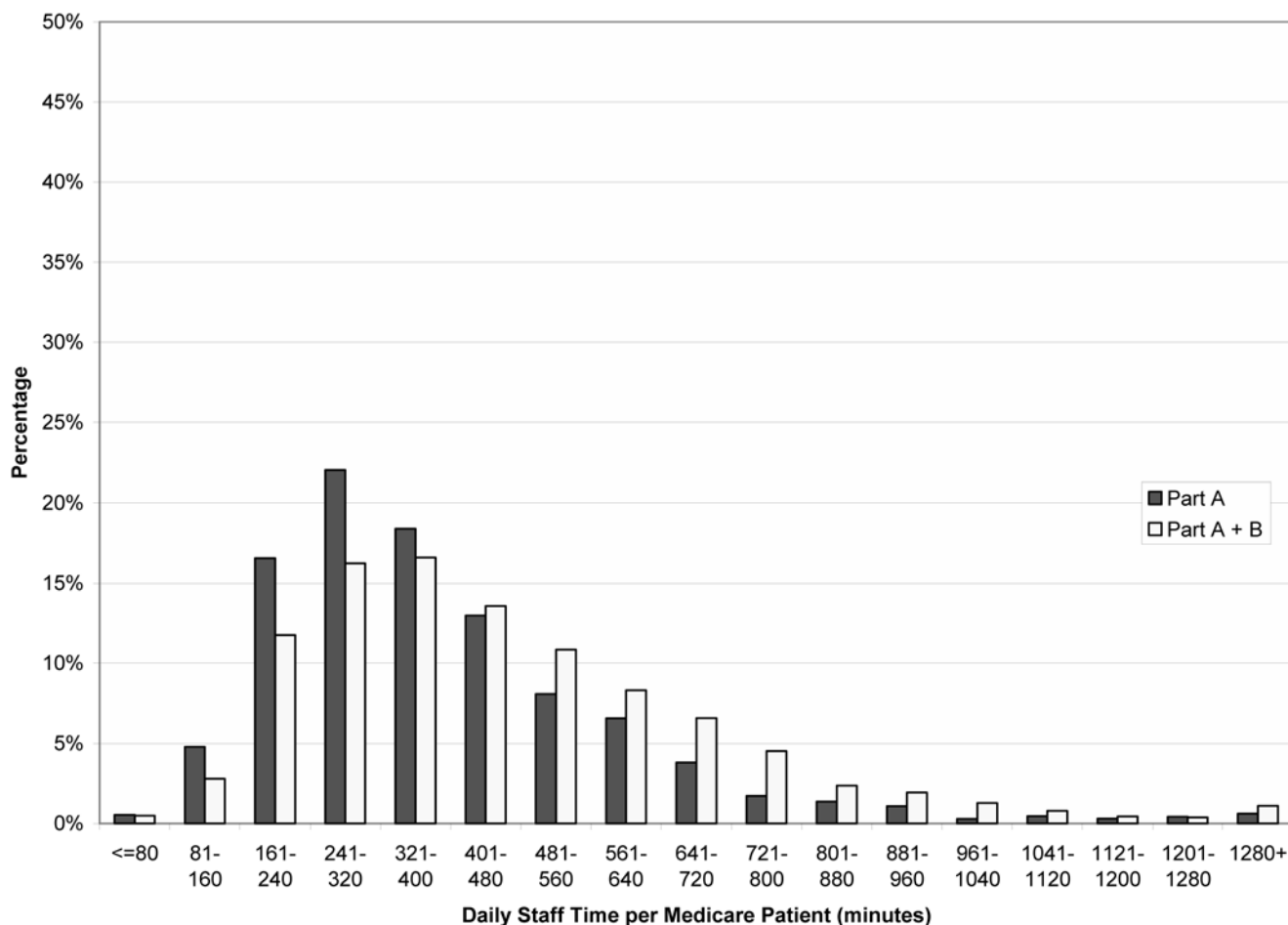
Figure 1 Frequency Distribution of Medicare Daily Routine Intensity (RI)

Source: Primary survey of 40 psychiatric facilities, 2001-2003.

Table 3. Medicare Average Daily Part A Routine Intensity (in Minutes): Major Diagnostic Group by Psychiatric Severity

	Schizophrenia	Dementia	Mood Disorder	Residual	Substance Related	Overall Average	No. of Days
Psychiatric severe Dx							
No	338	469	393	482	315	368	2,444
Yes	489***	554	429	453	340	458***	1,705
Dual Dx							
No	377	526	439	477	298	420	3,273
Yes	299***	350*	348***	444	318	328***	876
GAF Group							
≤ 20	396	483	407	556	481	420	1,425
$21 - 29$	384	610	476	458	340***	453	756
$30 - 40$	341	466	386	468	337***	371**	1,520
$41 +$	285**	346*	476	365***	298***	357	399
Average	362	499	414	473	317	398	4,149
No. of Days	1,586	648	1,603	127	185		

Note:

Mean RN-equivalent staffing times per patient day weighted by patient day sampling proportions. *p < 0.10; **p < 0.05; ***p < 0.01.

T-tests against ''no'' or ≤ 20 GAF group.

Source: Primary survey of 40 psychiatric facilities, 2001-2003.

J. CROMWELL *ET AL.*

Table 4. Medicare Average Daily Routine Staff Intensity (in Minutes): Age, Gender, and Medical Severity by Major Diagnostic Group

	Schizophrenia	Dementia	Mood Disorder	Residual	Substance Related	Overall Average	No. of Days
Age group							
< 65	326	339	378	442	328	346	2,346
75 − 74	366	533**	420	564	237***	408*	640
75 +	586***	537**	498**	493	434	532***	1,098
Gender							
Female	393	504	445	488	395	429	1,962
Male	332***	494	372***	437	295**	366**	2,175
Any medical Dx							
No	315	400	355	462	321	333	769
Yes	381***	507**	426***	475	315	416***	3,380
Medically severe Dx							
No	356	494	409	472	307	388	3,464
Yes	422	507	436	478	457**	453***	685
Average	362	499	414	473	317	398	4,149
No. of Days	1,586	648	1,603	127	185	4,148	

Note:

Mean RN-equivalent staffing times per patient day weighted by patient day sampling proportions. *p < 0.10; **p < 0.05; ***p < 0.01.
T-tests against <65 age group, female, ''no'' groups.

Source: Primary survey of 40 U.S. psychiatric facilities, 2001-2003.

attributable to the fact that patients without any medical diagnosis whatsoever are especially non-intensive. Patients with unclassified ''residual'' psychiatric diagnoses are notable for requiring well above average staffing intensity (462 minutes) even without a medical diagnosis.

Behavioral Effects

One-way comparisons of patients with and without selected behavioral and treatment characteristics suggest intensity drivers in addition to diagnosis (see **Table 5**). First episode inpatient days, 12 percent of all Medicare days, are 18 percent more intensive on average (482/408). Other characteristics strongly associated with greater intensity are patients with: history of falls (37 percent more intensive); three-or-more ADL deficits (43 percent more intensive); six or more medications upon discharge (31-33 percent more intensive); and cognitive impairment (24 percent more intensive). Combativeness, self-neglect, and ECT treatment also appear to increase daily routine intensity. Not all of these variables would be suitable for a payment system due to possible adverse clinical and revenue maximization incentives.

Facility Effects

Comparing DPU and private hospitals for which we have reasonable sample sizes (**Table 6**), the daily intensity difference across all diagnoses between the two groups is 124 minutes, or 2.1 RN-equivalent hours per day. DPUs range from 28 percent (schizophrenia) to 44 percent (mood disorders) more intensive on a patient-day basis. This is

equivalent to 1.4-2.4 more RN hours per day for each patient. Multivariate analysis below tests facility and other effects controlling for case mix.

Multivariate Results

Table 7, **Table 8**, and **Table 9** present case mix, day-of-stay, and facility regression coefficients, respectively, based on four different models of varying patient specificity in defining routine costs. Exponentiated, the coefficients are interpreted as the daily cost of a particular patient group relative to the lowest intensity reference group (e.g., schizophrenia, age < 65, with low ADL deficits or low psychiatric severity in **Table 7**). The first two models explain only routine costs while models 3 and 4 add patient-specific ancillaries to routine costs.

The adjusted R^2 in models 1 and 4 is higher than in models 2 and 3 because of the absence of any variation in patient routine cost within facility. Compared with model 1, model 2's explanatory power falls to 0.32 because of the increase in within-facility cost variation introduced by applying each patient's own daily routine index to the facility's constant per diem, RC_f. Any loss in overall explanatory power, however, is more than compensated for by gains in accuracy in estimating case mix costliness. Of the 12 case mix groups in **Table 7** with at least one statistically significant coefficient in either columns 1 or 2, 10 coefficients are larger in absolute value in column 2, even after controlling for variables shown in **Table 8** and **Table 9**. This indicates substantial compression of case mix coefficients using a claims-based, constant per diem, approach to costing. For example, costs of

Table 5. Medicare Average Part A Daily Routine Intensity (in Minutes): Behavioral Characteristics

Characteristic	No		Yes		Relative RI
	% Days	Mean (min)	% Days	Mean (min)	
First Episode	88%	408	12%	482**	1.18
Involuntary Commitment	65	407	35	389	0.96
Cognitive Impairment	57	356	43	440***	1.24
History of Falls	77	376	23	518***	1.37
Suicide Concern	87	396	13	377	0.95
Unusually Combative/Dangerous	62	381	38	418**	1.10
Extreme Self-Neglect	68	381	32	435**	1.14
Detox Treatment	90	403	10	344***	0.85
ECT Treatment	93	395	7	442	1.12
ADL Deficits					
• None			53	346	1.00
• 1 − 2			19	371*	1.07
• 3 +			28	496***	1.34
Count of Medications					
• 0 − 2			29	341	1.00
• 3 − 5			34	389***	1.14
• 6 − 9			25	448**	1.31
• 10 +			12	452***	1.33

Mean RN-equivalent staffing times per patient day weighted by patient day sampling proportions. *p < 0.10; **p < 0.05; ***p < 0.01. T-tests of ''yes'' versus ''no'' group or no ADL deficits or 0-2 medications.

Definitions:
Relative RI = Ratio of mean yes/no, or 0-1 ADL deficits, or 0-2 medications.
First Episode: First known admission for mental problem.
Involuntary Commitment: Commitment not converted to voluntary within 72 hours of admission.
ADL Deficits: Needs assistance in walking, toileting, transferring, eating, bathing, and incontinence.
Cognitive Impairment: As reported by attending physician.
History of Falls: History of accidental falls prior to admission.
Detox, ECT Treatment: During current admission.

Source: Primary survey of 40 U.S. psychiatric facilities, 2001 – 2003.

Table 6. Medicare Average Daily Part A Routine Intensity (in Minutes): Major Diagnostic Group and Facility Type

Facility Type	Schizophrenia		Dementia		Mood Disorders		All Diagnoses	
	N[a]	Mean (min.)	N	Mean (min.)	N	Mean (min.)	N	Mean (min.)
Private Hospital[b]	461	292	184	407	465	323	1,302	319
DPU[c]	902	375*	457	541**	1,088	464***	2,560	443**
Ratio: DPU/Hospital		1.28		1.33		1.44		1.39

Note:
Mean RN-equivalent staffing minutes per patient day, weighted by patient day sampling proportions. *p < 0.10; **p < 0.05; ***p < 0.01.
T-test of DPU mean against private hospitals.

Definitions:
N = Number of patient days.
Private hospital excludes public county and state mental institutions.
DPU = Medicare certified acute general hospital Distinct Part Unit.

Source: Primary survey of 40 U.S. psychiatric facilities, 2001 – 2003.

J. CROMWELL *ET AL.*

Table 7. Medicare Routine Part A Daily Resource Intensity (RI) Models: 16-group Case Mix Classification Effects

Case Mix Group	Dependent Variable			
	Ln (RC$_f$)	Ln (RC$_f$ · RI$_p$)	Ln (RC$_f$ · R$_p$ + A$_p$)	Ln (RC$_f$ + A$_p$)
1. Schizo; HiADL; Age > 65; HiMed	0.026	0.840***	0.852***	0.047
2. Schizo; Age > 65 (HiADL; LoMed or LoADL; HiDanger)	0.103	0.200**	0.173***	0.091
3. Schizo; LoADL; Age > 65; LoDanger	0.017	0.108	0.129*	0.045
4. Schizo; LoADL; Age < 65; HiPsy	−0.137**	0.053	0.062	−0.100***
5. Schizo; Age < 65 (LoADL; LoPsy or HiADL)	(REF)	(REF)	(REF)	(REF)
6. Dementia; HiADL; HiMed	0.092*	0.545***	0.541***	0.156**
7. Dementia; LoADL; LoMed	0.015	0.161**	0.141*	0.015
8. Dementia; All Others	0.097**	0.418***	0.375***	0.088*
9. Mood; Age > 65; HiPsy; HiMed	0.109*	0.293***	0.506***	0.319***
10. Mood; Age > 65; HiPsy; LoMed; HiDanger	0.071	0.320***	0.404***	0.192**
11. Mood; LoMed; OnECT (Age < 65 or Age > 65; HiPsy; LoDanger)	0.147**	0.270**	0.486***	0.348***
12. Mood; All Others	0.041	0.163***	0.166***	0.059
13. Mood; Age < 65; LoMed; NoECT; NoDetox	0.011	0.050	0.089*	0.050
14. Residual	0.043	0.324***	0.304***	0.060
15. Substance-Related; HiDanger	0.172**	0.076	0.253	0.300*
16. Substance-Related; LoDanger	0.121	0.004	0.010	0.106
Adj. R^2	0.518	0.317	0.390	0.586
N	3,346	3,346	3,346	3,346

Note:
Standard errors are adjusted for complex sample design. *p < 0.10; **p < 0.05; ***p < 0.01. Group 5 Reference group. Holding day-of-stay and facility characteristics constant. RC$_f$ = single facility-wide routine cost; RI$_p$ = patient's own daily routine intensity index; A$_p$ = patient's own average daily ancillary costs. HiADL = at least 2 deficits; HiMed = at lease one severe medical condition; Hi Danger = combative or suicidal; HiPsy = at least one severe psychiatric condition. Ln (X) = Natural log of variable X.

Source: Primary survey and merged claims data from 40 U.S. inpatient psychiatric facilities, 2001-2003.

Table 8. Medicare Routine Part A Daily Resource Intensity Models: Day-of-Stay Effects

Day of Stay	Dependent Variable			
	Ln (RC$_f$)	Ln (RC$_f$ · RI$_p$)	Ln (RC$_f$ · RI$_p$ + A$_p$)	Ln (RC$_f$ + A$_p$)
Day 1[a]	0.028	−0.300***	−0.145**	0.080***
Day 2	0.025	0.163***	0.188***	0.069***
Day 3-5	0.015	0.097**	0.128***	0.057**
Day 6-7	0.000	−0.003	0.040	0.037
Day 8-14	−0.011	0.012	0.033	0.006
Day 15 +	(REF)	(REF)	(REF)	(REF)

Note:
Standard errors are adjusted for complex sample design. *p < 0.10; **p < 0.05; ***p < 0.01. Day 15 + Reference group.
Holding case mix and facility characteristics constant. RC$_f$ = single facility-wide routine cost; RI$_p$ = patient's own daily routine intensity index; A$_p$ = patient's own average daily ancillary costs. Ln (X) = Natural log of variable X.

[a] Involves less than 24 hours of inpatient care.

Source: Primary survey and merged claims data from 40 U.S. inpatient psychiatric facilities, 2001-2003.

Table 9. Medicare Routine Part A Resource Intensity Models: Facility Effects

	Dependent Variable			
	Ln (RC$_f$)	Ln (RC$_f$ · RI$_p$)	Ln (RC$_f$ · RI$_p$ + A$_p$)	Ln (RC$_f$ + A$_p$)
Rural Hospital	−0.113	−0.070	−0.134	−0.161
Ln (Wage Index)	0.701**	0.555*	0.341	0.492*
Ln (IRADC if FTE > 1)[a]	0.773***	0.876***	1.127***	0.995***
Ln (SSI Ratio)[b]	−0.145***	−0.064	−0.051	−0.129***
Ln (Occupancy)[c]	−0.261	−0.153	−0.024	−0.140
Ln (ADC)	−0.121**	−0.125***	−0.156***	−0.145***
Public Hospital	0.044	0.077	−0.047	−0.071
Private Hospital	−0.116	−0.038	−0.043	−0.115
Urban DPU	(REF)	(REF)	(REF)	(REF)

Note:
Standard errors are adjusted for complex sample design. *p < 0.10; **p < 0.05; ***p < 0.01. Urban DPU reference group. Holding day-of-stay and case-mix characteristics constant. RC$_f$ = single facility-wide routine cost; RI$_p$ = patient's own daily routine intensity index; A$_p$ = patient's own average daily ancillary costs. Ln (X) = Natural log of variable X.

[a] IRADC for FTE>1 = intern/resident to ADC ratio for sites with at least 1 full-time-equivalent resident in psychiatric unit.
[b] SSI Ratio = facility share of Medicaid plus Medicare SSI eligibles.
[c] ADC = facility average daily psychiatric census.

Source: Primary survey and claims data from 40 U.S. inpatient psychiatric facilities, 2001-2003.

elderly schizophrenia patients with both high medical and ADL severity (group 1) appear no different than the costs of younger schizophrenia patients with low ADL deficits and psychiatric severity (reference group) when using facility-specific constant routine costs. After adjusting per diem costs by each patient's own daily intensity index, however, these severely ill patients are found to be 2.3 times more intensive ($e^{0.84}$). Similar dramatic compression occurs for group 6 dementia patients with high ADL and medical severity (72 percent versus 9.6 percent more costly); for group 10 elderly mood patients with high psychiatric severity or dangerousness (34 versus 12 percent more costly); and all group 14 residual diagnosis patients (38 versus 4 percent more costly).

Adding a fixed amount of daily ancillary costs to a patient's own routine costs (see column 3) has little effect on most coefficients in column (2). This is expected given the relatively minor ancillary services (e.g., lab tests, x-rays) used by most psychiatric patients. Two notable differences occur in mood disorder patients who are either elderly with high psychiatric and medical severity (group 9) or who receive ECT (group 11). Including ancillary costs for these patients raises their relative costliness from roughly 32 percent ($e^{0.293}$, $e^{0.27}$) to 65 percent ($e^{0.506}$, $e^{0.486}$), a substantial decompression.

The fourth column that adds patient-specific ancillary costs to a constant facility per diem is the typical equation estimated using claims-based costing methods (as reported in CMS' NPRM[6] and by the APA[8]). Adding ancillary costs decompresses the column 1 coefficients for the most severe dementia group 6 as well as the first three mood disorder groups 9 -11 and for dangerous substance-related disorders (group 15). Nevertheless, compared to column 3, adding

ancillary costs to a constant per diem fails to identify, statistically, the three more costly schizophrenia and residual groups, and still seriously understates cost differences for many other groups.

It is also worth noting the differential cost effects of certain patient characteristics on routine costs alone (column 2) or including ancillary costs (column 3). Groups with ''HiMed'' severity are considerably more costly: schizophrenia groups 1 (134 percent) versus 2 (19 percent); and dementia groups 6 (72 percent) versus 7 (15 percent).

Table 8 compares the same four models with respect to day-of-stay effects holding the explanatory variables in **Table 7** and **Table 9** constant. Coefficients in column 1 show no significant cost differences across a patient's stay. By contrast, day 1 routine costliness is 26 percent less ($1 - e^{-0.3}$) in column 2 compared with an inpatient day after two weeks. Lower cost is the result of a patient's admission day involving less than 24 hours of care on the unit. Conversely, day 2 is 18 percent more costly on average ($e^{0.163}$) and days $3 - 5$ are 10 percent more costly ($e^{0.097}$). After day 5, routine costliness does not appear to decline further. Adding a constant pro-rata amount of ancillary costs (column 3) apparently raises the costs of days 1 through 14 relative to later days, which supports the hypothesis that ancillary services are more intensive early in a patient's stay. Adding ancillary costs to a facility-wide routine per diem cost (column 4) decompresses daily costs for days 1 through 5 compared with column 1. Even so, the coefficients in column 4, ignoring truncated day 1, are 55-63 percent less (0.069/ 0.188; 0.057/0.128) than those in column 3 based on a patient-specific routine cost estimate.

As expected, several facility-level characteristics are quite significant in explaining routine costs using a constant

24

J. CROMWELL *ET AL.*

facility-wide per diem (column 1, **Table 9**). The teaching coefficient (0.773) is considerably higher than currently used in Medicare's medical/surgical PPS (0.409). The SSI ratio is negative implying less costly care per day in facilities with higher shares of poor patients. The negative ADC coefficient implies 12 percent lower costs per day in facilities with twice the average daily psychiatric census.

With the exception of the SSI ratio, facility-level effects are not particularly sensitive to converting facility to patient-specific routine costliness (in column 2). The teaching coefficient is slightly higher implying a greater divergence in intensity across patients in these facilities compared with non-teaching facilities. Further adjusting for ancillary use (column 3) raises the teaching effect considerably, implying greater daily ancillary, as well as routine, intensity in teaching hospitals.

Controlling for case mix, day-of-stay, and other facility characteristics, no statistical differences are found for either public or private psychiatric hospitals compared with DPUs in any of the models.

Discussion

In this paper, we have shown that claims-based costing methods have several key limitations for establishing an efficient and equitable payment system for psychiatric inpatients. First, administrative claims do not capture a few salient cost drivers such as ADL deficits and dangerous patient behaviors on the units. Moreover, based partly on our finding that ECT care is 60 percent more costly and partly on its own research, CMS agreed to make an explicit payment adjustment for ECT in its final payment rate.[7]

Second, claims-based methods using a single, facility-wide, estimate of daily routine cost artificially compress (narrow) the range of case mix costliness often by a factor of two or more. Consequently, very staffing-intensive patients are underpaid and vice-versa for less intensive patients. Adding ancillary costs to facility-wide routine per diems only marginally decompresses cost differences except for mood patients with severe psychiatric and medical diagnoses or undergoing ECT.

Third, day-of-stay cost differences are similarly compressed. Incorporating patient-specific routine intensity differences decompresses day-of-stay estimates by 50 percent or more during the first week of a stay. Consequently, estimated day-to-day differences that have been found using claims-based costing derive solely from ancillary use differences and any other unique, unmeasured, case mix characteristics of very short versus long-stay patients.

Fourth, while our sample of 40 facilities is not strictly representative of all facility subgroups, the results suggest that teaching status may have an even stronger cost impact in treating psychiatric inpatients than among medical and surgical patients. Again, failure to quantify within-facility patient daily routine cost differences may compress any estimates of teaching effects, albeit only slightly. Null findings regarding facility type imply no serious bias by facility ownership using a claims-based costing approach–as long as case-mix and other factors (e.g., size, teaching) are included.

Fifth, the interpretation of any model's explanatory power, or R^2, is materially affected by how finely routine costs are measured. Claims-based costing methods suffer from aggregation bias that produces inflated statistics of a model's explanatory power. As a direct consequence, a disproportionate explanatory weight is given to facility rather than patient characteristics. Uncommon, yet intensive, patient subgroups may add little to a claims-based model's explanatory power and be overlooked for higher payments.

Sixth, the assumption of a single all-patient per diem routine cost masks the fact that Medicare patients are 12.5 percent more staffing intensive than non-Medicare patients on average. This differential, though, does not account for possible case mix differences between the two eligibility groups.

An immediate policy implication of this research is that any psychiatric payment system based on claims-based costing methods will overpay for some case mix groups and underpay for others due to patient-level compression bias. How much compression occurs will depend upon the correlation of any particular case mix classification with actual, patient-specific, daily routine intensity. Because of their inherently high level of aggregation, the psychiatric DRGs will suffer less compression from claims-based costing than one capable of ''picking up'' true routine cost differences, say, using ADL deficits and dangerous behaviors. Claims-based costing using DRGs apparently results in double compression, once by grouping 85-90 percent of patients in two DRGs (429 and 430) with just two payment rates, and again by ignoring within-facility cost differences that could help identify costly subgroups. Substantial underpayment within broad DRGs can be ameliorated somewhat by age and medical comorbidity adjustments as well as through an outlier policy–as was proposed by CMS. Unfortunately, any outlier policy is subject to abuse and would still generally underpay for high routine cost patients because their daily routine costliness, when compared to the outlier threshold, is based on a (lower) facility-wide average. Conversely, outlier overpayments might occur for patients treated in facilities with extraordinarily rich routine staffing that automatically increases their outlier frequencies and payments.

The fact that ADL deficits and patient dangerousness, as well as ECT use, add materially to routine costs implies that existing administrative data systems need to be expanded to collect and pay on a few additional patient characteristics. When interacted with DSM-IV diagnostic groups and patient age, these characteristics produce a payment system analogous to the fully interacted DRG system for medical and surgical inpatients.

While the main focus of the paper concerns the compression of case-mix payment weights when relying on just administrative data, we note serious issues of validation that must be addressed before a final set of payment categories is used. For example, psychiatric severity was identified, in part, using the fifth digit of the ICD-9-CM code. To avoid ''gaming'' of the system to maximize revenues, providers and medical records auditors would need clear instructions about how to code ''severe'' cases. The same is true of ADL deficits and dangerous behaviors. It was encouraging that many ''difficult-to-validate'' or ''gameable'' measures such as

commitment status, medications counts, and cognitive impairment were dominated by more objective measures (e.g., patient age) in explaining cost differences.

To promote more equitable and efficient payment rates for inpatient psychiatric care, Medicare policy makers could use the relative case-mix weights implied in **Table 7** (column 3) until primary staffing data were reported from all providers using an assessment tool. Alternatively, policy makers, for billing purposes, could establish 2-3 unit staffing levels analogous to medical-surgical ICUs. Providers would then bill according to how intensive a unit a patient was treated in with the costs then linked to diagnostic and behavioral characteristics reported separately. Because the resulting cost weights would be expressed in relative terms and the system implemented on a ''budget neutral'' basis, no strong bias exists for providers to establish ''psychiatric ICUs'' as long as Medicare promulgates staffing and service minimums for such units.

Finally, higher-than-average Medicare routine intensity, if true, implies a systematic understatement in any standardized payment amount derived from claims-based costing. Adjusting costs by a facility-specific Medicare case mix index when calculating an industry-wide standardized amount, as done by CMS, would not fully redress the problem if the severity of non-Medicare cases differs within facilities. The exact bias is unknown because our data set lacked corresponding patient characteristics on the non-Medicare population. The government should fund another primary study to collect non-Medicare case-mix indicators and test whether Medicare patients are truly more costly per day.

APPENDIX

Appendix Table A-1. Psychiatric Severity Measures

Diagnoses		Patient Day Count	Part A Mean Resource Intensity
Severe Psychiatric Diagnoses			
307.50	Eating d/o NOS	7	559
307.10	Anorexia nervosa	14	557
780.09	Delirium	23	554
290.11	Early Onset Alzheimer's dementia w/ delirium	16	538
312.34	Intermittent explosive d/o	22	509
294.11	Dementia due to gen med. cond. w/agitation	106	494
293.00	Delirium due to general medical condition	48	485
296.64	Bipolar I mixed, severe w/psychotic features	29	475
298.90	Psychosis NOS	204	464
296.24	Major depression, single, severe w/psychotic features	88	447
296.23	Major depression, single, severe w/o psychotic features	56	429
296.33	Major depression, recurrent, severe w/o psychotic features	333	423
296.54	Bipolar I depression, severe w/psychotic features	64	415
296.34	Major depression, recurrent, severe w/psychotic features	307	407
292.81	Drug intoxication delirium	7	401
309.81	Posttraumatic stress d/o	173	394
318.10	Severe mental retardation	6	386
299.80	Pervasive developmental disorder NOS	15	385
312.30	Impulse control d/o NOS	20	384
301.83	Borderline personality d/o	147	372
296.63	Bipolar I mixed, severe w/o psychotic features	24	352
307.51	Bulemia nervosa	19	340
296.44	Bipolar I manic, severe w/psychotic features	87	330
296.43	Bipolar I manic, severe w/o psychotic features	11	324
296.53	Bipolar depression, severe w/o psychotic features	30	322
290.30	Alzheimer's dementia, late onset with delirium	NS	
318.20	Profound mental retardation	NS	
Excluded Diagnoses			
303.90	Alcohol dependence	50	315
304.00	Drug dependence (non-alcohol)	5	315
296.42	Bipolar I d/o, manic, moderate	14	297

Note:
Overall Mean Part A (imputed) = 392.4 (Table 9-2) with 4,149 Medicare patient days.
NS = Not found in sample but should be considered severe.

Source: Primary survey of 40 U.S. psychiatric facilities, 2001-2003.

Appendix Table A-2. Medical Severity Measures

ICD-9-CM	
Code	Text
042	AIDS
38.93	Venous catheterization, nec
86.06	Insertion of totally implantable infusion pump
153	Colon cancer
174	Breast cancer
185	Prostate cancer
250.X1*	Insulin-dependent diabetes mellitus, Type 1, not stated as uncontrolled
250.X3*	Insulin-dependent diabetes mellitus, Type 1, uncontrolled
333.92	Neuroleptic malignant syndrome
345.1	Generalized convulsive epilepsy
369.01	Bilateral blindness
428	Heart failure
436	Stroke, cva
496	COPD nec
572.2	End stage liver disease
585	End stage renal disease
586	Chronic renal failure
780.03	Convulsions
780.39	Seizure d/o, history of seizures
803.4	Unqualified skull fractures; closed with intracranial injury of other and unspecified nature
854	Intracranial injury of other and unspecified nature
891.1	Chronic wound non-healing
950.9	Bilateral blindness, secondary to trauma
V09.XX*	Drug resistant infectious diseases
V12.59	History stroke, cva
E950-958*	Self-inflicted injury codes; inclusive of codes which describe some cases found in study
E950.5	Suicide and self-inflicted poisoning by solid or liquid substances
E953	Suicide and self-inflicted injury by hanging, strangulation, and suffocation
E956	Suicide and self-inflicted injury by cutting and piercing instrument

Note:

* Includes some codes not found in sample but considered severe.

All codes are from the ICD-9-CM, 2001.

X indicates all options within that digit space.

References

1. Frank RG, Lave JR. Per case prospective payment for psychiatric inpatients: an assessment and alternatives. *J Health Polit Policy Law* 1986; **11**(1): 83-96.
2. Lave JR. Developing a Medicare prospective payment system for inpatient psychiatric care. *Health Aff* 2003; **22**(5): 97-109.
3. Cromwell J, Harrow B, McGuire TG, Ellis RP. Medicare payment for psychiatric facilities: unfair and inefficient. *Health Aff* 1991; **10**(2): 124-134.
4. Balanced Budget Refinement Act of 1999, Pub. L. No. 106-113, 113 Stat. 1501 (Nov. 29, 1999).
5. Liu CF, Cromwell J (Health Economics Research, Inc., Waltham, MA). *Impact of the Balanced Budget Act of 1997 on PPS-Exempt Psychiatric Facilities*. Final Report. Washington (DC): National Association of Psychiatric Health Systems; 1998 March 6.
6. Centers for Medicare and Medicaid Services. *Medicare program; prospective payment system for inpatient psychiatric facilities; proposed rule*. Federal Register 2003 Nov. 28; 68(229): 66920-66978.
7. Center for Medicare and Medicaid Services. *Medicare program; prospective payment system for psychiatric facilities; final rule*. Federal Register 2004 November.
8. American Psychiatric Association. *Inpatient psychiatric prospective payment system*. Unpublished manuscript; December, 2001.
9. Taube CA, Goldman HH, Lee ES. Use of specialty psychiatric settings in constructing DRGs. *Arch Gen Psychiatry* 1988; **45**: 1037-1040.
10. Cromwell J, Gage BJ, Drozd EM, Maier J, Osber DS, Richter EM, Goldman HH (RTI International, Waltham, MA): *Psychiatric Inpatient Routine Cost Analysis*. Final Report. Baltimore (MD): Centers for Medicare & Medicaid Services; 2003 Dec. 2. Contract No.: 500-95-0058(13).
11. English JT, Sharfstein SS, Scherl DJ, Astrachan B, Muszynski IL. Diagnosis-related groups and general hospital psychiatry: The APA study. *Am J Psychiatry* 1986; **143**(2): 131-139.
12. Mitchell JB, Dickey B, Liptzen B, Sederer LI. Bringing psychiatric patients into the Medicare Prospective Payment System: Alternatives to DRGs. *Am J Psychiatry* 1987; **144**(5): 610-615.
13. Freiman MP, Mitchell JB, Rosenbach ML. Simulating policy options for psychiatric care in general hospitals under Medicare's PPS. *Arch Gen Psychiatry* 1988; **45**: 1032-1036.
14. Ashcraft MLF, Fries BE, Nerenz DR, Falcon SP, Srivastava SV, Lee CZ, Berki SE, Errera P. A psychiatric patient classification system: an alternative to Diagnosis-Related Groups. *Med Care* 1989; **27**(5): 543-554.

15. Fries BE, Nerenz DR, Falcon SP, Ashcraft MLF, Lee CZ. A classification system for long-staying psychiatric patients. *Med Care* 1990; **28**(4): 311-323.
16. Sullivan G, Jinnett KJ, Mukhesjee S, Henderson KL. How mental health providers spend their time: A survey of 10 VA administration mental health services. *J Ment Health Policy Econ* 2003; **6**:89-97.
17. Hirdes JP, Smith TF, Rabinowitz T, Yamauchi K, Perez E. Telegdi NC, Prendergast P, Morris JN, Ikegami N, Phillips CD, Fries BE. The Resident Assessment Instrument-Mental Health (RAI-MH): Inter-Rater Reliability and Convergent Validity. *J Behav Health Serv Res* 2002; **29**(4):419-432.
18. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed. Washington, DC: APA Publisher; 1994.
19. Lawton MP, Brody EM. Assessment of Older People: Self-maintaining and Instrumental Activities of Daily Living. *Gerontologist 1969*; **9**(3):179-186.
20. Katz S, Ford AB, Moskowitz RW, Jackson BA, Jaffe MW. Studies of Illness in the Aged. The Index of ADL: A Standardized Measure of Biological and Psychosocial Function. *JAMA* 1963*; **195**: 914-919.
21. Breiman L, Friedmen J, Olshen R, Stone C. *Classification and Regression Trees*. Boca Raton, FL: Chapman and Hall/CRC, 1984.
22. Steinberg D, Colla P. *CART-Classification and Regression Trees*. San Diego, CA: Salford Systems; 1997.
23. Ellis RP, McGuire TG. Hospital response to prospective payment: cost sharing and supply. *J Health Econ* 1986; **5**(2): 129-151.
24. Fuller WA: Regression analysis for sample surveys. *Sankhya* 1975; **37**(3) Series C: 117-132.