Technical Report: Medicare Program Inpatient Psychiatric Facilities Prospective Payment System: A Review of the Payment Adjustments

Prepared for: Centers for Medicare & Medicaid Services (CMS), Department of Health and Human Services
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Acronyms

This report uses many terms referred to by acronym. We have listed below the acronyms used and their corresponding meaning, in alphabetical order.

BBRA	Balanced Budget Refinement Act
CAH	Critical Access Hospital
CMS	Centers for Medicare and Medicaid Services
COLA	Cost of Living Adjustment
CY	Calendar year
DSH	Disproportionate Share Hospital
ECT	Electroconvulsive Therapy
ED	Emergency Department
FTE	Full-time equivalent
FY	Fiscal year
ICD-10	International Classification of Diseases, 10th Revision
IPF	Inpatient Psychiatric Facility
IPPS	Inpatient Prospective Payment System
LIP	Low Income Patient
MS-DRG	Medicare Severity Diagnosis Related Group
PSF	Provider Specific File
POS	Provider of Services
PPS	Prospective payment system
SSI	Supplemental Security Income

EXECUTIVE SUMMARY

Background and Purpose

The Balanced Budget Refinement Act (BBRA) of 1999 required the Centers for Medicare & Medicaid Services (CMS) to establish a per day prospective payment system (PPS) for inpatient hospital services furnished in psychiatric hospitals and psychiatric units in acute care hospitals. This PPS would include an adequate patient classification system reflecting the differences in patient resource uses and costs among such hospitals. The Inpatient Psychiatric Facility (IPF) PPS was effective for cost reporting periods beginning on or after January 1, 2005. It was transitioned over three years and became fully implemented in 2008.

The IPF PPS pays a per diem base rate that accounts for costs associated with furnishing inpatient hospital and psychiatric services, including routine, ancillary, and capital-related costs. The base rate is adjusted to account for patient and facility characteristics that contribute to higher costs per day, including Medicare Severity Diagnosis Related Group (MS-DRG) assignment, comorbidities, age, length of the stay (LOS), geographic wage area, rural location, teaching status, cost of living adjustment (COLA) factors for IPFs located in Alaska and Hawaii, and the presence of a full-service emergency department (ED). Additional IPF PPS payments include, when applicable, an outlier payment and a per treatment payment for electroconvulsive therapy (ECT) treatments. CMS annually updates the IPF PPS base rate to account for cost inflation.

The IPF PPS uses the patient level and facility level adjustment factors derived from the original regression model. This report studies potential changes to the payment adjustments when using the most recently available data and reassesses important aspects of the IPF PPS payment regression model. These analyses are intended to support the continued accuracy of the payment system and properly account for variation in patient costs.

Methods and Approach

The IPF PPS model is based on a regression analysis reflecting the impact of various independent variables on the dependent variable, which is per diem cost. Some of the independent variables are used by the IPF PPS to adjust payments, and others are included in the model as control variables.

The team created an updated regression analysis that incorporated the most recently available IPF claims and cost data. The updated regression analysis for this report was derived from calendar year (CY) 2018 MedPAR claims, hospital cost reports, and various other publicly available data sources. Working collaboratively with CMS, the regression analyzed whether the patient level and facility level adjustments continue to be statistically significant in mitigating cost differences.

We updated the original regression model with CY 2018 claims and evaluated potential additions and changes to the model based on recent trends in the delivery of inpatient psychiatric care. We simulated IPF PPS payments using FY 2019 MedPAR claims data in order to understand the potential payment impacts of changes to the existing IPF PPS adjustment factors and the addition of a hypothetical disproportionate share hospital (DSH) payment adjustment.

Highlights and Findings

Overall, the updated regression estimates for both the patient level and facility level adjustments remained similar to the current model, though some MS-DRGs and comorbidities were found to be not statistically significant. The age adjustment showed slight variation among the factors, with less variation in costs from younger-to-older age groups than the currently implemented adjustment factors. The analysis indicated updating the age category groupings, combining ages 45 to 49 and 50 to 54 into one grouping, 45 to 54, and consolidating age groupings 70 to 74 and 75 to 79 into one grouping, 70 to 79. In addition, 12 new infectious disease ICD-10 codes added to the comorbidity adjustment grouping for infectious diseases resulted in a decrease in the infectious disease comorbidity adjustment factor from 1.07 to 1.02.

Other highlights include the adjustment for the comorbidity category of oncology treatment, which changed from the adjustment factor of 1.07 to 1.51 with the updated analysis. In addition, the variable per diem adjustment coefficients increased for lengths of stays less than 10 days, relative to the base 10-day LOS. The updated coefficient for care in a rural facility was meaningful, declining from the currently implemented 1.17 to 1.11. Finally, the updated regression analysis showed little variation in the adjustment factors for the MS-DRG categories, but there were a few changes to the MS-DRGs themselves due to coding changes over the years.

The impact simulations indicate that there would be significant potential changes to payments if the IPF PPS adjustment factors were updated based on the updated regression coefficients from this report. The greatest potential increase to payments would be for IPFs with more than 30% intern and resident full-time equivalents (FTE) to beds in training at the facility, which would experience an estimated 17.75% increase in payments. The impact simulations also indicate that payments for rural IPFs would decrease by 5.29% due to updating the adjustment factors, and that the potential addition of a DSH payment adjustment would increase payments to rural IPFs by 0.31 %.

INTRODUCTION

The Balanced Budget Refinement Act (BBRA) of 1999 required the Centers for Medicare & Medicaid Services (CMS) to establish a per day prospective payment system (PPS) for inpatient hospital services furnished in psychiatric hospitals and psychiatric units in acute care hospitals. The new payment approach, designed to replace the previous 'reasonable cost' based payment system, was established by CMS on November 15, 2004 as the Inpatient Psychiatric Facilities Prospective Payment System (IPF PPS) through a final rule in the Federal Register (69 FR 66922).

The IPF PPS rolled out over a three-year period beginning in January 2005 and reached full implementation in 2008. The PPS provides payments adjusted for patient and facility characteristics associated with varying costs. CMS annually updates the IPF PPS national base rate to account for cost inflation, however, the payment regression and associated adjustment factors have not been updated since implementation.

For the development of this report, The Bizzell Group assisted CMS with reassessing and refining aspects of the regression model using the most recently available data. To better understand IPFs and the beneficiary populations served, the team examined ways to increase the accuracy of the payment system so that adjustments sufficiently accounted for variation in patient cost. In recent years, differences in costs have been observed across IPFs by facility type, ownership type, rurality, and case mix. This report discusses several studies that were undertaken to better understand these cost differences.

The team reexamined the regression specifications along with the currently implemented application of patient level and facility level adjustments, including adjustments derived from the regression as well as non-regression derived adjustments, including patients who receive electroconvulsive therapy (ECT), patient admitted through the hospital's emergency department (ED), and the outlier adjustment. To proportionally represent facility types and ownership types that were excluded from original estimates due to missing or aberrant data, we have weighted the regression model. The impact analysis uses refined and updated regression coefficients to produce estimated payment impacts to providers by facility type, bed size and teaching status. The following sections detail these topics and include updated regression estimates and payment impacts performed in conjunction with this report.

The IPF PPS Payment Model

As required by section 124 of the BBRA, a federal payment system was developed to calculate a standardized per diem payment rate to be paid to IPFs. This payment is derived from the national average daily routine operating, ancillary, and capital costs for each patient day of psychiatric care spent in an IPF, adjusted for budget neutrality. The Federal per diem payment is comprised of a base rate adjusted by factors for patient and facility characteristics that account for variation in patient resource use. The Federal per diem base rate is updated to the midpoint of the first year under the IPF PPS and standardized to account for the overall positive effects of the IPF PPS payment adjustments. Under the IPF PPS, the Federal per diem base rate includes all costs for a patient in the IPF, including inpatient operating and capital-related costs (routine and ancillary services). It excludes pass-through costs, such as bad debts and graduate medical education.

The November 2004 IPF PPS Final Rule established the IPF PPS, as required by section 124 of the BBRA and codified at 42 CFR part 412, subpart N.[1] The November 2004 IPF PPS Final Rule set forth the Federal per diem base rate for the implementation year (the 18-month period from January 1, 2005 through June 30, 2006), and provided payment for the inpatient operating and capital costs to IPFs for covered psychiatric services they furnish, i.e., routine, ancillary, and capital costs, but not costs of approved educational activities, bad debts, and other services or items that are outside the scope of the IPF PPS. Covered psychiatric services include services for which benefits are provided under the fee-for-service Part A (Hospital Insurance Program) of the Medicare program. A complete discussion of the regression analysis that established the IPF PPS adjustment factors can be found in the November 2004 IPF PPS Final Rule. In addition, the per diem base rate is adjusted by the applicable wage index factor and the patient level and facility level adjustments that are applicable to the stay over time. The patient level and facility level adjustments are described below.

Patient level:

- MS-DRG – Medicare Severity Diagnosis Related Grouping used to classify each type of Medicare discharge. On discharges on or after October 1, 2007, the IPF PPS provides adjustments for 17 designated MS-DRGs.
- Comorbidities – A comorbidity is a specific patient condition that is secondary to patient's principal diagnosis and that requires active treatment during the stay. IPFs receiving a grouping-specific adjustment for each of the 17 IPF PPS comorbidity groupings.
- Age – The IPF PPS has an age adjustment with 9 age categories; under 45, over 80, and categories in 5-year groupings in between. IPFs receive this adjustment for each day of the stay. The age adjustment is determined on the age at admission and does not change regardless of the length of stay.

- Variable per Diem – The variable per diem adjustments account for the ancillary and certain administrative costs that occur disproportionately in the first day after admission to an IPF. The variable per diem adjustment declines each day of the patient's stay through day 21. After day 21 the adjustment remains the same each day for the remainder of the stay.

- ECT – IPFs receive an additional payment for each ECT treatment provided during the IPF stay.

Facility level:

- Wage Index – The wage index accounts for the geographic differences in labor costs.

- Rural Location – A 17% adjustment is provided if a facility is located in a rural area.

- Teaching Adjustment – IPFs that train interns and residents receive a facility level adjustment to the Federal per diem base rate that is based on the ratio of interns and residents to the facility's average daily census.

- Cost of Living Adjustment (COLA) – The IPF PPS includes an adjustment for IPFs located in Alaska and Hawaii based on the area in which the IPF is located.

- ED Adjustment – A facility level adjustment is provided for IPFs that maintain a qualifying ED. (Note: The ED adjustment is not made where a patient is discharged from an acute care hospital or Critical Access Hospital (CAH) and admitted to the same hospital's or CAH's psychiatric unit.)

- Outlier Payments – Outlier payments are provided for cases incurring extraordinarily high costs. This was designed to protect IPFs from large financial losses due to unusually expensive cases.

During the IPF PPS 3-year transition period, stop-loss payments were also provided; however, since the transition ended as of January 1, 2008, these payments are no longer available.

The Patient Protection and Affordable Care Act of 2010 requires that any annual update to the IPF payment rates for rate years beginning in 2012 be reduced by an adjustment for productivity, and an "other adjustment" be applied for each rate year from 2010 through 2019 as follows: for each of the rate years beginning in 2010 and 2011, 0.25 percentage point; for each of the rate years beginning in 2012 and 2013, 0.1 percentage point; for the rate year beginning in 2014, 0.3 percentage point; for each of the rate years beginning in 2015 and 2016, 0.2 percentage point; and for each of the rate years beginning in 2017, 2018, and 2019, 0.75 percentage point. In addition, beginning in FY 2015, the annual update to the base payment amount is reduced by 2 percentage points for any IPF that fails to submit required quality data.[2]

METHODS

The following section outlines the data sources, variable creation, and data exclusions for this report.

Data Sources

The updated regression analysis was created to incorporate the most recently available data to use for refinements and payment impacts. The following data sources were used to construct the analysis:

MedPAR Claims Data - The MedPAR file contains inpatient hospital final action stay records. Each MedPAR record represents a stay in an inpatient hospital. Each record summarizes all services rendered to a beneficiary from the time of admission through discharge. Each MedPAR record may represent one claim or multiple claims, depending on the length of stay (LOS). The regression analysis utilized the 2018 MedPAR claims files. We specify in the sections below if other years were used for analyses.

Hospital Cost Report Data - Medicare-certified institutional providers are required to submit an annual cost report. The cost report contains provider information such as facility characteristics, utilization data, costs and charges by cost center (in total and for Medicare), Medicare settlement data, and financial statement data. CMS maintains the cost report data in the Healthcare Provider Cost Reporting Information System (HCRIS). The regression analysis utilized FY 2017 and FY 2018 hospital cost report files. We specify in the sections below if other years hospital cost report data was used.

Provider of Services File - The Provider of Services (POS) File contains data on characteristics of hospitals and other types of healthcare facilities, including the name and address of the facility and the type of Medicare services the facility provides, among other information. The publicly available file contains an individual record for each Medicare-approved provider and is updated quarterly. The regression analysis utilized the December 2018 POS Files. We indicate in the sections below if other years POS files were used.

Provider Specific Data for Public Use Files for the IPF PPS - The Medicare Administrative Contractor maintains the Provider Specific File (PSF). The file contains information about the facts specific to the provider that affect computations for the PPS. The regression analysis utilized the 2018 quarter four PSF.

Common Working File (CWF) Inpatient Claims Data - The Inpatient Claims File contains claims data submitted by inpatient hospital providers for reimbursement of facility costs. Some of the information contained in this file includes diagnosis, revenue center code, revenue center count, procedure code, dates of service, reimbursement amount, hospital provider, and beneficiary demographic information. The regression analysis used the CY 2018 CWF. If other years CWF files were used we indicate that in the sections below.

Regression Analysis Data Preparation

The stay-level analysis matched 2018 MedPAR records to facility level information from hospital cost reports, the POS files, and the PSF.

Data Restrictions and Exclusions

The total IPF population data was created using MedPAR stays meeting the following criteria were included:

- Hospital CMS Certification Number (CCN) containing "40", "41", "42", "43", or "44" in the third and fourth position or a special unit code of "S" or "M" for psychiatric unit or psychiatric unit in a critical access hospital
- Beneficiary primary payer code equal to "Z" or blank, where Medicare is the primary payer
- Group Health Organization (GHO) paid code equal to zero or blank, indicating that a GHO has not paid the facility for the stay
- National Claims History (NCH) claim type code equal to "60," an inpatient claim
- Providers matched the facility level information from IPF wage index, hospital cost reports, the POS file, and the PSF.

These criteria identified 1,635 IPF facilities in 2018. When then completed a series of trimming steps which are shown in Table 1. First, we matched facilities from the 2018 MedPAR subset to the FY 2018 cost report files, or the FY 2017 cost report file if a FY 2018 match did not occur. Of the 1,635 IPF facilities identified in 2018, 62.9% (1,028 / 1,635) had corresponding cost report records for FY 2018. The remaining 599 IPF facilities matched to FY 2017 cost report data files. This approach matched cost report data to 99.5% of IPF facilities (1,627 / 1,635). We excluded 8 IPF facilities without cost report records in either the 2018 or 2017 cost report files, resulting in a population of 1,627 (1,627=1,635-8) IPF facilities.

From the 1,627 facilities, 1,007 facilities had more than one cost report in the given year. In this case, we selected the cost report representing the longest time span to capture costs that most accurately represent the full calendar year. Since hospital cost reports may take several years to be settled, the team did not place any restrictions on the cost report status code within the IPF population. This step resulted in no impact to the number of facilities both in the stay and provider counts. The team utilized FY 2020 wage index[3] adjustment factors provided by CMS to apply facility-level wage adjustments. Core-Based Statistical Areas (CBSA) specific adjustment factors were matched to over 99.6% (1,620 / 1,627) of IPF facilities.

IPF facilities with outlier routine costs per day (+/- 3 standard deviations of mean log routine cost per day) and stays with outlier total per diem costs (+/- 3 standard deviations of mean cost per diem) were trimmed as well as stays of providers without a PSF or POS file. This step involved merging facility-level variables such as ownership type, CBSA code, urban/rural indictor, name and location to the 2018 POS file and merging COLA from the 2018 PSF file. These trimming steps yielded a 97.3% match rate (1,576 / 1,620) as presented below in Table 1.

The subsequent steps excluded stays from facilities where greater than or equal to 95% of stays had no ancillary charges. Such stays are removed due to the question of their validity and their lack of modeling utility. The final two trimming steps removed stays with non-listed DRGs and stays with missing values of regression values.

The series of trimming steps utilized in the exclusion criteria are outlined in Table 1. As a result of these steps, the free-standing facilities experienced significant trimming in comparison to the unit-based facilities. Trimming stays from facilities where greater than or equal to 95% of stays had no ancillary charges resulted in the largest impact in stay and provider counts with the greatest effects being seen in free-standing facilities. The extent of this missing data on ancillary cost creates a substantial risk of biasing the regression coefficients used for payment adjustments, thus we introduced weighting to the updated regression model to make the limited data sample more representative of the full set of IPFs. The weighting methodology is discussed in the following section.

Table 1: Trimming Steps for Stay and Provider Facilities Count

	Stay Count			Provider Count		
Trimming Step	**Freestanding**	**Unit-based**	**All Facilities**	**Freestanding**	**Unit-based**	**All Facilities**
Unrestricted IPF Population	152,546	211,534	364,080	553	1,082	1,635
Removed facilities without a cost report	152,135	211,534	363,669	545	1,082	1,627
Removed facilities without a wage index	151,830	211,454	363,284	541	1,079	1,620

	Stay Count			Provider Count		
Trimming Step	**Freestanding**	**Unit-based**	**All Facilities**	**Freestanding**	**Unit-based**	**All Facilities**
Removed facilities without routine cost per day reported	151,830	211,454	363,284	541	1,079	1,620
Removed facilities with outlier routine costs per day (facilities with +/- 3 standard deviations of mean log routine cost per day)	151,271	209,176	360,447	534	1,057	1,591
Removed stays with outlier total per diem costs (stays with +/- 3 standard deviations of mean per diem cost by facility type)	149,550	208,427	357,977	523	1,056	1,579
Removed stays of provider without PSF or POS file	148,492	208,427	356,919	520	1,056	1,576
Removed stays from facilities where ≥95% of stays had no ancillary charges	67,054	207,862	274,916	217	1,052	1,269
Removed stays with non-listed MS-DRG	66,699	206,599	273,298	217	1,052	1,269
Removed stays with missing values of regression variables	66,699	205,743	272,442	217	1,041	1,258
Input for Regression (after all trimming steps)	**66,699**	**205,743**	**272,442**	**217**	**1,041**	**1,258**

Weighting

As previously explained, we excluded facilities that were found to have greater than or equal to 95% of stays having no associated ancillary charges and trimmed their corresponding stays. Studies showed that free-standing for-profit and free-standing government facilities were disproportionately excluded due to this trimming step, thus we increased the weight given to cases with missing data from these facility types. Without such adjustment, the sample would otherwise have been biased towards unit-based cases.

To obtain a weight for each facility type, we divided the number of stays in the full sample, including stays from facilities where greater than or equal to 95% of stays had no ancillary charges, by the number of cases in the limited regression sample. The CY 2018 regression weights are shown in Table 2.

Table 2: Construction of CY 2018 Weighted Regression Model

Facility Type	For-Profit	Government	Non-Profit
Freestanding – after removing stays of provider without PSF or POS file	103,181	11,779	33,532
Freestanding – after removing stays from facilities where ≥95% of stays had no ancillary charges	37,563	4,793	24,698
Freestanding – Weights	***2.747***	***2.458***	***1.358***
Units – after removing stays of provider without PSF or POS file	49,993	34,859	123,575
Units – after removing stays from facilities where ≥95% of stays had no ancillary charges	49,578	34,758	123,526
Units - Weights	***1.008***	***1.003***	***1.000***

Ownership types were classified into for-profit, government, and non-profit. Non-profit had the highest post-trim frequency recorded at 146,519 (53.8%) stays and government was reported with the least frequency at 39,185 (14.4%) stays as shown in Table 3

Table 3: Ownership Frequency

Ownership	Frequency of Stays	Percent (%) of Total Frequency
For Profit	86,738	31.84%
Government	39,185	14.38%
Non-Profit	146,519	53.78%

REGRESSION MODEL

The basic IPF PPS payment regression model follows the outline described in the FY 2004 Final Rule, using the formula:

$$log(per\ diem\ cost)_i = \alpha_0 + \alpha_{DRG} * DRG_i + \alpha_{Comorbidities} * Comorbidities_i + \alpha_{Age} * Age_i + \alpha_{day} * LOS_i + \alpha_{Rural} * Rural_i + \alpha_{Teaching} * log\ (Teaching)_i + \alpha_{Controls} * ControlVariables_{IPF,i} + \varepsilon_i$$

Where *i* indicates the stay, *DRG* is a vector of Diagnostic Related Group indicator variables, *Age* is a vector of beneficiary age categories, *LOS* is a vector of indicators based on the length (in days) of the stay, *Rural* is an indicator identifying if the facility is rural, *Teaching* is a continuous variable identifying if the facility is a teaching hospital, and *Control Variables* include the occupancy rate of the facility and an indicator variable taking the value of one if the patient had ECT, and zero otherwise. Control variables are used to account for variation in the dependent variable (per diem cost) that is associated with factors outside the adjustment factors of the payment model.

Variable Construction

Following the reassessment of the IPF PPS regression model, the following sections detail the refinements introduced as part of this report. Various refinements to the methods and model were implemented in the analysis to increase the accuracy of the payment system.

To smooth the dependent variable (the natural log of per diem costs), and retain a greater number of stays, we winsorized the distributions of the 17 ancillary cost centers on the cost report at the 2nd and 98th percentiles. If the cost-to-charge ratio was missing and there was a charge on the claim, the cost-to-charge ratio was imputed to the calculated median value for each respective cost center.

Regression estimates were produced using the updated regression analysis derived from 2018 MedPAR claims files. In addition to the changes to the MS-DRGs included in the model, coefficients changed meaningfully for several other MS-DRGs historically receiving an IPF PPS payment adjustment.

For this analysis, if a facility was found to have greater than or equal to 95% of stays containing no ancillary charges, stays from those facilities were trimmed from the analysis. Data from these facilities were incomplete and deemed inadequate to capture variation in costs.

Some exclusions that we applied to the regression analysis disproportionately removed certain types of facilities, therefore, we applied weights to proportionally represent facility types and ownership types in the payment regression. We assigned the highest weights to freestanding, for-profit, and government facilities, as these facilities were dropped in greater proportion during the trimming process.

Per Diem Cost Variable

The IPF PPS regression model uses the natural log of per diem costs as the dependent variable. Total per diem costs were calculated for each stay as the sum of routine costs per day and ancillary costs per day. Routine costs were derived from the IPF's cost report, and ancillary costs were the product of cost center cost-to-charge ratios from the cost report and ancillary department charges from the MedPAR stay record.

To address extreme cost-to-charge ratios, we winsorized the distributions of the 17 ancillary cost centers from Worksheet C of the cost report at the 2nd and 98th percentiles. If the cost-to-charge ratio was missing and there was a charge on the claim, the cost-to-charge ratio was imputed to the calculated median value for each respective cost center.

We adjusted the labor portion of the Federal per diem base rate with IPF wage index to account for geographic differences, and then adjusted the non-labor portion of the Federal per diem base rate by COLA to account for a higher COLA for IPFs in Alaska and Hawaii, using the formula:

Standardized cost = Cost / (wage index * laborshare + COLA*(1- laborshare))

Wage adjusted per diem cost = per diem cost / (wage index*laborshare + COLA*(1-laborshare)),

Finally, we obtained the COLA, wage index, and labor share values from PSF and FY 2020 IPF PPS Addendum A.

INDEPENDENT VARIABLES

The independent variables in the IPF PPS regression model include age, LOS, MS-DRG indicators, comorbidity flags, rural indicator, a continous teaching variable, occupancy rate, and an indicator for ECT treatment. We discuss findings related to patient level and facility level adjustments in the following section, as well as the inclusion of a disproportionate share hospital (DSH) variable as a possible new independent variable.

Patient level Adjustments

Adjustment for MS-DRG Assignment

The IPF PPS provides an adjustment for 17 designated MS-DRGs. MS-DRGs are used to group each Medicare discharge. The team examined the MS-DRGs included in the current payment model to determine if treatment patterns or the shift to ICD-10 coding necessitated changes in the current IPF PPS MS-DRG adjustments factors. The 17 MS-DRG groupings can be found in Table 4, below.

MS-DRGs 080 and 081 *Nontraumatic stupor and coma with and without major complication or comorbidity (MCC)* have historically received a payment adjustment under the IPF PPS but were excluded from the updated model and replaced with MS-DRGs 947 and 948 *Signs and symptoms with and without an MCC*. The exclusion was based on the finding that, after mapping the primary and closely related 2014 ICD-9 codes to the 2016 ICD-10 codes, it was found that the codes which defined MS-DRGs 080 and 081 are now commonly associated with the ICD codes contained in MS-DRGs 947 and 948. Our analysis showed that in CY 2018 there were 33 stays with MS-DRG 947 and 366 stays with MS-DRG 948, while there were zero stays with MS-DRG 080 and two stays with MS-DRG 081. Additionally, MS-DRGs 917 and 918 *Poisoning and toxic effects to drugs with and without MCC*, were added to the updated model given an increase in observed frequency within the IPF population. In the current 2018 MedPAR, we saw that MS-DRG 917 had a prevalence of 0.03% (70 stays) and MS-DRG 918 had a prevalence of 0.15% (402 stays). As with the current model, MS-DRG code 885 *Psychoses*, had the highest frequency of 196,336 stays (72.07%) as shown in Table 4. There were several MS-DRG codes with a frequency no higher than 0.7%.

The current and updated regression model use MS-DRG 885 *Psychoses* as the referent category. Table 4 shows that the regression coefficients changed meaningfully for several MS-DRGs between 2004 and 2018. The adjustment factor for MS-DRG 876 *O.R. procedure with principal diagnosis of mental illness* increased by 0.19 (15.57%). MS-DRG 887 *Other mental disorder diagnoses* increased 0.31 (33.70%). MS-DRGs 894 for *alcohol/drug abuse or dependence, left AMA* declined 0.10 (10.31%). MS-DRGs 895 for *alcohol/drug abuse or dependence w/rehabilitation therapy* declined 0.12 (11.76%). Although all MS-DRGs were statistically significant in the current regression model, note that some MS-DRGs were found to be not statistically different from zero in this updated model.

Table 4: MS-DRG Frequency and Adjustment Regression Results, CY 2018

MS-DRG Code	Description	Frequency	Percent % of Total Frequency§	Current Adjustment Factors	2018 Data Adjustment Factors	Sig. (.05)
056	Degenerative nervous system disorders w MCC	1,805	0.66%	1.05	1.10	*
057	Degenerative nervous system disorders w/o MCC	19,132	7.02%	1.05	1.04	*
876	O.R. procedure w principal diagnosis of mental illness	317	0.12%	1.22	1.41	*
880	Acute adjustment reaction & psychosocial dysfunction	2,713	1.00%	1.05	0.98	
881	Depressive neuroses	10,190	3.74%	0.99	1.06	*
882	Neuroses except depressive	3,813	1.40%	1.02	0.97	
883	Disorders of personality & impulse control	1,974	0.72%	1.02	1.10	*
884	Organic disturbances & mental retardation	22,576	8.29%	1.03	1.05	*
885	Psychoses (omitted)	196,336	72.07%	1.00	1.00	
886	Behavioral & developmental disorders	600	0.22%	0.99	1.00	
887	Other mental disorder diagnoses	139	0.05%	0.92	1.23	*
894	Alcohol/drug abuse or dependence, left AMA	596	0.22%	0.97	0.87	*

MS-DRG Code	Description	Frequency	Percent % of Total Frequency§	Current Adjustment Factors	2018 Data Adjustment Factors	Sig. (.05)
895	Alcohol/drug abuse or dependence w/rehabilitation therapy	1,379	0.51%	1.02	0.90	
896	Alcohol/drug abuse or dependence w/o rehabilitation therapy w MCC	341	0.13%	0.88	0.96	
897	Alcohol/drug abuse or dependence w/o rehabilitation therapy w/o MCC	9,660	3.55%	0.88	0.94	
917	Poisoning & toxic effects to drugs w MCC	70	0.03%	-	1.18	*
918	Poisoning & toxic effects to drugs w/o MCC	402	0.15%	-	1.07	*
947	Signs & symptoms w MCC	33	0.01%	1.07	1.09	
948	Signs & symptoms w/o MCC	366	0.13%	1.07	1.03	

§*The percent of total frequency represents the percent of stays with each MS-DRG out of the number of stays with any of the listed MS-DRGs.*

Comorbidities

Flags for comorbid conditions were created by grouping ICD-10 codes as outlined in the FY 2018 IPF comorbidity files provided by CMS. To identify oncology, we used the oncology diagnosis and procedure codes. As expected, stays with no comorbidities had the highest frequency recorded at 195,943 (71.92%), as shown in Table 5. Stays with 6 comorbidities had the least frequency of 1 (0.00%).

Table 5: Number of Comorbidity on Stay Frequency

Number of Comorbidities on a Stay	Frequency	Percent (%) of Total Frequency
0	195,943	71.92%
1	61,824	22.69%
2	12,656	4.65%
3	1,799	0.66%
4	206	0.08%
5	13	0.00%
6	1	0.00%

Eating and Conduct Disorder comorbidity

As shown in Table 8, the coefficient for the comorbidity category, eating and conduct disorder, decreased from 1.12 to 0.98 in the updated model. In order to understand this drop, we utilized MedPAR data from CY 2003 and CY 2018 and reviewed the billing patterns for this comorbidity including average per diem Medicare reimbursement and average per diem charge in CY 2003 and CY 2018. The study showed that the stay count and provider count of comorbidity eating and conduct disorder dropped in the unit-based setting, while they increased in the freestanding setting from CY 2003 to CY 2018.

Next, the billing patterns of eating disorder and conduct disorder were analyzed separately with the assumption that we would observe an increasing number of conduct disorder, which is less costly, and a decreasing number of eating disorder, which is more expensive. We observed that the number of stays of conduct disorder increased while the number of stays of eating disorder decreased between CY 2003 and CY 2018. According to the average per diem Medicare reimbursement and average per diem total charge within CY 2003 and CY 2018, the eating disorder is more expensive than the conduct disorder. To some extent, this could explain the drop of the comorbidity eating and conduct disorder factors.

As noted previously, the stay and provider count for comorbidity and eating disorder increased in the freestanding setting and decreased in the unit-based setting from CY 2003 to CY 2018. Freestanding facilities showed an increase of 626 stays from CY 2003 to CY 2018 while unit-based facilities saw a decrease of 567 stays. The billing pattern analysis showed that average charge per diem was lower in freestanding settings in both CY 2003 and CY 2018. The decrease in the regression factor may be attributed to the fact that more stays for this comorbidity are occurring in freestanding facilities where the average charge per diem is lower.

We also observed that the average length of stay for both eating disorder and conduct disorder increased significantly from CY 2003 to CY 2018 in all facility types. As a result, the average Medicare reimbursement per stay also increased with a large portion. The increased length of stay could be another reason why the per diem cost decreased.

Additional studies were conducted to evaluate changes to the existing comorbidity categories and the addition of new comorbidity categories. One study evaluated the infectious disease comorbidity category and the effects of potentially adding 14 ICD-10 codes into this category. Additional studies included evaluating the effects of the addition of two new comorbidity groupings for homelessness and pregnancy.

Infectious Disease Comorbidity study

The purpose of this study was to provide the average cost per diem for the infectious diseases category with the addition of new ICD-10 codes as part of an exploration of expanding the current regression coefficients. Regressions were also run to compare the updated model to the current IPF regression model. The new ICD-10 codes of interest for addition to the comorbidity category are shown in Table 6. The 2018 MedPAR data was utilized for this analysis.

Table 6: ICD-10 Codes Considered for Comorbidity Addition

ICD-10 Code	ICD-10 Code Description
A499	Bacterial infection, unspecified
B9561	Methicillin suscep staph infct causing dis classd elswhr
B9562	Methicillin resis staph infct causing diseases classd elswhr
B9620	Unsp Escherichia coli as the cause of diseases classd elswhr
B963	Hemophilus influenzae as the cause of diseases classd elswhr
B964	Proteus (mirabilis) (morganii) causing dis classd elswhr
B965	Pseudomonas (mallei) causing diseases classd elswhr
B966	Bacteroides fragilis as the cause of diseases classd elswhr
B9681	Helicobacter pylori as the cause of diseases classd elswhr
J150	Pneumonia due to Klebsiella pneumoniae
J158	Pneumonia due to other specified bacteria
J200	Acute bronchitis due to Mycoplasma pneumoniae
W5589XS	Other contact with other mammals, sequela
W5659XS	Other contact with other fish, sequela

A binary variable was created for the new ICD-10 codes of interest and added to the 7 currently used infectious disease codes (A4101, A4102, A4151, A413, A4152, A414, and A488), for comparison. The average and standard deviation of cost per diem by presence or absence of ICD codes was calculated as well as an Analysis of Variance (ANOVA) to test for group mean equivalence of cost per diem.

Of the new ICD-10 codes being reviewed for this study, B9620 had the highest prevalence of 0.84%. Code B964 had the second highest prevalence of 0.14%, and third was B9562 at 0.12%. All other codes, including the codes that are currently used in the infectious disease category, had <0.10% prevalence.

Of the new ICD-10 codes being considered for addition, stays with B9620 had a significantly (p-value <0.0001) higher mean cost per diem of $1,104.74 than those without which had a cost of $959.55. Similarly, stays with codes B964 and B9562 had significantly (p-value <0.0001) higher mean cost per diem of $1,119.64 and $1,107.24 compared to those without the codes ($960.55 and $960.60), respectively. All other newly added codes also had a higher mean cost per diem in stays that contained the codes, with significant differences observed in codes B9561, B965, B9681, and J150.

A regression was run with the additional ICD-10 codes and the results were compared to the current IPF regression model. The infectious disease comorbidity grouping with the additional ICD-10 codes had a regression factor of 1.02, which was a 4.85% decrease from the current IPF regression model.

Based on the findings of this study we have included 12 of the 14 ICD-10 codes shown in Table 6 to the final regression for the infectious disease comorbidity adjustment factor. The 2 excluded ICD-10 codes are: W5589XS and W5659XS.

Homelessness comorbidity study

For this analysis we utilized the 2018 MedPAR data to review the average cost per diem for the homelessness ICD-10 code (Z590) in the overall trimmed regression sample. We next reviewed the data by rurality and region and compared the costs of stays with and without the presence of homelessness. Regressions were also run to compare the factors of the model with the addition of a homelessness comorbidity grouping against the current IPF regression model.

The ICD-10 code for homelessness was present in 6.73% of the IPF population. Stays with Z590 (homelessness) had a significantly lower (p-value <0.0001) mean cost per diem of $1,045.34 which was $13.21 less costly than stays without which had a mean cost per diem of $1,058.55. In the current model with homelessness as an additional comorbidity, homelessness had a regression factor of 1.01, which had a wide confidence interval of [0.9746 - 1.0567].

Average costs were $139.58 and $87.31 more expensive in rural settings without and with homelessness, respectively. Costs were significantly different for presence of homelessness, rural, and the effect of homelessness was different by rural as well (interaction term was significant). Costs were most expensive in West North Central States ($1,166.94) without homelessness, and least expensive in West South Central States ($968.31) with homelessness. The range of costs in stays without homelessness was $187.42, and with homelessness was $171.12, implying that overall costs were less expensive by region with homelessness stays. Results of two-way ANOVA showed that costs were different by the main effects of homelessness and rural as well as the interaction between homelessness and rural.

Based on the findings of this analysis we have not included homelessness as a new comorbidity adjustment factor in the impact analysis.

Pregnancy comorbidity study

The IPF PPS does not include a comorbidity adjustment for pregnancy, however we conducted a study to investigate whether the data supports adding a new comorbidity grouping for pregnancy. We utilized CY 2016 through CY 2018 and FY 2019 MedPAR data, along with the CY 2015 through FY 2019 cost reports and looked at IPF stays with a non-principal diagnosis code within the following ICD-10 pregnancy related code groups (as shown in Table 7 below).

Table 7: ICD-10 Codes for Pregnancy Comorbidity Consideration

ICD-10 Code	ICD-10 Code Description
O00	Ectopic pregnancy
O010	Classical hydatidiform mole
O02	Other abnormal products of conception
O03	Spontaneous abortion
O031	Delayed or excessive hemor following incmpl spon abortion
O04	Complications following (induced) termination of pregnancy
O07	Failed attempted termination of pregnancy
O08	Complications following ectopic and molar pregnancy
O09	Supervision of high risk pregnancy
O10	Pre-existing hypertension compl preg/chldbrth
O21	Excessive vomiting in pregnancy
O22	Venous complications and hemorrhoids in pregnancy
O25	Malnutrition in pregnancy, childbirth and the puerperium
O34	Maternal care for abnormality of pelvic organs
O36	Maternal care for other fetal problems
O45	Premature separation of placenta [abruptio placentae]
O46	Antepartum hemorrhage, not elsewhere classified
O48	Late pregnancy
O62	Abnormalities of forces of labor
O63	Long labor
O64	Obstructed labor due to malposition and malpresent of fetus
O65	Obstructed labor due to maternal pelvic abnormality
O69	Labor and delivery complicated by umbilical cord comp
O70	Perineal laceration during delivery
O71	Other obstetric trauma
O72	Postpartum hemorrhage
O73	Retained placenta and membranes, without hemorrhage
O74	Complications of anesthesia during labor and delivery
O75	Oth complications of labor and delivery, NEC
O80	Encounter for full-term uncomplicated delivery
O85	Puerperal sepsis
O86	Other puerperal infections

ICD-10 Code	ICD-10 Code Description
O88	Obstetric embolism
O89	Complications of anesthesia during the puerperium
O90	Complications of the puerperium, not elsewhere classified
O91	Infect of breast assoc w pregnancy, the puerp and lactation
O92	Oth disord of brst/lactatn assoc w pregnancy and the puerp
O94	Sequelae of comp of pregnancy, chldbrth, and the puerperium
O99	Oth maternal diseases classd elsw but compl preg/chldbrth
O9A	Maternl malig or injury compl preg/childbrth
Z33	Pregnant state
Z34	Encounter for supervision of normal pregnancy
Z39	Encounter for maternal postpartum care and examination

For each of the above groups, we compared the average cost per diem for IPF stays that include a diagnosis code in the group to the average cost per diem of IPF stays without a diagnosis code in that group. We also examined the estimated outlier payments for each of the above code groups. Consistent with the construction of the regression model, we focused on stays in 2018.

In 2018, almost all pregnancy codes had no stay counts. Code group O99 (oth maternal diseases classd elsw but compl preg/chldbrth) had the highest number of stays (420) in CY 2018, which represented a 0.12% prevalence. Stays with this code were 1.06 times more expensive than stays without this code, but this result was not satistically significant. Code groups O09 (supervision of high risk pregnancy) and O90 (complications of the puerperium, not elsewhere classified) were present in 0.01% of the CY 2018 stays. The average cost per day for stays containing code O09 were 1.27 times greater than for stays without, which was significantly higher (p-value <0.05). The average cost per day for stays with code O90 were 0.89 times less expensive than stays without, which is not significant. Stays in other code groups listed accounted for 0.00% of the stay count for CY 2018.

Given that most pregnancy codes had very low stay counts, all pregnancy codes had less than 3 outlier payments, except for code O99, which had 20 outlier payments. Outlier payments for code O99 were 1.83 times higher in stays with pregnancy.

Summary

Based on the outcomes of the infectious diseases comorbidity study, we added 12 of the 14 codes in Table 6 to the regression model. The two codes not included were W5589XS (other contact with other mammals, sequela), and W5659XS (other contact with other fish, sequela). With the addition of the 12 ICD-10 codes, the adjustment factor in the current model decreased from 1.07 to 1.02 and the current factor was found to be not statistically significant.

After reviewing the results of the analyses for the addition of a comorbidity category for homelessness and pregnancy it was decided not to include these categories into the 2018 data model. While all comorbidity groupings were statistically significant in the original regression, note in Table 8 that some comorbidity groupings were found to be not statistically significant in the updated model.

The regression estimates for most comorbidity adjustments did not change meaningfully, as seen in Table 8. The one exception was oncology treatment, which increased from 1.07 to 1.51. This increase is attributable to the fact that in the original regression, any claim with an oncology diagnosis code was included; however, in this updated 2018 regression model we include only claims with both an oncology diagnosis code and an oncology procedure code, consistent with the way this comorbidity is assigned for payment in the IPF PPS.

Table 8: Comorbidity Grouping Frequency and Adjustment Regression Results, CY 2018

Comorbidity Grouping	# of Stays	Percent (%) of Total Frequency§	Current Adjustment Factors	2018 Data Adjustment Factors	Sig. (.05)
Developmental disabilities	8,420	9.01%	1.04	1.04	
Coagulation factor deficits	202	0.22%	1.13	1.05	
Tracheostomy	146	0.16%	1.06	1.07	
Eating and conduct disorders	2,766	2.96%	1.12	0.98	
Infectious disease	14,892	15.94%	1.07	1.02	
Renal Failure, Acute	6,871	7.35%	1.11	1.08	*
Renal Failure, Chronic	17,930	19.19%	1.11	1.08	*
Oncology Treatment	6	0.01%	1.07	1.51	*
Uncontrolled Diabetes-Mellitus with or without complications	7,395	7.92%	1.05	1.07	*

Comorbidity Grouping	# of Stays	Percent (%) of Total Frequency§	Current Adjustment Factors	2018 Data Adjustment Factors	Sig. (.05)
Severe protein calorie malnutrition	1,610	1.72%	1.13	1.15	*
Drug and/or alcohol induced mental disorders	16,817	18.00%	1.03	0.96	
Cardiac Conditions	8,403	8.99%	1.11	1.05	*
Gangrene	92	0.10%	1.10	1.07	*
Chronic Obstructive Pulmonary Disease	2,494	2.67%	1.12	1.14	*
Artificial Openings— Digestive and Urinary	1,414	1.51%	1.08	1.07	*
Severe musculoskeletal and connective tissue diseases	1,413	1.51%	1.09	1.04	*
Poisoning	2,557	2.74%	1.11	1.15	*

§*The percent of total frequency represents the percent of stays with each comorbidity out of the number of stays with comorbidities.*

Patient Age

The IPF PPS contains 9 age variable groupings consisting of under 45, over 79, and 5-year groupings in between. When reviewing the results of the updated model with current data, it was found that the regression factors for age groupings 45 to 49 and 50 to 54 had identical factors. This was also seen in the age groupings 70 to 74 and 75 to 79. In order to provide insight into these similarities and the impact of changes to the baseline age group or to the variable groupings, we analyzed the regression results of age variables under two scenarios. The first scenario studied the regression analysis using different age groups as the baseline. The second studies the effects of using different age groups compared to the IPF PPS model.

For the first scenario, we constructed three baseline age groups: Age under 30, Age under 35, and Age under 40. These were compared to the existing baseline age group of Age of 45. Ages were grouped every 5 years up to age group over 99 for each.

For age groups Age under 30, Age under 35 and Age under 40, it was observed that the regression factors for all age groups under 45 were not statistically significant at 0.05 p-value. However, when using the existing baseline age group (Age under 45), the regression factors for all age groups are statistically significant. Under all four age groups within this scenario, each with a different baseline age group, we observe that the regression factors for all age groups greater than 70 are approximately 1.11 or 1.12 in the regression model.

Based on these findings, age group Age under 45 was kept as the baseline age group in the construction of the second scenario, which analyzed results using different age groupings.

For this scenario we studied the regression analysis using four models constructed of different age groups compared to the IPF PPS Model which uses the same baseline age group as the 2004 - IPF-regression model (Age under 45), which groups the ages every 5 years. The four models are described below.

- Model A uses the age groups of the existing IPF regression model but combines ages 45 to 49 and ages 50 to 54 into ages 45 to 54 and combines ages 70 to 74 and ages 75 to 79 into ages 70 to 79.
- Model B groups the ages every 6 years, beginning at age 45.
- Model C groups the ages every 7 years, beginning at age 45.
- Model D groups the ages every 8 years, beginning at age 45.

Under the current IPF regression model, the regression factors are the same for age groups 70 to 74 and 75 to 79 (1.11) as well as age groups 45 to 49 and 50 to 54 (1.02). Thus, for Model A we combined these age groups into age 70 to 79 and age 45 to 54. The regression factors remained the same at 1.11 for age group 70 to 79 and 1.02 for age group 45 to 54. Using the age groups under Models B (every 6 year), C (every 7 year), and D (every 8 year) - each with the current baseline age group: age under 45 - the regression factors for all age groups in the model were statistically significant in the models. Under Model D, which groups the ages every 7 years, we observed that all age variables had distinct regression factors. The distribution falls between a similar range (10 to 14%) across all age groups.

Based on the outcomes of this study, the patient age groupings 45 to 49 and 50 to 54 were combined to create a new grouping 45 to 54. The age groupings 70 to 74 and 75 to 79 were also combined into a new grouping 70 to 79. The updated adjustment factors can be found in Table 9.

Beneficiary age can be found in the MedPAR data. As seen in Table 9, the Under 45 age group accounted for 24.41% of beneficiaries. Beneficiaries from age 45 to 64 account for 34.44%. The remaining group aged 65 and over account for 41.14%. The regression coefficients in Table 9 showed less significant change in costs from age 45 to 64. Age 65 to over 79 years showed a significant decrease in the regression coefficients.

Table 9: Age Frequency and Adjustment Regression Results, CY 2018

Age	Frequency	Percent (%) of Total Frequency	Current Adjustment Factors	2018 Data Adjustment Factors	Sig. (.05)
Under 45	66,515	24.41%	1.00	1.00	
45 to 49§	42,578	15.63%	1.01	1.02	*
50-54§			1.02		
55 to 59	27,171	9.97%	1.04	1.05	*
60 to 64	24,096	8.84%	1.07	1.08	*
65 to 69	31,413	11.53%	1.10	1.09	*
70 to 74§	44,091	16.18%	1.13	1.11	*
75-79§			1.15		
Over 79	36,578	13.43%	1.17	1.12	*

§*For the 2018 model the age groupings for 45 to 49 and 50 to 54 have been consolidated into grouping 45 to 54, and groupings 70 to 74 and 75 to 79 have been consolidated into grouping 70 to 79. The 2018 factors presented are for the consolidated age groupings 45 to 54 and 70 to 79.*

Variable Per Diem Adjustment

To account for variable daily costs over the course of a patient stay, the regression model includes a variable for LOS. We used the Medicare covered days (cov_days) on each stay from the 2018 MedPAR data to assign the appropriate indicator to each stay. The 22 possible values for this variable are found in Table 10.

As shown in Table 10, the LOS (Day) 19, 20, and 21 had the least frequency of 4,353, 4,430, and 4,267, respectively. The median LOS was 9 days.

In order to understand the impacts LOS distribution may have on the construction of the LOS variable in the regression model, we completed a series of analyses first focusing on the LOS distribution for FY 2019 IPF stays. This analysis found that for the 272,442 stays in CY 2018 MedPAR IPF stays, the average LOS was 12.5, the mode was 7 and the median was 9. We observed that 52% of stays had a LOS less than or equal to 9 days.

Next, we studied the 2018 MedPAR regression analysis results for the LOS variables to analyze the regression factors for LOS variables greater than LOS 22 and to observe the changes in the regression factors when using a baseline of LOS 9 compared to the results under the existing IPF regression model, which uses LOS 10 as the baseline.

In the LOS variable greater than LOS 22 study, we analyzed the regression factors from LOS 1 to LOS 30 and observed that the cost per diem continued to decline. The regression factors for LOS variables LOS 22 to LOS 29 ranged from 0.93 to 0.96 with the exception of LOS 28 where the factor decreased to 0.81.

We also reviewed the regression factors with the base set at the median LOS 9 and noticed a 1.56% decrease in the regression factors for all LOS variables. However, since the Federal per diem payment would be the same no matter which day of the stay is used as a base point and to keep the model consistent with 2004, 10-day LOS is used as the base.

Thus, we continue to use LOS with 10 days as the base to match with the 2004 regression model and to take into consideration that 9-day is the median LOS.

The median LOS serves only as a point of reference for the variable per diem adjustment factors relative to the Federal per diem base rate (the day for which the factor equals the base amount). In addition, the actual magnitudes of the variable adjustment factors were not affected by using the median in this manner because the median had no impact on the cost regression from which the variable per diem adjustment factors are derived.

As shown in Table 10, regression coefficients increased for LOS less than 10 days, relative to the base 10-day LOS. Other coefficients for LOS greater than 10 days remained similar to the current adjustment factors after analysis.

Table 10: Length of Stay (Day) Frequency and Adjustment Regression Results, CY 2018

LOS (Days)	Frequency	Percent (%) of Total Frequency	Current Adjustment Factors	2018 Data Adjustment Factors	Sig. (.05)
1	6,599	2.42%	1.19	1.26	*
2	11,006	4.04%	1.12	1.21	*
3	15,772	5.79%	1.08	1.16	*
4	17,729	6.51%	1.05	1.12	*
5	18,989	6.97%	1.04	1.10	*
6	20,239	7.43%	1.02	1.07	*

LOS (Days)	Frequency	Percent (%) of Total Frequency	Current Adjustment Factors	2018 Data Adjustment Factors	Sig. (.05)
7	20,844	7.65%	1.01	1.04	*
8	16,491	6.05%	1.01	1.03	*
9	13,958	5.12%	1.00	1.02	*
10	12,829	4.71%	1.00	1.00	
11	11,583	4.25%	0.99	0.99	
12	10,596	3.89%	0.99	0.98	*
13	11,089	4.07%	0.99	0.97	*
14	12,182	4.47%	0.99	0.97	*
15	8,327	3.06%	0.98	0.97	*
16	5,989	2.20%	0.97	0.97	*
17	5,386	1.98%	0.97	0.96	*
18	4,711	1.73%	0.96	0.97	*
19	4,353	1.60%	0.95	0.95	*
20	4,430	1.63%	0.95	0.94	*
21	4,267	1.57%	0.95	0.94	*
>=22	35,073	12.87%	0.92	0.95	

Other Patient Level Adjustments

Patients who Receive Electroconvulsive Therapy (ECT)

IPFs receive an additional payment for each ECT treatment provided during an IPF stay. As discussed in the November 2004 Final Rule, cases with ECT are substantially more costly than cases without ECT. The updated analysis continues to indicate that the average cost per ECT case is twice as much compared to non-ECT cases, and the average LOS is approximately double for ECT cases compared to non-ECT cases.

In order to receive payment for ECT, an IPF must report revenue code 0901 (Electroshock Treatment), along with the number of units of ECT on the claim. The units should reflect the number of ECT treatments provided to the patient during the IPF stay. In addition, IPFs must include the ICD-10 procedure code for ECT (GZB0ZZZ, GZB2ZZZ, GZB4ZZZ) in the procedure code field.

The November 2004 Final Rule outlines the formula used to describe the IPF PPS payment regression model. This formula contains a control variable which includes an indicator variable that has the value of one if a patient had ECT treatment during their stay and zero if they did not. The frequency of the ECT treatment variable in the updated model is shown in Table 11.

If the number of ECT treatments > 0, then the ECT treatments variable = 1, otherwise ECT treatments variable = 0

Table 11: Frequency of Stays with ECT Treatment

ECT Treatments Variable	# of Stay	Percent (%) of Total Frequency
0 – ECT Treatment not present during stay	276,026	98.01%
1 – ECT Treatment present during stay	5,416	1.99%

As discussed in the November 2004 Final Rule, the payment amount per ECT treatment was calculated based on the median cost for ECT procedure code 90870, calculated under the Outpatient Prospective Payment System (OPPS).

We analyzed ECT claims using the 2017 and 2018 MedPAR data in order to compare the cost for ECT cases to the cost for non-ECT cases. Similar to the methodology discussed in the 2004 IPF Final Rule, we estimated the average ancillary cost per ECT unit by taking the average additional ancillary cost for ECT cases divided by the average number of ECT units per case. Additionally, we looked at ECT frequency per provider using the CWF data and examined the diagnosis codes and comorbidities that are found on IPF claims that contain ECT using 2017 and 2018 MedPAR data.

Our analysis indicated that ECT cases comprised about 2% of all cases. Among ECT cases, there were on average 6.3 units of ECT per case in 2017 and 6.4 units in 2018 in the full sample.

On a total cost per case basis, ECT cases are approximately 2.5 times more expensive as the non-ECT cases ($28,574.90 vs $11,325.76 in 2017 and, $30,489.56 vs. $11,653.25 in 2018 in the full sample). Most of this difference was due to differences in average LOS (23.71 days for ECT cases vs. 12.4 days for non-ECT cases in 2017, and 24.33 days for ECT and 12.39 days for non-ECT stays in 2018).

The average ancillary costs per case for ECT cases are $4,600.94 higher than those for non-ECT cases in 2017 and $5,004.12 higher in 2018. Table 12 below summarizes the results of this analysis.

Table 12: Summary of ECT provider statistics and ancillary costs

Year	# of Providers	Average Claim Count per Provider	Average Claim Count with ECT per Provider	Average Total ECT Units per Provider	Mean Age of Beneficiaries	Average Ancillary cost per ECT Unit
2017	374	433	19	119	61.01	$730.31
2018	360	417	18	114	61.48	$781.89

The five most frequent primary diagnosis codes in ECT cases in both 2017 and 2018 were:

- F332: Major depressive disorder, recurrent severe without psychotic features
- F333: Major depressive disorder, recurrent, severe with psychotic symptoms
- F250: Schizoaffective disorder, bipolar type
- F314: Bipolar disorder, current episode depressed, severe, without psychotic features
- F315: Bipolar disorder, current episode depressed, severe, with psychotic features

There was an average of 0.31 comorbidities among ECT cases in 2017 and 0.30 in 2018. The ICD-10 code I25.10 (atherosclerotic heart disease of native coronary artery without angina pectoris) had the highest frequency among ECT cases in any position (8.68% in 2017 and 9.24% in 2018).

Facility level Adjustments

Wage Index

The IPF wage index uses unadjusted, pre-reclassified, pre-floor hospital wage index based on the existing methodology. The wage index accounts for geographic differences in labor costs and is applied to the labor-related share of the Federal per diem base rate.

Frontier State Analysis

CMS has received comments encouraging the adoption of the frontier floor policy that is applicable under the IPPS, to recognize the additional costs associated with providing care in a frontier state. CMS conducted a study to evaluate whether the data shows that there are additional costs for IPFs in frontier states and to explore if the frontier state variable needs to be added to the current model.

We first tested the incorporation of the frontier state variable by adding a dummy variable for frontier states (if_frontier) to the original MedPAR 2018 regression. The FY 2022 IPPS Final Rule (86 FR 45178)[4] defines frontier states as states in which at least 50% of counties have a population density less than 6 persons per square mile. This includes 5 states: Montana, Nevada, North Dakota, South Dakota and Wyoming. The frontier states were identified by using the state codes which were represented by the first two characters of the provider variable. The frontier states and the state codes were Montana - 27, Nevada - 29, North Dakota - 35, South Dakota - 43, and Wyoming – 53.

Greater than 98% of the stays were found to be from non-frontier states in CY 2018. The regression factor for the frontier variable was 1.04 (p-value = 0.6017), implying there was a 4% increase in costs in the frontier states, but this increase was not statistically significant.

The regression factors for most variables showed slight to no change resulting from the addition of the frontier variable, and all variables had less than a 0.48 percentage point change. MS-DRG 948 (signs & symptoms w/o MCC) exhibited a 0.48% decrease which was the largest among the regression factors, followed by MS-DRG 917 (poisoning & toxic effects to drugs w MCC) which decreased by 0.23% and MS-DRG 883 (disorders of personality & impulse control) had a decrease of 0.17%. Conversely, teaching status had the largest increase in regression factor of 0.18%. In addition, the regression factors decreased for rural by 0.16% and log occupancy by 0.02%, and increased 0.05% for the variable occupancy less than 30%.

Results for the tests of association of the independent variables and frontier states showed that most variables are not associated with the frontier variable (p-value >0.05). However, MS-DRG codes 882, 883, 917, 918 and 948, comorbiditiy categories for chronic obstructive pulmonary disorder, severe protein calorie malnutrition, and poisoning, age group 55 to 59, LOS of 1 and LOS greater or equal to 22 days, and rural and log occupancy showed strong positive associations (p-value <0.001) with the frontier variable. MS-DRG codes 895, 884, age group over 79, ECT indicator, occupancy less than 30%, and teaching status showed strong negative associations with the frontier variable.

Next, we added the if_frontier variable and an interaction term between the rural and frontier states variables (rural*if_frontier) to see if there is a significant interaction between the effects of these two independent variables on the cost estimates. We found that the interaction term had a factor of 1.13 but was not significant (p-value= 0.3984). This showed that there was no difference on cost for rural IPFs depending on their frontier status. Furthermore, the confidence intervals (CI) of the regression factors for both the frontier (95% CI: 0.8572 - 1.1660) and the rural*frontier interaction term (0.8559 - 1.4789) are fairly wide compared to the other covariates, indicating that there is a higher standard error around the regression estimate, decreasing our confidence in the calculated factors. Finally, addition of the interaction term did not largely change the magnitude of the factors for many variables, but an attenuation of the effect size was observed for the frontier (2.98% decrease) and rural (0.36% decrease) variables.

The conclusion of both studies found that the data showed no statistically significant increase in costs for providers located in frontier states.

Rural Location Adjustment

We used the variable CBSA_URBN_RRL_IND from the December 2018 POS file. If CBSA_URBN_RRL_IND = "R" then the provider is a rural provider. The stays also recorded frequencies for urban at 229,557 (84.26%) and rural at 42,885 (15.74%).

Table 13: Rural Stay Frequency

Rural or Urban	Frequency	Percent (%) of Total Frequency
Urban	229,557	84.26%
Rural	42,885	15.74%

As shown in Table 14, the updated coefficient for care in a rural facility declined from the currently implemented 1.17 to 1.11.

Table 14: Rural Location Regression Results, CY 2018

Facility level Adjustors	Current Adjustment Factors	2018 Data Adjustment Factors	Sig. (.05)
Rural	1.17	1.11	*

Rural Regression Factor With and Without Occupancy Variables

As discussed in the section below, we include two control variables in the model related to facility occupancy. These variables are the natural log of the occupancy rate and the indicator for facilities with an occupancy rate less than 30%. We tested the removal of the occupancy variables from the regression model to understand the effect on the rural coefficient. The columns in Table 15 represent the CY 2018 rural factor for the model as calculated with and without occupancy variables, and the percentage difference between the two calculations.

The analysis finds that excluding the two occupancy variables would increase the CY 2018 rural factor from 1.11 to 1.16 (4.6%), and bring the CY 2018 rural factor closer to the 2004 results.

Table 15: Impact of Rural Regression Factors Modeled With and Without Occupancy Variables

	2004 Model	Weighted Model		
Year	With Occupancy Variables	With Occupancy Variables	Without Occupancy Variables	% Difference
CY 2018 Rural Factor	1.17	1.11	1.16	4.6%

Teaching Status Adjustment

Teaching status is calculated from the provider's cost report based on the ratio of the number of interns and residents FTEs being trained at a facility to the facility's average daily census. Table 16 shows the distribution of this ratio among teaching IPFs.

Table 16: Percentile Distribution of Intern and Resident to Average Daily Census Ratio

	Percentile Distribution											
	Mean	Pctl 0	Pctl 10	Pctl 20	Pctl 30	Pctl 40	Pctl 50	Pctl 60	Pctl 70	Pctl 80	Pctl 90	Pctl100

Intern and Resident to Average Daily Census Ratio	0.16	0.00	0.01	0.03	0.05	0.08	0.10	0.13	0.15	0.22	0.32	1.99

As shown in the formula below, the teaching status for each facility is calculated as one plus the facility's ratio of intern and resident FTEs to average daily census. The teaching variable used in the regression is the natural log of each facility's teaching status, resulting in a continuous variable with a distribution ranging from 0.00 to 1.09.

Teaching status = 1+ (number of interns and residents / average daily census)

Table 17 shows the number of stays in teaching facilities (Teaching Status > 1.00) and non-teaching facilities (Teaching Status = 1.00).

Table 17: Teaching Status Frequency

Teaching Status	Frequency of Stays	Percent (%) of Total Frequency
Teaching (>1.00)	61,742	22.66%
Non-Teaching (=1.00)	210,700	77.34%

Table 18 shows that the regression coefficient for log (Teaching Status) increased from 0.5150 to 0.9486.

Table 18: Teaching Status Adjustment Regression Results, CY 2018

Facility level Adjustors	Current Adjustment Factors	2018 Data Adjustment Factors	Sig. (.05)
Teaching Status	0.5150 §	0.9486 §	*

§*The teaching status variable is expressed as the coefficient, not the exponentiated payment factor, as in the 2004 Final Rule. That is, the adjustment is calculated by the formula 1+(number of residents / average daily census) raised to the power of the variable value listed in Table 18*

Other Facility Level adjustments

Patients admitted through the Hospital's Emergency Department (ED)

Currently in the IPF PPS, Medicare adjusts payments to IPFs with qualified EDs to cover the ED costs incurred as part of an inpatient psychiatric facility stay. The ED payment adjustment takes the form of a higher payment factor applied to the first day of the psychiatric stay. To avoid creating an incentive to admit through the ED, the ED payment adjustment was applied to all admissions to IPFs with qualified EDs, with one exception. The ED adjustment is not made where a patient is discharged from an acute care hospital or CAH and admitted to the same hospital's or CAH's psychiatric unit. An ED adjustment is not made in these cases because the costs associated with ED services are reflected in the DRG payment to the acute care hospital or through the reasonable cost payment made to the CAH.

The decision to adjust the first day of the stay to include ED costs was based on two factors. First, ED costs occur at the beginning of the stay. Second, in IPFs with EDs, ED costs accounted for essentially all the difference in costs per stay between cases admitted through the ED and cases not admitted through the ED.

The adjustment factor was calculated in three steps:

- First, we estimated the proportion by which the ED costs of a case would increase the cost of the first day of the stay.
- Second, we adjusted the factor estimated in the first step to account for the fact that we will pay the higher first day adjustment for all cases in the qualifying IPFs, not just the cases admitted through the ED.
- Third, we added the adjusted factor calculated in the previous two steps to the variable per diem adjustment derived from the regression equation.

We updated the FY 2020 ED adjustment factor based on updated data using the established methodology. The following inputs were used to calculate the FY 2020 ED adjustment factor:

CY 2018 ED Cost per Stay = $401.60

CY 2018 Total Cost per Day for Admissions through the ED = $1,197.61

CY 2018 Proportion of the Admission through the ED = 0.55

Using the following formula, we found the FY 2020 ED adjustment factor to be 0.19.

FY 2020 ED adjustment factor = (ED cost per stay / Total cost per day for Admissions through the ED) * Proportion of the Admission through the ED

Outlier Policy

The IPF PPS includes outlier payments for IPF cases that incur extraordinarily high costs. In instances when an IPF case qualifies for an outlier payment, the IPF PPS pays 80% of the difference between the estimated cost for the case and the adjusted fixed dollar loss threshold amount for days 1 through 9 of the stay (consistent with the median LOS for IPFs in FY 2002), and 60% of the difference for day 10 and thereafter. The adjusted threshold amount is equal to the outlier threshold amount adjusted for wage index, teaching status, rural area, and the COLA adjustment (if applicable), plus the amount of the Medicare IPF payment for the case.

CMS prospectively calculates the fixed dollar loss threshold so that outlier payments represent 2% of total estimated IPF PPS payments. As discussed in the November 2004 Final Rule, CMS established the 2% outlier target because it provides an appropriate balance between patient access, IPF financial risk, and the payment rate reduction required for all cases to offset the cost of the policy. In that rule, CMS estimated that approximately 5% of IPF cases would meet the fixed dollar loss threshold amount and qualify for an average outlier payment of $3,248.

As part of this technical report, we used more recent IPF claims to estimate the percent of IPF cases and facilities qualifying for outlier payments and the average amount of outlier payment per case and per facility. We also considered alternative outlier target percentages, specifically a 3% outlier target and a 4% outlier target.

With a 2% outlier target, the fixed dollar loss threshold is around $14,000. Approximately 50% of providers receive outlier payments, and the average amount of outlier payments per provider is approximately $119,000. Approximately 3.2% of stays receive outlier payments, with an average outlier payment amount per stay of about $8,400.

With a 3% outlier target, the fixed dollar loss threshold decreases to around $10,000. Approximately 59% of providers would receive outlier payments, and the average amount of outlier payments per provider increases to approximately $151,000. Approximately 5.6% of stays would receive outlier payments, with an average outlier payment amount per stay of about $7,000.

Lastly, with a 4% outlier target, the fixed dollar loss threshold decreases further to around $7,600. Approximately 66% of providers would receive outlier payments, and the average amount of outlier payments per provider increases to approximately $179,000. Approximately 8.5% of stays would receive outlier payments, with an average outlier payment amount per stay of about $6,300.

As noted above, increases to the outlier target percentage would require a reduction to payment rates for all cases to offset the cost of the policy. That is, if the outlier target percentage increased by 1 percentage point, IPF PPS payment rates would need to be reduced by 1% in order to offset the increase in outlier payments. Therefore, we estimated what the payment impacts would be if the outlier target percentage were increased, accounting for the required reduction to payment rates. Table 19 below shows the percentage change in total IPF PPS payments if the outlier target percentage were increased from 2% to either 3% of 4%. We calculated these impacts using the current IPF PPS adjustment factors as well as using the updated adjustment factors (including a payment adjustment for disproportionate share, which is discussed in the section below).

Table 19: Percent Change in Total Payment Using Current or Updated Adjustment Factors at Different Outlier Ratios, FY 2019

		Current Adjustment Factors		Updated Adjustment Factors (including DSH)	
	Number of Facilities	2% → 3% Outlier Ratio	2% → 4% Outlier Ratio	2% → 3% Outlier Ratio	2% → 4% Outlier Ratio
All Facilities	**1,615**	**-0.01%**	**0.00%**	**-0.01%**	**0.00%**
Total Urban	1,286	0.02%	0.04%	-0.02%	-0.04%
Total Rural	329	-0.15%	-0.26%	0.08%	0.24%
Urban Freestanding	495	-0.68%	-1.38%	-0.68%	-1.37%
Urban Unit	791	0.76%	1.53%	0.67%	1.35%
Rural Freestanding	67	-0.90%	-1.79%	-0.86%	-1.67%
Rural Unit	262	0.34%	0.76%	0.70%	1.49%
By Type of Ownership					
Freestanding IPFs	**562**	**-0.71%**	**-1.42%**	**-0.70%**	**-1.40%**
Urban	495	-0.68%	-1.38%	-0.68%	-1.37%
Government	124	-0.61%	-1.30%	-0.62%	-1.30%
Non-Profit	97	-0.51%	-0.97%	-0.52%	-0.97%

	Number of Facilities	Current Adjustment Factors		Updated Adjustment Factors (including DSH)	
		2% → 3% Outlier Ratio	2% → 4% Outlier Ratio	2% → 3% Outlier Ratio	2% → 4% Outlier Ratio
For-Profit	274	-0.78%	-1.55%	-0.77%	-1.54%
Rural	67	-0.90%	-1.79%	-0.86%	-1.67%
Government	33	-0.92%	-1.84%	-0.90%	-1.78%
Non-Profit	15	-0.65%	-1.33%	-0.58%	-1.14%
For-Profit	19	-0.98%	-1.92%	-0.93%	-1.77%
IPF Units	**1,053**	**0.69%**	**1.41%**	**0.68%**	**1.37%**
Urban	791	0.76%	1.53%	0.67%	1.35%
Government	113	1.53%	2.88%	1.34%	2.47%
Non-Profit	515	0.85%	1.73%	0.74%	1.50%
For-Profit	163	-0.08%	-0.02%	-0.04%	0.05%
Rural	262	0.34%	0.76%	0.70%	1.49%
Government	69	-0.10%	-0.15%	0.18%	0.48%
Non-Profit	144	0.72%	1.48%	1.10%	2.21%
For-Profit	49	-0.01%	0.19%	0.41%	1.03%
By Teaching Status					
Non-teaching	1,416	-0.15%	-0.26%	-0.09%	-0.15%
Less than 10% interns and residents to beds	109	0.09%	0.18%	-0.04%	-0.06%
10% to 30% interns and residents to beds	67	1.52%	2.82%	0.98%	1.80%
More than 30% interns and residents to beds	23	1.91%	3.36%	1.14%	1.83%
By Region					
New England	107	-0.08%	-0.10%	-0.16%	-0.24%
Mid-Atlantic	231	0.15%	0.26%	0.08%	0.12%
South Atlantic	249	-0.34%	-0.63%	-0.34%	-0.64%
East North Central	271	0.09%	0.18%	0.12%	0.24%
East South Central	161	-0.09%	-0.06%	0.04%	0.21%
West North Central	121	0.12%	0.28%	0.11%	0.31%
West South Central	241	-0.07%	-0.11%	0.03%	0.06%
Mountain	108	-0.46%	-0.90%	-0.49%	-0.93%
Pacific	126	0.36%	0.64%	0.35%	0.61%
By Bed Size					
Freestanding IPFs	**562**	**-0.71%**	**-1.42%**	**-0.70%**	**-1.40%**
Beds:0-24	90	-0.18%	-0.43%	-0.11%	-0.29%
Beds:25-49	86	-0.64%	-1.30%	-0.62%	-1.26%
Beds:50-75	90	-0.81%	-1.59%	-0.82%	-1.59%
Beds:76+	296	-0.75%	-1.51%	-0.75%	-1.50%
IPF Units	**1,053**	**0.69%**	**1.41%**	**0.68%**	**1.37%**
Beds:0-24	607	0.78%	1.60%	0.97%	1.96%
Beds:25-49	263	0.41%	0.91%	0.33%	0.75%
Beds:50-75	115	0.52%	1.07%	0.41%	0.82%
Beds:76+	68	1.05%	2.00%	0.79%	1.50%

Disproportionate Share Intensity

The IPF PPS does not currently include any payment adjustment for disproportionate share intensity or disproportionate share hospital (DSH) status. As discussed in the November 2004 Final Rule, CMS investigated including an adjustment for DSH, but found a statistically significant negative relationship between per diem cost and DSH status. CMS noted that a negative payment adjustment would not be consistent with the purpose of a DSH adjustment, which is intended to

provide additional payments to providers to account for the costs of treating low-income patients. CMS therefore did not include a DSH adjustment in the IPF PPS.

As part of this report, we examined the relationship between disproportionate share intensity and per diem cost. For this analysis, we constructed a DSH percentage for each IPF consistent with the methodology used in determining DSH status under the IPPS and determining the low-income patient (LIP) adjustment under the Inpatient Rehabilitation Facility Prospective Payment System (IRF PPS). As shown in the formula below, the DSH percentage is the sum of two ratios: the Supplemental Security Income (SSI) ratio and the Medicaid ratio. The SSI ratio is the ratio of an IPF's Medicare SSI days to total Medicare days, and the Medicaid ratio is the ratio of Medicaid, non-Medicare days to total patient days.

DSH = (Medicare SSI Days / Total Medicare Days) + (Medicaid, Non-Medicare Days / Total Days)

For this variable, we calculated a facility's Medicare SSI days from the sum of SSI days in MedPAR. We calculated total Medicare days; Medicaid, non-Medicare days; and total days from each provider's cost report. For IPF units of an acute care hospital, we included only the Medicare; Medicaid, non-Medicare; and total days attributed to the unit past on the hospital's cost report.

Calculated this way, the mean DSH percentage for freestanding providers was 0.3258 and the mean percentage for unit-based providers was slightly higher at 0.3418. Compared to unit-based providers, our analysis found that freestanding providers have a slightly higher mean SSI ratio, a lower mean Medicaid ratio, and a slightly lower mean DSH percentage.

We constructed the DSH variable used in the regression following a methodology similar to the construction of the teaching variable discussed earlier in this report. The DSH variable for each facility was calculated as the natural log of one plus the facility's DSH percentage.

We introduced the DSH percentage variable into the regression model to determine the regression coefficient, statistical significance, and effect on other coefficients in the model. In the updated model, we calculated a coefficient of 0.2196 for the DSH percentage variable, which was statistically significant ($p<0.01$). Additionally, some of the adjustment factors for other independent variables changed as a result of adding the DSH percentage variable to the regression model. Most of the changes to the adjustment factors were minor. Notably, however, the adjustment factor for the oncology comorbidity decreased by 3.96%, the teaching status factor decreased by 3.55%, and the factor for patient age grouping Age Over 79 increased by 2.51%.

Lastly, we compared the R-squared statistics for each model to evaluate goodness of fit and found that adding the DSH percentage to the model would increase the R-squared value modestly, from 0.2496 to 0.2576. The impact section of this report, which is found later in the report, includes estimates of the expected payment impacts if CMS were to add an adjustment for DSH intensity to the IPF PPS based on the construction of the DSH percentage described in this report. We simulated payments for the hypothetical DSH payment adjustment by adding 1 to the facility's DSH percentage and then raising this value to the power of the regression coefficient (0.2196).

CONTROL VARIABLES

Control variables are unpaid variables used to avoid bias in the payment factors as a result of possible correlation with the control variables. The first control variable included in the analysis was occupancy rate less than 30% (see Table 20). The second control variable included was ECT treatment. IPFs receive an additional payment for each ECT treatment provided during an IPF stay and so the control variable includes an indicator variable for the presence or lack of ECT treatments.

Log occupancy rate:

Log occupancy rate = log (total days / (Beds * days in report period))

Occupancy rate less than 30% indicator:

Occupancy rate < 30%, the variable occupancy_lt30 = 1, otherwise occupancy_lt30 = 0.

ECT indicator:

If the number of ECT treatments > 0, then the ECT treatments variable = 1, otherwise ECT treatments variable = 0

Table 20: Occupancy Rate Less Than 30% Frequency

Occupancy Less Than 30%	Frequency	Percent (%) of Total Frequency
N	269,418	98.89%
Y	3,024	1.11%

Table 21 shows the regression results for the control variables occupancy rate less than 30% and ECT treatments.

Table 21: Control Variables Regression Results, CY 2018

Control Variables	2018 Data (Weighted)	Sig. (.05)
Occupancy rate less than 30%	0.79	*
Log occupancy rate	0.65	*
ECT treatments indicator	1.26	*

IMPACT ANALYSIS

Using FY 2019 MedPAR claims, we simulated IPF PPS payments in order to evaluate the potential payment impacts of changing the IPF PPS adjustment factors based on the analyses summarized in this report. Table 22 below shows a step-wise analysis of the percentage changes in total payments when moving one set of adjustment factors to another. We start with the baseline scenario, which represents the current IPF PPS adjustment factors. The first column shows the estimated payment impact of updating the IPF PPS patient and facility level adjustment factors. The second column shows the estimated payment impact of adding the hypothetical DSH payment adjustment to the IPF PPS model with updated adjustment factors. Note that for this impact analysis, all payment simulations have been calculated to maintain the 2% outlier target.

Table 22: Percentage Change in Total Payment Using Current or Updated Adjustment Factors at 2% Outlier Ratio, FY 2019

	Number of Facilities	Percentage change from updating IPF PPS adjustment factors (without DSH)	Percentage change from adding DSH payment adjustment to the IPF PPS
All Facilities	**1,615**	**0.00%**	**0.00%**
Total Urban	1,286	0.82%	-0.05%
Total Rural	329	-5.29%	0.31%
Urban Freestanding	495	0.29%	-0.31%
Urban Unit	791	1.38%	0.23%
Rural Freestanding	67	-5.45%	-0.19%
Rural Unit	262	-5.19%	0.64%
By Type of Ownership			
Freestanding IPFs	**562**	**-0.32%**	**-0.30%**
Urban	495	0.29%	-0.31%
Government	124	1.22%	-1.86%
Non-Profit	97	0.64%	-0.39%
For-Profit	274	-0.38%	0.66%
Rural	67	-5.45%	-0.19%
Government	33	-4.94%	-0.05%
Non-Profit	15	-4.93%	0.40%
For-Profit	19	-6.35%	-0.61%
IPF Units	**1,053**	**0.32%**	**0.30%**
Urban	791	1.38%	0.23%
Government	113	2.67%	0.50%
Non-Profit	515	1.41%	0.46%
For-Profit	163	0.28%	-0.56%
Rural	262	-5.19%	0.64%
Government	69	-5.98%	0.29%
Non-Profit	144	-4.52%	1.12%
For-Profit	49	-5.80%	-0.13%
By Teaching Status			
Non-teaching	1,416	-0.86%	-0.12%

	Number of Facilities	Percentage change from updating IPF PPS adjustment factors (without DSH)	Percentage change from adding DSH payment adjustment to the IPF PPS
Less than 10% interns and residents to beds	109	1.55%	0.72%
10% to 30% interns and residents to beds	67	5.60%	0.42%
More than 30% interns and residents to beds	23	17.75%	-0.86%
By Region			
New England	107	0.67%	0.34%
Mid Atlantic	231	0.76%	-0.04%
South Atlantic	249	0.54%	-0.80%
East North Central	271	-0.52%	0.41%
East South Central	161	-2.32%	0.12%
West North Central	121	-0.87%	-0.06%
West South Central	241	-1.00%	-0.03%
Mountain	108	-0.28%	1.23%
Pacific	126	1.00%	-0.24%
By Bed Size			
Freestanding IPFs	**562**	**-0.32%**	**-0.30%**
Beds:0-24	90	-1.90%	0.77%
Beds:25-49	86	-1.30%	-0.04%
Beds:50-75	90	0.33%	-0.37%
Beds:76+	296	-0.12%	-0.44%
IPF Units	**1,053**	**0.32%**	**0.30%**
Beds:0-24	607	-1.47%	-0.42%
Beds:25-49	263	1.08%	0.55%
Beds:50-75	115	1.71%	0.85%
Beds:76+	68	2.07%	1.01%

SUMMARY

The following table (Table 23) contains a summary of the updated adjustment factors calculated from the results of the regression model.

Table 23: Summary of Adjustment Factors

Dependent Variable: Log per diem cost of a stay	Current Adjustment Factors (2004 model)	2018 Data Adjustment Factor	Sig. (.05)
MS-DRGs			
DRG 056 - Degenerative nervous system disorders w MCC	1.05	1.10	*
DRG 057 - Degenerative nervous system disorders w/o MCC	1.05	1.04	*
DRG 876 - O.R. procedure w principal diagnosis of mental illness	1.22	1.41	*
DRG 880 - Acute adjustment reaction & psychosocial dysfunction	1.05	0.98	
DRG 881 - Depressive neuroses	0.99	1.06	*
DRG 882 - Neuroses except depressive	1.02	0.97	
DRG 883 - Disorders of personality & impulse control	1.02	1.10	*
DRG 884 - Organic disturbances & mental retardation	1.03	1.05	*
DRG 886 - Behavioral & developmental disorders	0.99	1.00	
DRG 887 - Other mental disorder diagnoses	0.92	1.23	*
DRG 894 - Alcohol/drug abuse or dependence, left AMA	0.97	0.87	*

Dependent Variable: Log per diem cost of a stay	Current Adjustment Factors (2004 model)	2018 Data Adjustment Factor	Sig. (.05)
DRG 895 - Alcohol/drug abuse or dependence w/rehabilitation therapy	1.02	0.90	
DRG 896 - Alcohol/drug abuse or dependence w/o rehabilitation therapy w MCC	0.88	0.96	
DRG 897 - Alcohol/drug abuse or dependence w/o rehabilitation therapy w/o MCC	0.88	0.94	
DRG 917 Poisoning & toxic effects to drugs w MCC	-	1.18	*
DRG 918 Poisoning & toxic effects to drugs w/o MCC	-	1.07	*
DRG 947 Signs & symptoms w MCC	1.07	1.09	
DRG 948 Signs & symptoms w/o MCC	1.07	1.03	
Current IPF PPS comorbidities			
Acute, Renal Failure	1.11	1.08	*
Chronic, Renal Failure	1.11	1.08	*
Chronic obstructive pulmonary disease	1.12	1.14	*
Coagulation factor deficits	1.13	1.05	
Developmental disabilities	1.04	1.04	
Drug and/or alcohol induced mental disorders	1.03	0.96	
Eating and conduct disorders	1.12	0.98	
Gangrene	1.10	1.07	*
Oncology Treatment	1.07	1.51	*
Poisoning	1.11	1.15	*
Severe musculoskeletal and connective tissue diseases	1.09	1.04	*
Severe protein calorie malnutrition	1.13	1.15	*
Tracheostomy	1.06	1.07	
Uncontrolled Diabetes-Mellitus with or without complications	1.05	1.07	*
Artificial Openings – Digestive and Urinary	1.08	1.07	*
Cardiac Conditions	1.11	1.05	*
Age of Patient			
age 45 to 54		1.02	*
age 55 to 59	1.04	1.05	*
age 60 to 64	1.07	1.08	*
age 65 to 69	1.10	1.09	*
age 70 to 79		1.11	*
age over 79 years	1.17	1.12	*
Length of Stay			
Length of Stay = 1	1.19	1.26	*
Length of Stay = 2	1.12	1.21	*
Length of Stay = 3	1.08	1.16	*
Length of Stay = 4	1.05	1.12	*
Length of Stay = 5	1.04	1.10	*
Length of Stay = 6	1.02	1.07	*
Length of Stay = 7	1.01	1.04	*
Length of Stay = 8	1.01	1.03	*

Dependent Variable: Log per diem cost of a stay	Current Adjustment Factors (2004 model)	2018 Data Adjustment Factor	Sig. (.05)
Length of Stay = 9	1.00	1.02	*
Length of Stay = 11	0.99	0.99	
Length of Stay = 12	0.99	0.98	*
Length of Stay = 13	0.99	0.97	*
Length of Stay = 14	0.99	0.97	*
Length of Stay = 15	0.98	0.97	*
Length of Stay = 16	0.97	0.97	*
Length of Stay = 17	0.97	0.96	*
Length of Stay = 18	0.96	0.97	*
Length of Stay = 19	0.95	0.95	*
Length of Stay = 20	0.95	0.94	*
Length of Stay = 21	0.95	0.94	*
Length of Stay >= 22	0.92	0.95	
Facility level Adjustors			
Rural	1.17	1.11	*
Log (Teaching Status)	0.5150	0.9486	*
Control Variables			
Occupancy less than 30%		0.79	*
Log occupancy Rate		0.65	*
ECT		1.26	*

The regression models we tested included an N of 272,442 IPF stays. The models fit the data quite well. According to the generated Goodness-of-Fit statistics, R-squared, 25% of the variance in the model dependent variables, respectively, were explained by the linear combination of the covariates (independent variables) entered in the regression (See Table 24).

Table 24: IPF PPS Regression Model Goodness-of-Fit Statistics

Dependent Variable: Log per diem cost of a stay	2018 Data (Weighted)
N	272,442
R-squared	0.25

CONCLUSION

The team, working collaboratively with CMS, reexamined and refined aspects of the IPF PPS regression model using the most recent available data. Various refinements to the methods and model were implemented during the analysis to increase the accuracy of the regression model to sufficiently account for variation in patient cost.

For this analysis, the team excluded stays from facilities that were found to have greater than or equal to 95% of stays with no ancillary charges. Stays from these IPFs were excluded from the cost regression analysis since data from these facilities were incomplete and deemed inadequate to capture variations in cost.

The team refined the exclusion criteria to produce the trimmed population to estimate the cost regression. The exclusion criteria reduced the total number of IPFs from 1,635 to 1,258. Some exclusions (e.g., facilities with ≥ 95% of stays with no ancillary charges) disproportionately removed certain types of facilities, therefore, we used weights to proportionally represent facility types and ownership types in the payment regression. Freestanding for-profit and government facilities received the greatest weights, as these facilities were dropped in greater proportion during the trimming process.

The team applied an alternative approach to smoothen the dependent variable, the natural log of per diem costs, and retain a greater number of stays. Total per diem costs were calculated for each stay as the sum of routine costs per day and ancillary costs per day. To address extreme cost-to-charge ratios, the team winsorized the distributions of ancillary cost

centers at the 2nd and 98th percentiles. The team also imputed cost-to-charge ratios to the calculated median value for each respective cost center if the cost-to-charge ratio was missing and there was a charge on the claim.

The regression analysis compared factors from 2018 MedPAR data to 2004 MedPAR data. Four factors changed significantly: MS-DRG 896, MS-DRG 887, comorbidity eating and conduct disorders, and comorbidity oncology. The increase in comorbidity oncology was attributed to a change in methodology. Diagnosis and procedure codes were used in the 2018 model while oncology codes alone were utilized in the 2004 model. The team produced unweighted and weighted regression estimates using the updated regression analysis derived from 2018 MedPAR claims files. In addition to the composition of MS-DRGs included in the model, coefficients changed meaningfully for several other MS-DRGs historically receiving an IPF PPS payment adjustment.

Examining MS-DRG frequencies informed an update to the MS-DRGs included in the payment regression model. MS-DRG codes that historically received a payment adjustment under the IPF PPS, 080 and 081 for nontraumatic stupor and coma with and without MCC, were excluded from the model and replaced with MS-DRG 947 and 948 (signs and symptoms w and w/o MCC). Additionally, MS-DRG 917 and 918 (poisoning and toxic effects to drugs w and w/o MCC) were added to the model given an increase in observed frequency within the IPF population.

Comorbidity flags were updated to ICD-10 definitions, however, the conditions included in the regression model did not change. More than three out of four stays did not include a comorbid condition, and when comorbid conditions did occur, beneficiaries were not likely to experience multiple comorbidities.

Rural IPFs saw the largest declines in estimated payments. The rural adjustment factor has been gradually trending downward over previous regression analyses. An examination of the composition of facilities found that the share of IPFs operating in rural settings has not changed from 2011 to 2018. Rural facilities were less sensitive to the exclusion of stays from facilities with greater than or equal to 95% of stays with no ancillary charges, suggesting that a greater share of urban facilities have greater numbers of stays with no documented ancillary charges. Data limitations existed that prevented a direct comparison between current IPF data and data used during the development of the IPF PPS. Further research and analyses may be required to better understand rural IPFs and care patterns in these facilities over time.

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