MILLIMAN REPORT

Kidney transplantation admissions in the Medicare fee-for-service population

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Milliman

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Executive summary

Chronic kidney disease (CKD) poses a substantial health burden globally, presenting a high economic cost to health systems and increasing the risk of cardiovascular morbidity, premature mortality, and decreased quality of life.[1] The Centers for Disease Control and Prevention (CDC) estimates that 36 million adults have CKD.[2] The progressive loss of kidney function in individuals with CKD may lead to end-stage kidney disease (ESKD) that results in the need for renal replacement therapy, defined as dialysis or kidney transplantation.[2] In 2021, there were about 800,000 individuals with ESKD in the U.S.[3] A kidney transplant is the preferred treatment for eligible patients with ESKD, improving both patient survival and quality of life as compared to dialysis and over time potentially reducing the total cost of medical care.[4,5] Medicare covers treatment of ESKD, including renal dialysis and kidney transplant services for individuals with ESKD.[6]

Milliman was commissioned by Sanofi U.S. to understand the economic implications of kidney transplants on U.S. hospitals and to summarize clinically relevant characteristics with hospital resource implications and hospital charges, estimated hospital internal costs, and Medicare fee-for-service (FFS) allowed costs for kidney transplant admissions. In the last five years, CMS has taken a number of steps to encourage kidney transplants in order to help improve the quality of life of beneficiaries with ESKD, including finalizing the End-Stage Renal Disease (ESRD) Treatment Choices (ETC) Model and revising the Medicare severity diagnosis related groups (MS-DRGs) that pay for kidney transplants under the Inpatient Prospective Payment System (IPPS).[7,8] Many individuals and organizations share CMS' interest in encouraging more kidney transplants, including patients, healthcare providers, health insurers, federal and state governments, and patient advocacy groups. Appropriate Medicare FFS payment to hospitals for kidney transplants is important to advancing this objective, as Medicare FFS is the primary payer for about half of all kidney transplants in the U.S.[18] This analysis provides insights for kidney transplant centers, clinicians, and other interested parties into financial metrics for Medicare FFS kidney transplant hospitalizations that help illustrate the appropriateness of the level of relative reimbursement for hospital kidney transplant admissions paid under the IPPS.

This report concentrated on admissions that were classified under the MS-DRGs specific to sole kidney transplant under Medicare's IPPS during fiscal years (FYs) 2021 and 2022. Fiscal years were defined using the federal fiscal year that begins October 1 and ends September 30.[9] The MS-DRGs analyzed were:

- 650: Kidney Transplant with Hemodialysis with Major Complication or Comorbidity (MCC)
- 651: Kidney Transplant with Hemodialysis without Major Complication or Comorbidity (MCC)
- 652: Kidney Transplant

Kidney transplant admissions were limited to those where Medicare FFS was the primary payer using inpatient claims from the Centers for Medicare and Medicaid Services (CMS) 100% Limited Data Set (100% LDS).[10] The LDS does not include encounters for beneficiaries enrolled in Medicare Advantage (MA).

This report examines several types of costs:

- Hospital internal cost includes service delivery costs that reflect the expenses incurred in the production of hospital services, such as wages, supplies, and utility costs. These costs are distinct from the specific amounts that hospitals receive as payments from the patient and/or payer.
- The Medicare FFS total allowed cost refers to the total amount that CMS sets under the IPPS for Medicare-participating providers and includes both the payer and patient pay amounts.
- Total adjusted allowed cost represents the total allowed cost under the IPPS excluding hospital-specific adjustments that are generally unrelated to care provided by hospitals specifically for patients admitted for kidney transplants. The total adjusted allowed cost excludes the indirect medical education (IME), disproportionate share (DSH), uncompensated care, and pass-through amounts from the total allowed cost. The sequestration amount is also removed since the hospital does not receive this portion of the total allowed cost. The impact of the wage index is not removed from the total adjusted allowed cost because all kidney transplants require some amount of labor.

In this analysis, we summarized at the national level clinically relevant characteristics with hospital resource implications and hospital charges, estimated hospital internal costs, and Medicare FFS allowed costs for kidney transplant admissions assigned to MS-DRGs 650, 651, and 652. Our objective was to describe the relationships among these metrics for Medicare FFS kidney transplant admissions, segmented by MS-DRG, based on the first and

second year of transplant hospital experience with the refined three MS-DRG structure initially adopted by CMS in FY 2021 for kidney transplants.[8]

We followed CMS IPPS methodology for setting MS-DRG relative weights, which uses the national average cost to charge ratios (CCRs) applied to hospital charges rather than hospital-specific CCRs to estimate hospital internal costs.[11] Readers should not draw conclusions about specific hospitals performing kidney transplants or kidney transplant hospitalizations reimbursed through other sources of health insurance coverage (e.g., commercial, Medicare Advantage) based solely on the information in this report without first considering the payment dynamics and different populations in each market that would be expected to influence the metrics reported. Hospital charges shown in this report do not represent the actual Medicare FFS total allowed costs for a kidney transplant admission.

Key findings from our analysis of Medicare FFS kidney transplant admissions include:

- 190 unique hospitals were represented in the kidney transplant admissions analyzed, making up about 6% of the hospitals paid by CMS under the IPPS. Fewer than 1% of those hospitals were located in rural geographic areas, and 96% were teaching hospitals.
- Hospitals performing kidney transplants were distributed across the U.S. census regions—defined by the U.S. Census Bureau as South (36%), Northeast (23%), Midwest (23%), West (17%).[12] Despite this distribution, a disproportionate share of kidney transplants were performed in the South (41%) and West (20%) census regions, suggesting that these regions conduct more transplants than their hospital distributions indicate. This variance could imply that hospitals in the South and West have some combination of having larger capacity for providing kidney transplants, serving larger populations, and/or providing services to populations with higher demands for such procedures in these areas, compared to the Northeast and Midwest.
- The majority of admissions for kidney transplants (almost two-thirds) were to MS-DRG 652, the MS-DRG that was assigned to patients who did not receive hemodialysis during their transplant admission. Medicare FFS total allowed cost per admission was higher for MS-DRGs 650 and 651 where hemodialysis was provided during the transplant admission. Other notable characteristics of the admissions by MS-DRG are shown in Figure 1.

FIGURE 1: HOSPITAL KIDNEY TRANSPLANT ADMISSION CHARACTERISTICS BY MS-DRG IN FYS 2021 AND 2022

	MS-DRG 650	MS-DRG 651	MS-DRG 652
Arithmetic Mean Length of Stay	8.0	6.3	5.1
Geometric Mean Length of Stay	6.8	5.8	4.6
% from Living Donor	4%	3%	24%
% with ICU Stay	34%	21%	27%

- Under the IPPS, the Medicare FFS total allowed costs per kidney transplant admission ranged as follows:
  - MS-DRG 650: $50,000 to $51,000
  - MS-DRG 651: $41,000 to $42,000
  - MS-DRG 652: $33,000 to $34,000
- The distributions of standardized billed charges and hospital internal costs by 19 hospital cost centers, calculated according to CMS' standard methodology, were similar.[11,13] The cost centers comprising the majority of standardized billed charges and hospital internal costs (i.e., 82% to 88%) were Drugs, Operating Room, Intensive Days, Routine Days, and Laboratory for all kidney transplant admissions analyzed, regardless of MS-DRG.
- For FYs 2021 and 2022, the ratio of average total adjusted allowed costs to hospital internal costs varied by MS-DRG. These findings suggest that, on average, reimbursement to hospitals for the cost of care related to

kidney transplants for Medicare FFS beneficiaries (where Medicare FFS is primary) as estimated by the CMS IPPS methodology is similar to the hospital internal costs for those transplants.

- MS-DRG 650: 0.99-1.00
- MS-DRG 651: 1.00
- MS-DRG 652: 0.95-0.97

- The hospital costs of organ acquisition are paid on a reasonable and necessary cost basis by CMS outside of the IPPS MS-DRG total allowed costs for the kidney transplant and make up a substantial amount of the hospital internal costs related to kidney transplantation.[14] Average organ acquisition billed charges on kidney transplant admission claims ranged from $121,000 to $138,000 in FYs 2021 and 2022.

Background

CKD is defined as the presence of kidney damage or an estimated glomerular filtration rate (eGFR) less than 60 ml/min/1.73 m^2, persisting for three months or more, regardless of the cause.[15] This disease poses a substantial health burden globally, presenting a high economic cost to health systems and increasing the risk of cardiovascular morbidity, premature mortality, and decreased quality of life.[1] The CDC estimates that 36 million adults, making up 14% of the U.S. adult population, have CKD.[2] The progressive loss of kidney function in individuals with CKD may lead to ESKD that results in the need for renal replacement therapy, defined as dialysis or kidney transplantation.[2] In 2021, there were about 800,000 individuals with ESKD in the United States.[3] A kidney transplant is the preferred treatment for eligible patients with ESKD, improving both patient survival and quality of life as compared to dialysis and over time potentially reducing the total cost of medical care.[4,5] Medicare covers treatment of ESKD, also known as end-stage renal disease (ESRD), including renal dialysis and kidney transplant services for individuals with ESRD.[6]

Currently, there are more than 100,000 patients on the national organ transplant waiting list, so expanding access to organ transplantation has been a growing priority of the Department of Health and Human Services (HHS) in recent years.[16] In 2021, there were more than 25,000 kidney transplants performed in the United States at 250 different kidney transplant centers out of the approximately 6,100 total hospitals (roughly 4%).[17,18,19] About 25% of those used transplanted kidneys from living donors, and Medicare FFS was the primary payer for about 49% of all kidney transplants.[18]

Under the IPPS, Medicare FFS currently covers most kidney transplant admissions through three specific MS-DRGs:

- 650: Kidney Transplant with Hemodialysis with Major Complication or Comorbidity
- 651: Kidney Transplant with Hemodialysis without Major Complication or Comorbidity
- 652: Kidney Transplant

According to the IPPS methodology, Medicare FFS assigns each inpatient admission to an MS-DRG based on patient characteristics, primarily the patient's clinical conditions and treatment strategies.[20] The Medicare FFS total allowed cost for the admission refers to the total amount that CMS sets under the IPPS for Medicare-participating providers and includes both the payer and patient pay amounts. The Medicare FFS total allowed cost for the discharge is based on a national base rate, adjusted for the MS-DRG relative weight and hospital-level characteristics.[20] The MS-DRG relative weight, as displayed in Figure 2, represents the average hospital internal cost of caring for admissions in a specific MS-DRG relative to the average internal hospital cost for all Medicare admissions.[21] Hospital internal costs are service delivery costs reflected in the expenses incurred in the production of hospital services, such as wages, supplies, and utility costs.[20] These costs are distinct from the specific Medicare FFS total allowed costs that hospitals receive as payments from the patient and/or payer.[20]

FIGURE 2: MS-DRGS AND WEIGHTS IN FYS 2021 AND 2022[22,23]

	FY	MS-DRG 650	MS-DRG 651	MS-DRG 652
Weights	**2021**	4.5131	3.6936	3.1819
	2022	4.5207	3.6984	3.1851

Under the IPPS, the formula used to calculate the Medicare FFS total allowed cost for a specific admission multiplies an individual hospital's base rate per case by the weight of the MS-DRG to which the admission is assigned.[21] Annually, CMS adjusts the MS-DRG classifications and relative weights based on analysis of claims data from two years prior to the fiscal year of the IPPS final rule to reflect changes in treatment patterns, technology, and any other factors that may change the relative use of hospital resources.[11]

In some of our analysis and metrics in this report, we also refer to the total adjusted allowed cost, which represents the total allowed cost under the IPPS excluding hospital-specific adjustments that are generally unrelated to care provided by hospitals specifically for patients admitted for kidney transplants. The total adjusted allowed cost excludes the following hospital-specific impacts:

- IME amount
- DSH amount
- Uncompensated care amount
- Pass-through amount
- Sequestration amount (which is a reduction to the Medicare FFS payer pay amount and is removed since the hospital does not receive this portion of the total allowed costs)

The impact of the wage index is not removed from the total adjusted allowed cost because all kidney transplants require some amount of labor. The total adjusted allowed cost is constructed to provide a point of comparison to the hospital internal cost.

The hospital internal cost for each Medicare FFS admission is estimated by applying national average CCRs published in the IPPS final rules for 19 cost center groupings to corresponding charges on the Medicare claim for each inpatient admission.[11] The national average CCRs are estimated by CMS from cost and charge information reported by hospitals on the Medicare cost reports, and they are used when setting the MS-DRG weights.[11] The charges on the Medicare claim for each inpatient admission are standardized for systematic differences in costs across hospitals, such as geographic differences in hospital wage levels and cost of living, teaching activities, and serving a disproportionate share of low-income patients.[11]

Prior to October 2020, CMS paid for most kidney transplants through a single MS-DRG (652).[24] In FY 2021, CMS introduced two new kidney transplant MS-DRGs (650 and 651), which resulted in higher total allowed costs for kidney transplant procedures with hemodialysis with or without MCCs.[8] Note that Medicare does not reimburse kidney transplant acquisition costs through the kidney transplant MS-DRGs but rather pays the hospital internal reasonable and necessary costs of organ acquisition as claimed through the Medicare hospital cost report filed by the hospital where the transplant was performed.[14]

Overview of data and analyses

We used 2021 and 2022 CMS 100% LDS files to analyze kidney transplant admissions where Medicare FFS was the primary payer.[10] We summarized the billed charges, estimated hospital internal costs (excluding organ acquisition costs), and Medicare FFS total allowed costs for kidney transplant discharges in FYs 2021 and 2022. Per CMS methodology (i.e., the term CMS methodology when used throughout this report means the IPPS methodology for setting MS-DRG relative weights), we converted billed charges reported on claims to standardized charges, removed statistical outliers, and further converted standardized charges to estimated hospital internal costs using national average CCRs, rather than hospital-specific CCRs.[11] We also summarized certain clinically relevant characteristics of the admissions that would be expected to impact the hospital internal costs of caring for patients: average length of stay (reporting both the arithmetic mean and geometric mean), proportion of admissions with intensive care unit (ICU) utilization, and proportion of admissions with a living donor kidney transplant.

Refer to the Data Sources and Methodology Details section of this paper for further information on these items.

Results

In FYs 2021 and 2022, we identified 21,491 hospital admissions for MS-DRGs 650 to 652 where Medicare FFS was the primary payer. On average, almost two-thirds of admissions for kidney transplant were to MS-DRG 652 where hemodialysis was not provided during the transplant admission, as displayed in Figure 3.

FIGURE 3: HOSPITAL KIDNEY TRANSPLANT ADMISSION DISTRIBUTION BY MS-DRG IN FYS 2021 AND 2022

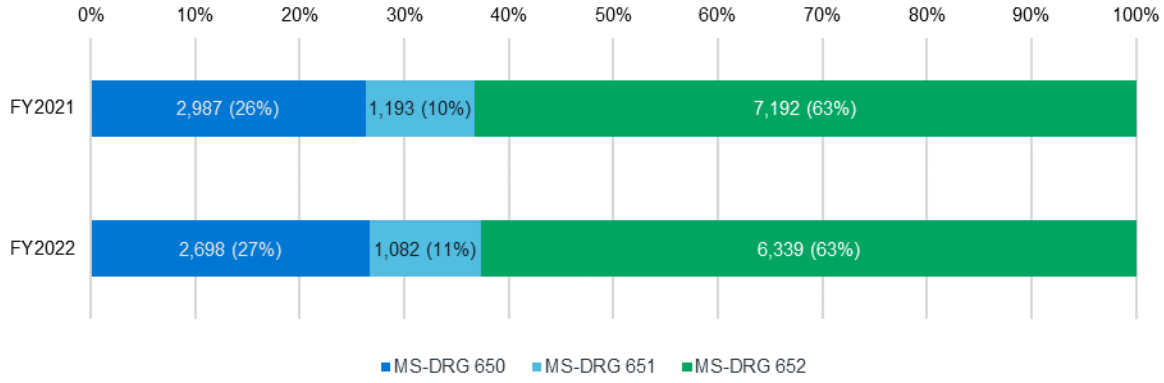
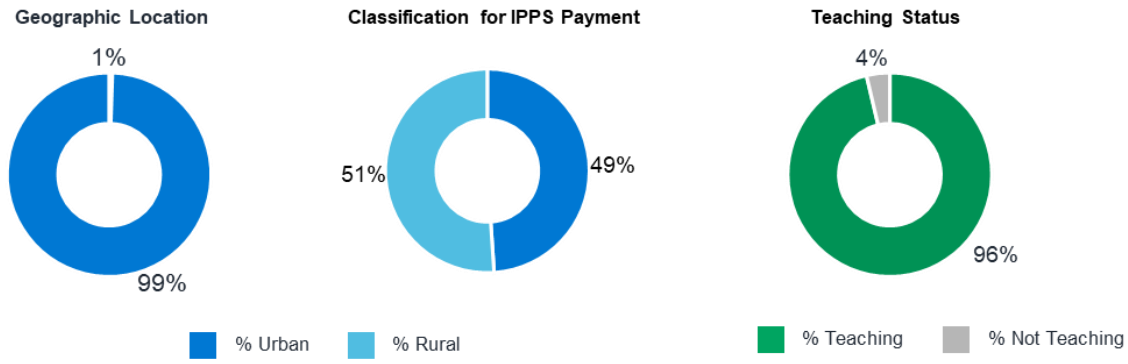


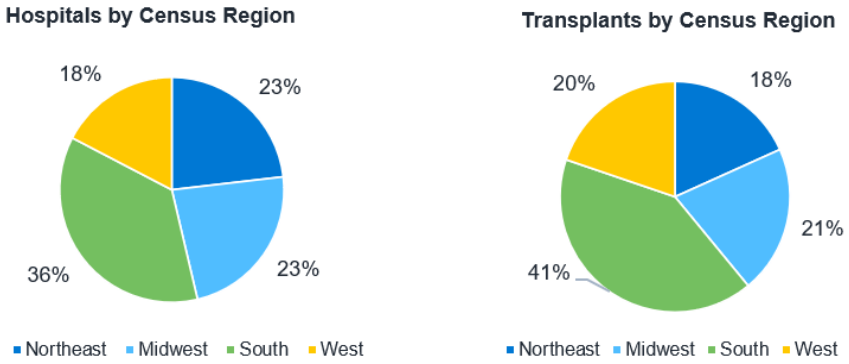
Figure 4 displays characteristics of the 190 unique hospitals where the 21,491 admissions for MS-DRGs 650 to 652 occurred. These hospitals made up about 6% of the hospitals paid by CMS under the IPPS. Fewer than 1% of these hospitals were located in a rural area, and only about 4% were not teaching hospitals in FY 2022. The average transplant hospital bed size was 638, and the proportion of hospitals classified as urban for IPPS payment was 49% in FY 2022. While geographic location placed 99% of transplant hospitals in urban settings and only 1% in rural, the distribution for IPPS payment showed a more balanced 51% of hospitals classified as rural and 49% as urban. Hospitals that classify as rural receive certain advantages under the IPPS, such as exemption from a 12% cap on Medicare disproportionate share hospital (DSH) amounts.[11]

FIGURE 4: TRANSPLANT HOSPITAL CHARACTERISTICS IN FYS 2021 AND 2022



Hospitals performing kidney transplants were distributed across census regions, with 36% in the South, 23% in both the Northeast and Midwest, and 17% in the West. However, the distribution of kidney transplants themselves showed a different pattern: 41% in the South, 21% in the Midwest, 20% in the West, and 18% in the Northeast. This variance between the location of transplant hospitals and the actual transplant procedures performed by region is shown in Figure 5.

FIGURE 5: HOSPITALS AND KIDNEY TRANSPLANTS BY CENSUS REGION IN FYS 2021 AND 2022



Note: Puerto Rico was grouped into the South census region.

Figures 6 and 7 display the average billed charges, standardized billed charges, and estimated hospital internal costs per hospital kidney transplant admission. Per CMS methodology, the billed charges on each claim were standardized to remove the effects of differences in area wage levels, IME and DSH amounts, and cost-of-living adjustments and were then used to estimate the hospital internal costs. Standardized billed charges were 21% to 27% lower than billed charges, while hospital internal costs were about 84% to 85% lower than billed charges. While hospitals report billed charges for kidney transplants, these amounts rarely reflect the actual amount that the hospital is reimbursed by the patient and/or payer for these services. We used the billed charges in this analysis to estimate hospital internal costs using CMS methodology.

FIGURE 6: AVERAGE BILLED CHARGE, STANDARDIZED BILLED CHARGE, AND HOSPITAL INTERNAL COST FOR KIDNEY TRANSPLANTS BY MS-DRG IN FY 2021

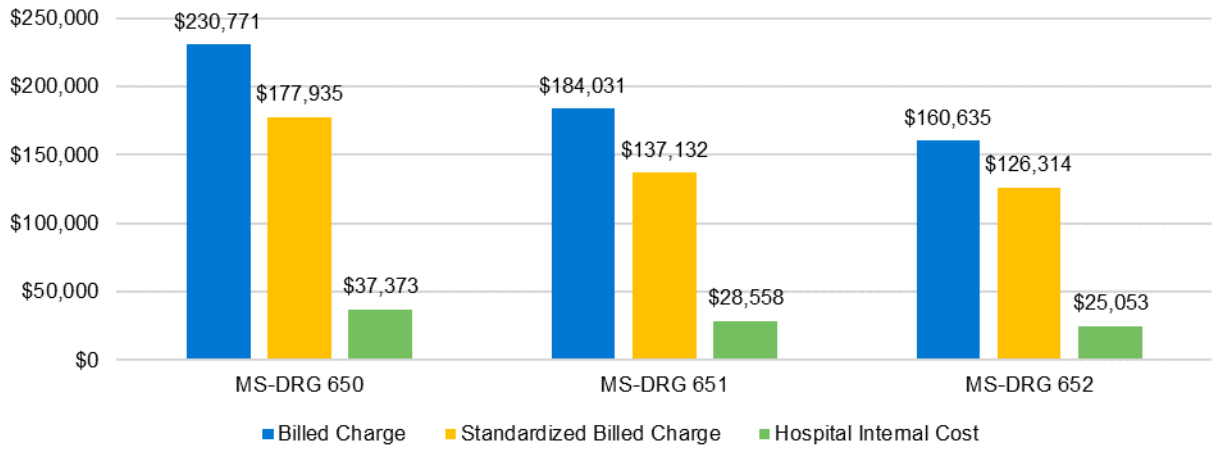
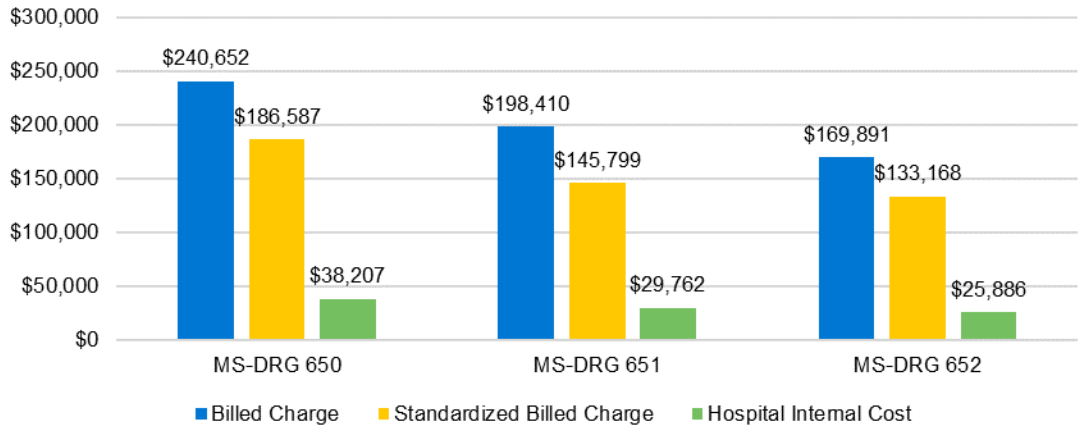
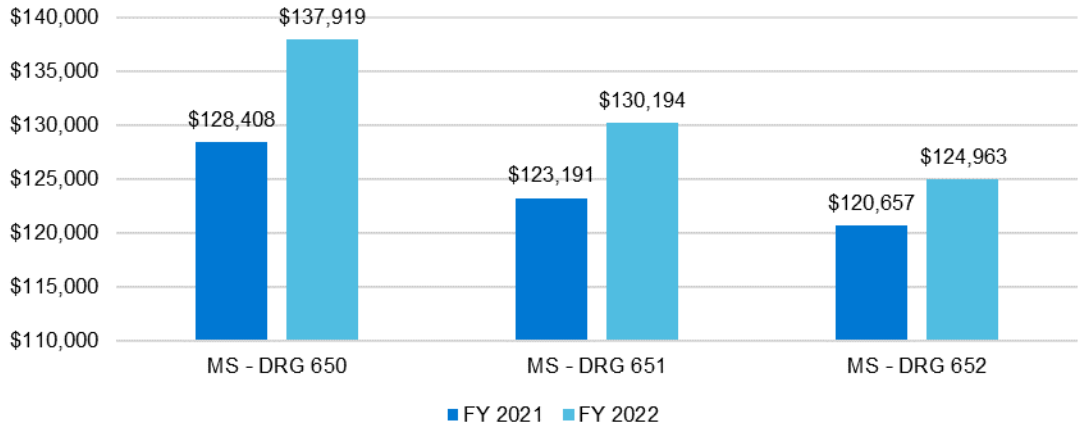


FIGURE 7: AVERAGE BILLED CHARGE, STANDARDIZED BILLED CHARGE, AND HOSPITAL INTERNAL COST FOR KIDNEY TRANSPLANTS BY MS-DRG IN FY 2022



Standard kidney acquisition charges are reported separately on kidney transplant claims under revenue codes 0811-0819. The hospital costs of kidney acquisition are paid by CMS outside of the IPPS MS-DRG total allowed costs for the kidney transplant.[14] Average organ acquisition billed charges on kidney transplant admission claims ranged from $121,000 to $138,000 in FYs 2021 and 2022, as displayed in Figure 8.

FIGURE 8: AVERAGE BILLED CHARGE FOR ORGAN ACQUISITON FOR KIDNEY TRANSPLANTS BY MS-DRG IN FYS 2021 AND 2022



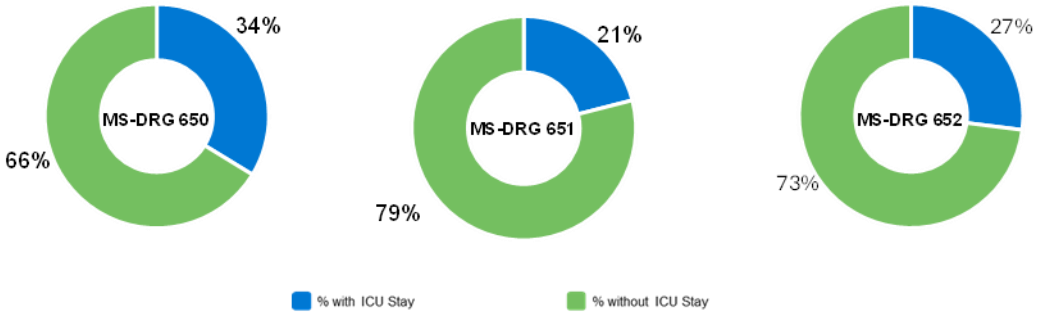
The hospitalization length of stay would be expected to impact the hospital internal resource costs used to care for kidney transplant patients and is a marker of patient complexity. Figure 9 shows the arithmetic and geometric mean lengths of stay for kidney transplant admissions. Note that as MS-DRG relative weight increased across MS-DRGs, the average length of stay also increased. This pattern holds true for both the arithmetic and the geometric mean lengths of stay.

FIGURE 9: HOSPITAL KIDNEY TRANSPLANT ADMISSION MEAN LENGTH OF STAY IN FYS 2021 AND 2022

	MS-DRG 650	MS-DRG 651	MS-DRG 652
FY 2022 MS-DRG Relative Weight	4.5207	3.6984	3.1851
Arithmetic Mean Length of Stay	8.0	6.3	5.1
Geometric Mean Length of Stay	6.8	5.8	4.6

ICU stays during admissions would also be expected to affect the hospital internal costs of caring for patients with kidney transplants because high-acuity ICU care requires greater hospital resources compared to routine hospital care. As displayed in Figure 10, admissions with an ICU stay ranged from 21% to 34% of all kidney transplant admissions for MS-DRGs 650 to 652. The MS-DRG with the largest percentage of admissions with ICU stays was MS-DRG 650, which had highest relative weight and represented admissions with hemodialysis and major complication and comorbidity (MCC).

FIGURE 10: PROPORTION OF HOSPITAL KIDNEY TRANSPLANT ADMISSIONS WITH ICU STAY BY MS-DRG IN FYS 2021 AND 2022



Living donor kidney transplants are the optimal treatment option for patients with ESKD, providing better patient and graft survival and quality of life than either dialysis or a deceased donor transplant.[25] On the other hand, deceased donor kidney transplant increases the risk of delayed graft function, which may require hemodialysis during the transplant admission and which, in turn, would be expected to increase the hospital internal cost of caring for these patients and impact the MS-DRG assignment. As displayed in Figure 11, a minority of kidney transplants in MS-DRGs 650 to 652 were from living donors (3% to 24%). MS-DRG 652 had the highest rate of kidney transplant admissions with organs transplanted from living donors, where these admissions did not include hemodialysis.

FIGURE 11: PROPORTION OF HOSPITAL KIDNEY TRANSPLANT ADMISSIONS WITH LIVING VERSUS DECEASED DONOR KIDNEYS BY MS-DRG IN FYS 2021 AND 2022

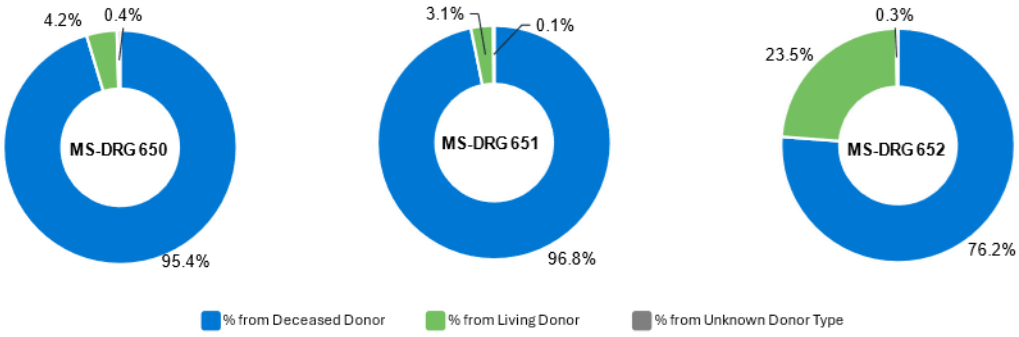


Figure 12 displays the hospital internal costs, Medicare FFS total allowed costs, and related amounts for kidney transplant MS-DRGs, segmented by adjustments made under the IPPS.

FIGURE 12: KIDNEY TRANSPLANT ADMISSION HOSPITAL INTERNAL COSTS, MEDICARE FFS TOTAL ALLOWED COSTS, AND RELATED AMOUNTS BY MS-DRG FOR FYS 2021 AND 2022

	MS - DRG 650		MS - DRG 651		MS - DRG 652	
DESCRIPTION OF AVERAGE	**FY 2021**	**FY 2022**	**FY 2021**	**FY 2022**	**FY 2021**	**FY 2022**
Total Allowed Cost	$49,960	$51,427	$40,503	$42,297	$33,013	$34,062
Indirect Medical Education (IME) Amount	$6,376	$6,698	$5,495	$5,986	$4,313	$4,565
Disproportionate Share (DSH) Amount	$1,393	$1,479	$1,119	$1,160	$968	$997
Uncompensated Care Amount	$1,314	$1,148	$1,461	$1,096	$1,362	$1,196
Outlier Amount	$4,343	$4,423	$1,298	$1,668	$998	$1,031
Pass-through Amount	$3,480	$3,794	$3,031	$3,219	$2,182	$2,441
Sequestration Amount	$0	$337	$0	$288	$0	$233
Geographically Adjusted Hospital-specific MS-DRG Weighted Base Amount including Minor Hospital Specific Adjustments	$31,662	$32,146	$26,765	$27,473	$21,859	$22,194
Beneficiary Cost-sharing Amount	$1,393	$1,402	$1,335	$1,407	$1,331	$1,405
Total Adjusted Allowed Cost *	$37,398	$37,972	$29,398	$30,548	$24,188	$24,630
Hospital Internal Cost	$37,373	$38,207	$28,558	$29,762	$25,053	$25,886

* Excludes IME amount, DSH amount, uncompensated care amount, pass-through amount, and sequestration amount

Beginning with the total allowed cost, the terms used in Figure 12 are defined below:

- **TOTAL ALLOWED COST**
  - The Medicare FFS total allowed cost refers to the total amount that CMS sets under the IPPS for Medicare-participating providers and includes both the payer and patient pay amounts.

Note that some of the adjustments in Figure 12 are not related to the specific care received by the patient during the admission (e.g., care related to a kidney transplant) but are part of the IPPS methodology CMS uses to reimburse hospitals for additional hospital-specific costs incurred in providing services to patients at the hospital:

- **INDIRECT MEDICAL EDUCATION (IME) AMOUNT[26]**
  - Hospitals that train residents receive these operating and capital IPPS amounts to offset the additional costs of patient care associated with medical education not otherwise accounted for under the IPPS.
- **DISPROPORTIONATE SHARE (DSH) AMOUNT[27]**
  - Hospitals that treat a disproportionate share of certain low-income patients receive these operating and capital amounts to offset the additional costs of treating these patients.
- **UNCOMPENSATED CARE AMOUNT[27]**
  - Each Medicare DSH hospital receives an uncompensated care amount from a fixed pool of dollars, referred to as the uncompensated care pool, based on its share of insured low-income days reported by all Medicare DSH hospitals.
- **PASS-THROUGH AMOUNT[28]**
  - This additional amount is meant to offset certain pass-through expenses that IPPS hospitals may incur, such as capital-related costs, direct medical education costs, kidney acquisition costs for hospitals that are renal transplant centers, and bad debts.

CMS may also reduce the Medicare FFS payer pay amount using sequestration:

- **SEQUESTRATION AMOUNT**
  - This includes mandatory reductions in Medicare FFS reimbursement.[29] Due to the COVID-19 public health emergency (PHE), the sequestration reduction was temporarily 0% in FY 2021. In FY 2022, the sequestration reduction was 0% for the first six months, 1% in the third quarter, and 2% in the fourth quarter.[30]

We define the amount of the total allowed costs remaining after the above adjustment amounts are removed as:

- **AVERAGE GEOGRAPHICALLY ADJUSTED HOSPITAL-SPECIFIC MS-DRG WEIGHTED BASE AMOUNT, INCLUDING MINOR HOSPITAL-SPECIFIC ADJUSTMENTS**[20]
  - After removing the above adjustments, this amount includes the residual amount associated with capital and operating IPPS amounts adjusted by the MS-DRG weight for the admission and by a geographic factor representing the wage level and cost-of-living differences with some minor hospital-specific adjustments applied. Examples of minor hospital-specific adjustments include reductions made for hospital acquired conditions and hospital readmissions, adjustments for value-based purchasing, New Technology Add-on Payments (NTAP), and additional amounts for which sole community hospitals qualify.
  - Note that hospitals in Maryland have a waiver from IPPS and instead participate in a CMS Innovation Center model where all payers pay the same rate for hospital services.[31] We are not able to identify the separate components of the IPPS total allowed costs for these hospitals.

For extremely long or expensive inpatient admissions meeting certain IPPS criteria, CMS includes an additional outlier amount:

- **OUTLIER AMOUNT**[32]
  - Medicare-participating hospitals receive operating and capital amounts in addition to the basic prospective amounts described above for cases incurring extraordinarily high costs. To qualify for an outlier amount, a case must have costs above a fixed-loss cost threshold amount.

Other amounts displayed in Figure 12 include:

- **BENEFICIARY COST-SHARING AMOUNT**[33]
  - Medicare Part A covers inpatient hospital care, and beneficiaries are responsible for paying a deductible for the benefit period (days 1 to 60) and thereafter a daily copay beginning with day 61 of the benefit period, subject to a lifetime maximum of days.
- **TOTAL ADJUSTED ALLOWED COST**
  - This adjusted cost represents the total allowed cost under the IPPS excluding hospital-specific adjustments that are generally unrelated to care provided by hospitals specifically for patients admitted for kidney transplants. The total adjusted allowed cost excludes the IME, DSH, uncompensated care, and pass-through amounts. The sequestration amount is also removed since the hospital does not receive this portion of the total allowed costs. The impact of the wage index is not removed from the total adjusted allowed cost because patients receiving kidney transplants require some amount of labor from employees at the hospital.
- **HOSPITAL INTERNAL COSTS**[20]
  - These costs are service delivery costs that reflect the expenses incurred in the production of hospital services, such as wages, supplies, and utility costs. These costs are distinct from the specific amounts that hospitals receive as payments from the patient and/or payer.

For FYs 2021 and 2022, Figure 12 displays the total allowed costs per kidney transplant admission, which ranged as follows:

- MS-DRG 650: $50,000 to $51,000
- MS-DRG 651: $41,000 to $42,000
- MS-DRG 652: $33,000 to $34,000

Hospital-specific adjustments for IME, DSH, uncompensated care, and pass-through amounts made up 25% to 27% of the total allowed costs. These adjustments are not directly related to inpatient care for the MS-DRG for the specific admission but are designed to compensate hospitals for the incremental costs they may incur compared to non-teaching hospitals or hospitals not serving a disproportionate share of low-income patients and to reimburse hospitals for other pass-through expenses. The hospital-specific adjustment amounts ranged as follows:

- MS-DRG 650: $12,500 to $13,100
- MS-DRG 651: $11,100 to $11,500
- MS-DRG 652: $8,800 to $9,200

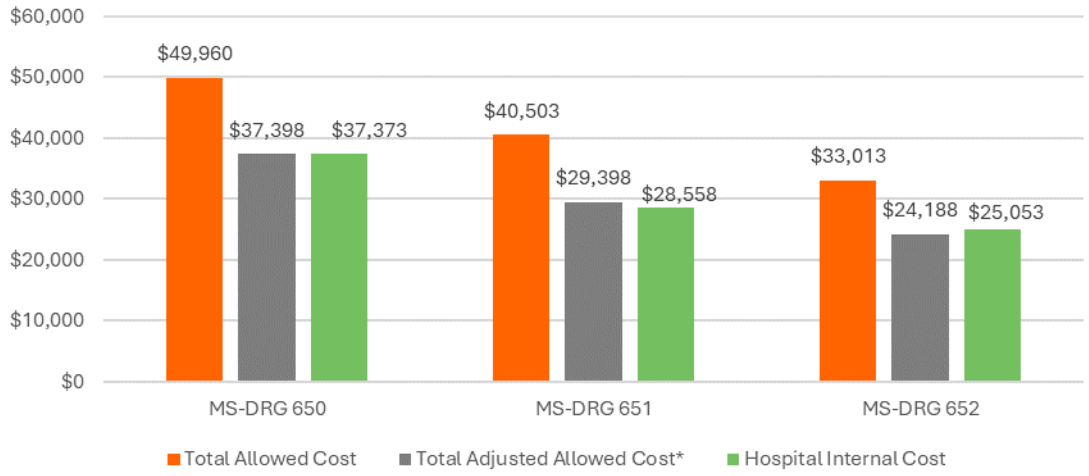
Outlier amounts, a component of the IPPS reimbursement methodology to help compensate hospitals for extremely high-cost admissions, contributed to the total allowed costs as follows:

- $1,000 to $4,400 per admission (including all admissions, not limited to those that received an outlier amount) as shown in Figure 12.
- The average outlier amount was about $21,100 for the 9% of transplants that qualified for an outlier amount.

Figure 12 also presents the average beneficiary cost-sharing amount (i.e., about $1,400) versus the amount that CMS was responsible for paying (i.e., $32,000 to $50,000 depending on the MS-DRG and year) for each kidney transplant admission.

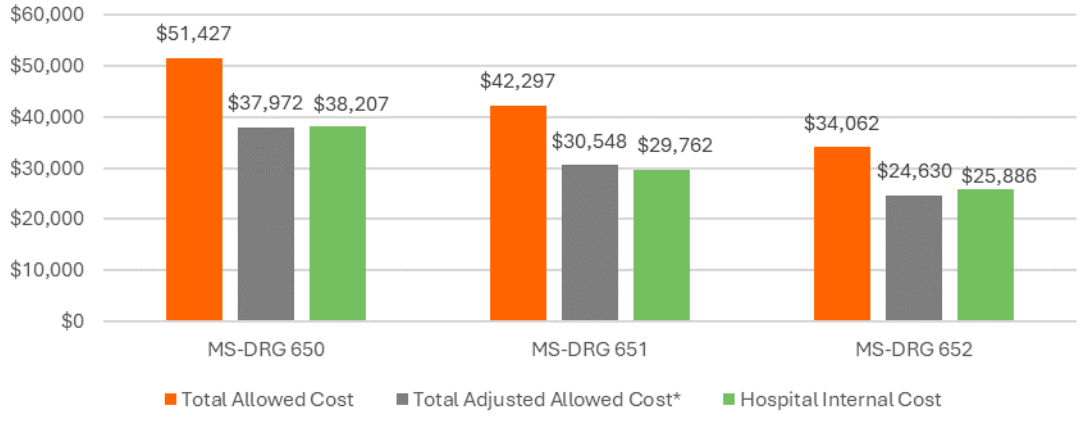
Figures 13 and 14 display the average total allowed cost, total adjusted allowed cost, and hospital internal cost per hospital kidney transplant admission. Total adjusted allowed cost (which excludes the IME, DSH, uncompensated care, pass-through, and sequestration amounts) to the hospital was 25% to 28% lower than total allowed cost, while hospital internal cost was about 24% to 30% lower than total allowed cost.

FIGURE 13: AVERAGE TOTAL ALLOWED COST, TOTAL ADJUSTED ALLOWED COST, AND HOSPITAL INTERNAL COST FOR KIDNEY TRANSPLANTS BY MS-DRG IN FY 2021



* Excludes IME amount, DSH amount, uncompensated care amount, pass-through amount, and sequestration amount

FIGURE 14: AVERAGE TOTAL ALLOWED COST, TOTAL ADJUSTED ALLOWED COST, AND HOSPITAL INTERNAL COST FOR KIDNEY TRANSPLANTS BY MS-DRG IN FY 2022

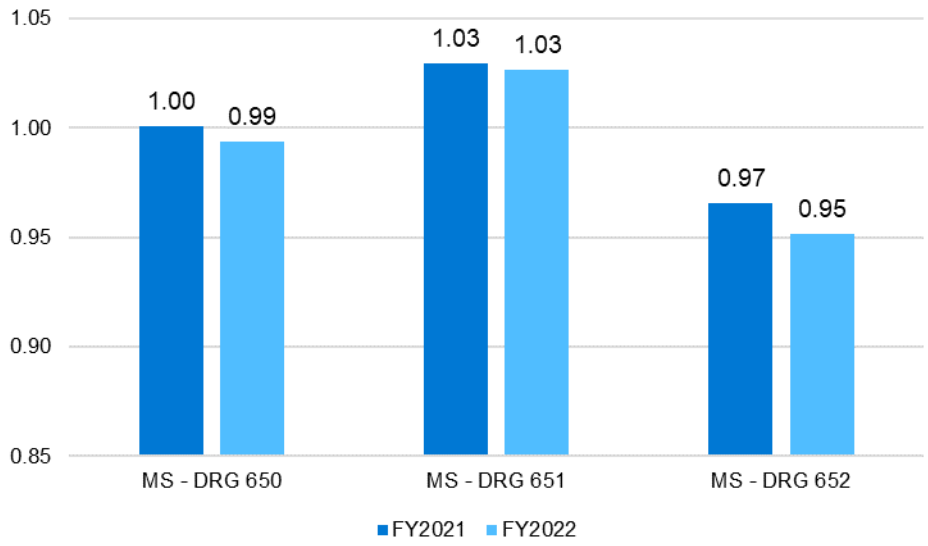


* Excludes IME amount, DSH amount, uncompensated care amount, pass-through amount, and sequestration amount

Figure 15A displays the total adjusted allowed-to-hospital internal cost ratio (termed the adjusted-allowed-to-cost ratio) for kidney transplant admissions. We used the total adjusted allowed cost to calculate the adjusted-allowed-to-cost ratio because it excluded the impact of many of the hospital-specific adjustments (e.g., IME, DSH, uncompensated care, and pass-through amounts) not specific to hospital care for kidney transplant admissions and the sequestration amount. This approach allowed the relativity of hospital reimbursement and internal costs among the kidney transplant MS-DRGs to be understood without being impacted by hospital-specific adjustments that could cause Medicare FFS total allowed costs for similar admissions to vary among individual hospitals based on other hospital characteristics that were generally unrelated to the specific kidney transplant admissions at those hospitals. The average adjusted-allowed-to-cost ratio for FYs 2021 and 2022 varied by MS-DRG:

- MS-DRG 650: 0.99-1.00
- MS-DRG 651: 1.03
- MS-DRG 652: 0.95-0.97

FIGURE 15A: AVERAGE RATIO OF TOTAL ADJUSTED ALLOWED COST TO HOSPITAL INTERNAL COST FOR KIDNEY TRANSPLANTS BY MS-DRG IN FYS 2021 AND 2022



Note: The numerator of the ratio is the adjusted allowed cost and the denominator of the ratio is the hospital internal cost, which are both listed in Figure 12.

Figure 15B displays the variation in the total adjusted-allowed-to-cost ratios across hospitals, which ranged from a 25th percentile value of 0.67 to a 75th percentile value of 1.36 across FYs 2021 and 2022 for MS-DRGs 650 to 652. Note that these total adjusted-allowed-to-cost ratios developed using the CMS methodology applicable to setting MS-DRG relative weights using national average CCRs to estimate hospital internal costs should not be interpreted as representing the true total adjusted-allowed-to-cost ratio for any hospital, which may have a substantially different true total adjusted-allowed-to-cost ratio based on their own hospital-specific CCRs.

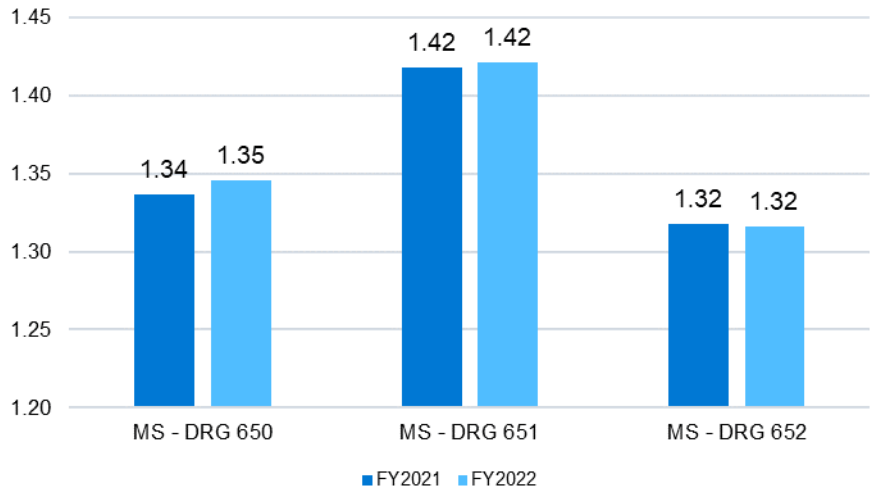
FIGURE 15B: VARIATION IN THE RATIO OF AVERAGE TOTAL ADJUSTED ALLOWED COST TO HOSPITAL INTERNAL COST FOR KIDNEY TRANSPLANTS BY MS-DRG IN FYS 2021 AND 2022

	MS - DRG 650		MS - DRG 651		MS - DRG 652	
Total Adjusted Allowed Cost to Hospital Internal Cost Ratio	**FY 2021**	**FY 2022**	**FY 2021**	**FY2022**	**FY2021**	**FY2022**
25th Percentile	0.74	0.78	0.67	0.70	0.69	0.70
Median	0.96	1.00	0.87	0.91	0.88	0.88
75th Percentile	1.35	1.36	1.21	1.28	1.24	1.22

Figure 16A displays the total allowed cost-to-hospital internal cost ratio (termed the allowed-to-cost ratio) for kidney transplant admissions. Unlike the adjusted-allowed-to-cost ratio above, this metric included the impact of the hospital-specific adjustments (e.g., area wage levels, IME and DSH amounts, and cost-of-living adjustments) as well as the sequestration amount. This approach allowed the relativity of total allowed costs and hospital internal costs among the kidney transplant MS-DRGs to be understood from the perspective of the total amount for which the hospital receives compensation under the IPPS in association with a kidney transplant admission before any adjustments or reductions. Note that the total allowed cost to the hospital is not intended by CMS to represent appropriate Medicare FFS amount for an individual kidney transplant admission but instead generally includes additional reimbursement to hospitals based on hospital characteristics not specifically related to any given admission (e.g., teaching). The allowed-to-cost ratio for FYs 2021 and 2022 varied by MS-DRG:

- MS-DRG 650: 1.34-1.35
- MS-DRG 651: 1.42
- MS-DRG 652: 1.32

FIGURE 16A: AVERAGE RATIO OF TOTAL ALLOWED COST TO HOSPITAL INTERNAL COST FOR KIDNEY TRANSPLANTS BY MS-DRG IN FYS 2021 AND 2022*



Note: The numerator of the ratio is the total allowed cost and the denominator of the ratio is the hospital internal cost, which are both listed in Figure 12.

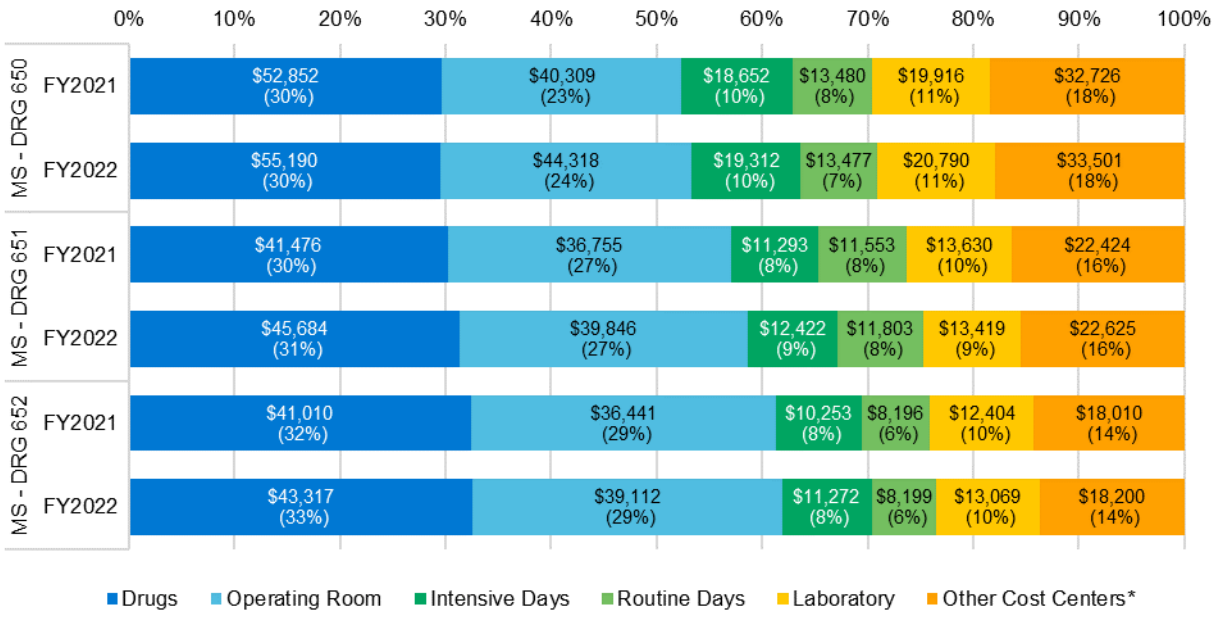
Figure 16B displays the variation in the total allowed-to-cost ratios across hospitals, which ranged from a 25th percentile value of 0.88 to a 75th percentile value of 1.92 across FYs 2021 and 2022 for MS-DRGs 650 to 652. Note that these total allowed-to-cost ratios were developed using hospital internal costs that were estimated using national average CCRs and should not be interpreted as representing the true total allowed-to-cost ratio for any hospital. The variation from the 25th and 75th percentiles (i.e., the interquartile range) was greater for the total allowed-to-cost ratio than for the total adjusted-allowed-to-cost ratio because the total allowed-to-cost ratio includes the impact of hospital-specific adjustments such as IME, DSH, uncompensated care, and pass-through amounts, which may vary significantly between hospitals and are not directly related to care for kidney transplant admissions.

FIGURE 16B: VARIATION IN THE RATIO OF AVERAGE TOTAL ALLOWED COST TO HOSPITAL INTERNAL COST FOR KIDNEY TRANSPLANTS BY MS-DRG IN FYS 2021 AND 2022

	MS - DRG 650		MS - DRG 651		MS - DRG 652	
Total Allowed Cost to Hospital Internal Cost Ratio	**FY 2021**	**FY 2022**	**FY 2021**	**FY2022**	**FY2021**	**FY2022**
25th Percentile	0.96	1.01	0.89	0.97	0.88	0.91
Median	1.27	1.33	1.18	1.26	1.24	1.21
75th Percentile	1.81	1.92	1.71	1.80	1.76	1.75

Figure 17 shows the distribution of standardized billed charges by hospital cost center. The Drugs cost center comprised the largest portion of the standardized billed charges (i.e., 30% to 33%) for MS-DRGs 650 to 652. The next largest category was the Operating Room cost center, which ranged from 23% to 29% of the standardized billed charges on the claims. The other top categories made up smaller percentages of the standardized charges and included Intensive Days, Routine Days, and Laboratory. The cost centers with less than 5% of standardized billed charges are grouped into the category Other Cost Centers and include Supplies & Equipment, Implantable Devices, Inhalation Therapy, Therapy Services, Anesthesia, Cardiology, Cardiac Catheterization, Radiology, MRIs, CT scans, Emergency Room, Blood and Blood Products, Labor and Delivery, and Other Services. In general, the distribution of standardized charges was reasonably consistent across MS-DRGs.

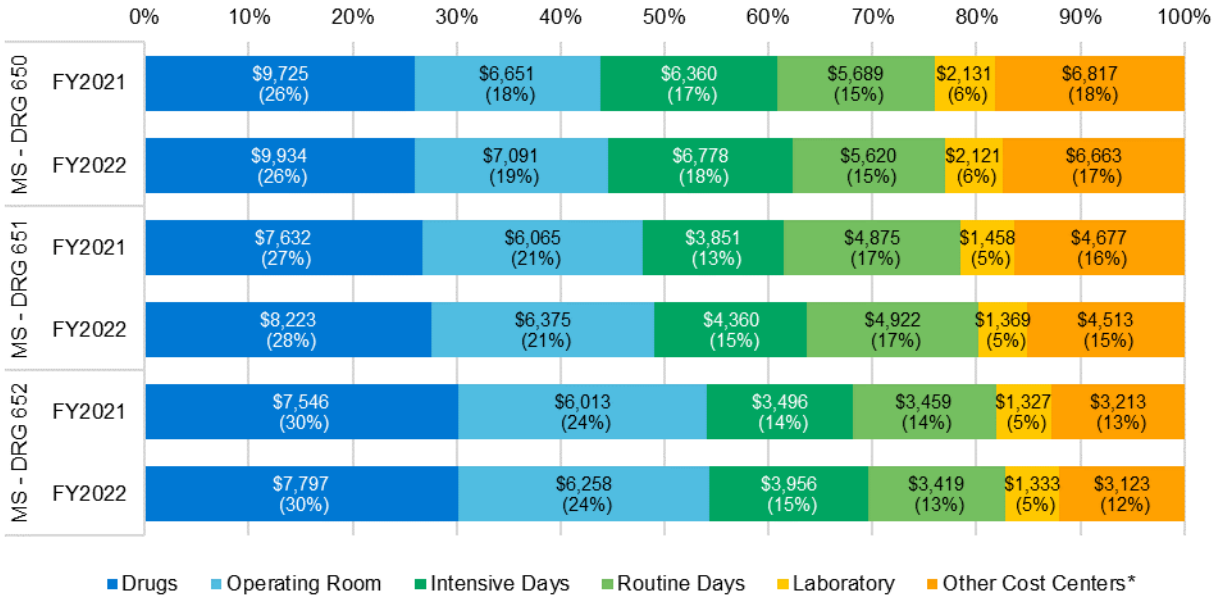
FIGURE 17: AVERAGE STANDARDIZED BILLED CHARGE WITHOUT STATISTICAL OUTLIERS BY COST CENTERS FOR KIDNEY TRANSPLANTS BY MS-DRG IN FYS 2021 AND 2022*



*In Figure 17, we grouped cost centers with less than 5% of standardized billed charges into the category Other Cost Centers.

Similarly, Figure 18 shows the distribution of hospital internal costs by hospital cost center for MS-DRGs 650 to 652. The distribution by cost center of hospital internal costs was similar to the cost center distribution of standardized billed charges, although we observed a decrease in the proportion of total hospital internal costs comprised of Drugs, Operating Room, and Laboratory cost centers and an increase in the proportion comprised of Intensive Days and Routine Days cost centers compared to the distribution of standardized billed charges. The Drugs cost center comprised the largest portion of the hospital internal costs (i.e., 26% to 30%). The next largest category was the Operating Room cost center, which ranged from 18% to 24% of the hospital internal costs on these claims. The other top categories made up a smaller percentage of the hospital internal costs and included Intensive Days, Routine Days, and Laboratory.

FIGURE 18: AVERAGE HOSPITAL INTERNAL COST WITHOUT STATISTICAL OUTLIERS BY COST CENTERS FOR KIDNEY TRANSPLANTS BY MS-DRG IN FYS 2021 AND 2022*



*In Figure 18, we grouped cost centers with less than 5% of hospital internal costs and the Other Services cost center (which represented more than 5% of the hospital's internal cost) into the category Other Cost Centers.

Specific insights and discussion

Since CMS revised the prior sole kidney transplant MS-DRG (652) to create three MS-DRGs (650 to 652) available for classifying sole kidney transplant admissions effective October 1, 2020, two years of Medicare FFS administrative claims data have become available. This allowed for analysis of kidney transplant admissions in FYs 2021 and 2022 under the revised MS-DRG structure in order to provide information on certain clinically relevant characteristics with hospital resource implications and hospital charge, estimated hospital internal cost, and Medicare FFS allowed cost metrics for kidney transplant admissions with and without hemodialysis.

Our analysis highlights the continued importance of the MS-DRG classification changes CMS adopted to create three kidney transplant MS-DRGs. We observed that the clinical characteristics, as well as charges, hospital internal costs, and total allowed costs for MS-DRGs 650 to 652, varied among the MS-DRGs. This underscores that CMS's annual updates to the MS-DRG classification system are important to maintaining an appropriate level of relative reimbursement for hospital admissions paid under the IPPS. The analysis provides kidney transplant centers, clinicians, patient advocacy groups, payers, federal and state governments, and other interested parties with information that furthers understanding of the appropriateness of the relative reimbursement for kidney transplant admissions paid under the IPPS.

MS-DRG DISTRIBUTION AND LENGTHS OF STAY

We found that for the more than 21,000 kidney transplants performed in FYs 2021 and 2022 where Medicare FFS was the primary payer, the majority (63% as shown in Figure 3) did not receive hemodialysis (i.e., MS-DRG 652). For the kidney transplant admissions that did receive hemodialysis, the average length of stay of the admission (both the arithmetic and geometric means) tended to be longer, and the charges and hospital internal costs were higher. The stable distribution of MS-DRGs across the two years suggests that there has been consistency in transplant hospitals' organ transplant care pathways and kidney transplant experiences since the kidney transplant MS-DRG classification changes were adopted.

GEOGRAPHIC DISTRIBUTION

The hospitals performing these kidney transplants were mostly urban (99%), and the large majority were teaching hospitals (96%). The largest percentage of hospitals that performed kidney transplants was in the South (36%)

census region, while the smallest percentage was in the West (17%). However, hospitals in these regions performed a disproportionate share of kidney transplants for Medicare FFS beneficiaries, 41% and 20% for the South and West census regions, respectively. This variance could imply that hospitals in the South and West have some combination of having larger capacity for providing kidney transplants, serving larger populations, and/or providing services to populations with higher demands for such procedures in these areas, compared to the Northeast and Midwest. As stated previously, Medicare FFS was the primary payer for about half of kidney transplants performed in 2021.[18] To understand the full financial impact of kidney transplant admissions on hospitals that provide these transplants, payments from other payers would need to be considered.

CHARGE AND COST VARIATION BY MS-DRG

In FYs 2021 and 2022, hospital charges and estimated hospital internal costs varied substantially by MS-DRG, and the average organ acquisition charge on kidney transplant admission claims ranged from $121,000 to $138,000. The hospital internal cost related to organ acquisition is paid by CMS outside of the IPPS based on the hospital internal cost determined at the Medicare hospital cost report settlement.[14] The hospital internal cost related to organ acquisition makes up a substantial amount of the total hospital internal cost associated with kidney transplantation, and this hospital internal cost for organ acquisition is paid by Medicare at the hospital internal cost claimed through the Medicare hospital cost report, in addition to the Medicare total allowed cost for the MS-DRG for the admission.

The charging practices and hospital internal costs may vary widely among hospitals and over time. Hospital internal costs are likely to be most accurately estimated for an individual hospital by multiplying its claim charges by that hospital's specific CCRs as calculated from the hospital's Medicare cost report. Therefore, the estimated hospital internal costs in this report should be considered estimated averages based on CMS methodology for calculating hospital internal costs using national average CCRs (i.e., not hospital-specific CCRs) to set the MS-DRG relative weights. The findings from our analysis are not indicative of any individual hospital's charging practices or internal costs for kidney transplant admissions.

ADJUSTED-ALLOWED-TO-COST RATIO

According to the Medicare Payment Advisory Commission (MedPAC), across all inpatient admissions Medicare pays IPPS hospitals less than 100% of their estimated hospital internal costs. For example, in 2021 Medicare payment to IPPS hospitals was 8.3% below hospitals' internal costs in aggregate, exclusive of federal relief funds.[34] In addition, some reimbursement to hospitals for inpatient admissions comes from the IPPS beneficiary cost-sharing amount by the beneficiary or another payer. Using the adjusted-allowed-to-cost ratio reported in our analysis as an estimate of payments specific to kidney transplant admissions (which removes the impact of hospital-specific adjustments such as DSH, IME, uncompensated care, and pass-through amounts, as well as the sequestration amount) in relationship to hospital internal costs, MS-DRGs 650 to 652 had an adjusted-allowed-to-cost ratio ranging from 0.95 to 1.03. These findings suggest that, on average, reimbursement to hospitals for kidney transplants for Medicare FFS beneficiaries (where Medicare FFS is primary) is similar to the hospital internal costs for those transplants. For those hospitals that receive Medicare payment adjustments that contribute to their total allowed costs for admissions, including kidney transplants (e.g., IME, DSH), payments on average exceed hospital internal costs for kidney transplant admissions by 20% to 30%.

ALLOCATIONS BY COST CENTER

In their MS-DRG cost estimation methodology, CMS segments the estimated hospital internal costs for admissions into 19 different cost centers. We found that the highest proportion of estimated hospital internal costs for kidney transplants was associated with the Drug cost center for all three MS-DRGs 650 to 652 and the next highest proportion with the Operating Room cost center. The other top categories made up smaller percentages of the estimated hospital internal costs and included Intensive Days, Routine Days, and Laboratory. These findings may have been driven partially by the impact of high-cost pharmaceutical treatments and laboratory testing associated with preparation for the transplant as well as the actual operating room costs to perform the surgery and aftercare given to the patient during recovery.

ANALYSIS LIMITATIONS AND POTENTIAL VARIATIONS IN RESULTS

There are several limitations of this analysis and potential variation in results from this analysis that should be kept in mind when reviewing the results:

- The financial information, arithmetic and geometric mean lengths of stay, and hospital transplant admission characteristics summarized in this report were at a national level, so results for specific hospitals cannot be inferred.
- Average billed charge in this report refers to the amount billed, which does not reflect the actual Medicare FFS amount set under the IPPS for the admission. Actual hospital charges may differ due to geographic area, cost-of-living, teaching hospital status, and being a disproportionate share hospital, as well as other factors.
- Average standardized charge in this report refers to billed charges adjusted for differences in area wage levels, IME and DSH amounts, and cost-of-living adjustments using factors from the FY 2021 and 2022 IPPS final rule impact files.[35, 36] Factors based on a different IPPS policy for a different FY (as reflected in a final rule for a different FY) would change the results.
- Average hospital internal cost in this report refers to standardized billed charges converted to costs using national average CCRs published by CMS. The national average CCRs were sourced from the FY 2023 and 2024 final rules, as these were the national average CCRs that CMS used for analysis of FYs 2021 and 2022 claims date, respectively.[37,38] Estimated hospital internal costs for individual hospitals may differ due to differences in the hospital-specific CCRs calculated from the hospital's own Medicare cost report compared to the national average CCRs. Therefore, conclusions should not be drawn regarding internal hospital costs for specific hospitals performing kidney transplants.
- Average total allowed cost in this report refers to the total amount that CMS sets under the IPPS for Medicare-participating providers and includes both the payer and patient pay amounts. Actual hospital reimbursement may differ due to missing or erroneous claim information or adjustments made to claims after adjudication that were not captured in the data set.
- We only considered kidney transplant admissions to MS-DRGs 650 to 652. Results may vary for kidney transplants reimbursed by Medicare FFS admissions to other MS-DRGs.
- We identified clinical characteristics of the kidney transplant admissions using revenue codes and admission and discharge dates on the administrative medical claims from the 100% LDS.[10] Any data discrepancies in the administrative claims compared to the electronic medical record (EMR) for the patients receiving kidney transplants may cause results to vary.

Data source and methodology details

DATA SOURCES

CMS 100% Limited Data Set (100% LDS)[10]

The CMS 100% LDS contains a Medicare eligibility file and all Medicare FFS claims for Medicare Parts A and B (excluding professional and durable medical equipment claims). The LDS does not include encounters for beneficiaries enrolled in Medicare Advantage (MA). Available information includes county of residence, diagnosis codes, procedure codes, MS-DRG codes, site-of-service information, beneficiary age, eligibility status, and an indicator for HMO enrollment. For this report, our analysis summarized claims with discharge dates ranging from October 2020 to September 2022 per CMS' definition for a given IPPS FY.[9]

FY 2021 and FY 2022 IPPS Final Rule Impact Files[35,36]

Tables published with the FY 2021 and FY 2022 IPPS final rules and correction notices were used to obtain wage indexes, geographic adjustment factors, applicable cost-of-living adjustments, and other relevant hospital-specific factors. The factors from these published tables were used to standardize hospital charges according to CMS methodology.

FY 2014 IPPS Final Rule[39]

A crosswalk of revenue codes reported on inpatient medical claims mapped to inpatient hospital cost centers reported in the Medicare hospital cost reports was published in the FY 2014 final rule, and this is the most recent known source. This crosswalk was used in our analysis to report standardized billed charges and hospital internal costs by hospital cost center.

FY 2023 and FY 2024 IPPS Final Rules[37,38]

The FY 2023 and FY 2024 IPPS final rules were used to obtain national average CCRs. The data underlying the FY 2023 and 2024 final rule tables were hospital cost reports pertaining to FYs 2021 and 2022 reporting periods, respectively.

DETAILED METHODOLOGY

Figure 19 summarizes the CMS methodology and steps we used in developing our analysis.[11]

FIGURE 19: METHODOLOGY STEPS

STEP 1	STEP 2	STEP 3	STEP 4
Identified claims with kidney transplant admissions where Medicare FFS was the primary payer and summarized billed charges. Removed charges related to organ transplant acquisition.	Standardized charges by removing the impact of the wage index, cost-of-living, IME, and DSH as well as removed statistical outliers.	Grouped standardized charges by revenue code.	Mapped revenue codes to the 19 hospital inpatient cost centers and applied national average cost-to-charge ratios to convert standardized billed charges to hospital internal costs.

IPPS KIDNEY TRANSPLANT ADMISSIONS

We used two years of medical claims data (FYs 2021 and 2022) from the 100% LDS with admission dates between October 2020 through September 2022. We identified kidney transplant admissions, where Medicare FFS was the primary payer, using ICD-10-PCS procedure codes for kidney transplants. To identify claims where Medicare FFS was the primary payer, we filtered the NCH_PRMRY_PYR_CD field for values of M, N, or blank and on the CLM_MDCR_NON_PMT_RSN_CD for values of B or blank.[40,41] We limited our analysis to admissions where Medicare FFS was the primary payer in order to remove claims where the Medicare FFS total allowed costs might not be complete due to other payers' amounts for which we did not have complete information. We retained only kidney transplant admissions reimbursed through MS-DRGs 650-652 for the analysis to create a more homogeneous population that included about 97% of the kidney transplants paid by Medicare FFS.

TRANSPLANT HOSPITAL CHARACTERISTICS

The FY 2022 impact file was used to characterize hospitals by geographic location, rural classification for IPPS payment, and teaching status.[36] For geographic location, we identified hospitals as rural using values in the URGEO field.[36] For IPPS payment, we identified hospitals as rural using the URSPA field.[36] To assign teaching status to hospitals, we used the fields TCHOP and TCHCP, where a value different from 0 in either of these fields characterized a hospital as teaching.[36]

We estimate the proportion of hospitals performing kidney transplants where Medicare FFS is the primary payer using the number of hospitals included in the FY 2022 impact file. Of these, 190 hospitals, out of the 3,269 included in the FY 2022 impact file, performed kidney transplants where Medicare FFS was the primary payer, representing roughly 6% of the total U.S. hospitals.

ORGAN ACQUISITION CHARGES

Organ acquisition charges were identified using the following revenue codes:

- 0810 - General
- 0811 - Living donor
- 0812 - Cadaver donor
- 0813 - Unknown donor
- 0814 - Unsuccessful organ search - donor bank charges
- 0815 - Stem cells – allogeneic
- 0819 – Other

We removed the organ acquisition charge when we summarized average billed charge, standardized billed charge, and internal hospital cost, since organ acquisition is reimbursed by CMS outside of the MS-DRG.[14]

We used the organ acquisition revenue codes to identify the donor types as one of the transplant admission characteristics.

STANDARDIZED BILLED CHARGES

Per CMS methodology, the billed charges on each claim were standardized to remove the effects of differences in area wage levels, IME and DSH amounts, and cost-of-living adjustments. Factors from the FYs 2021 and 2022 IPPS impact files were applied to FYs 2021 and 2022 data, respectively.[35,36]

REMOVED STATISTICAL OUTLIERS

Per CMS methodology, statistical outliers were eliminated by removing all cases that fell beyond ±3.0 standard deviations from the geometric mean of the log distribution of both the total standardized billed charges per case and the total standardized billed charges per day for each MS–DRG.[11] On average, about 0.4% of transplants were found to be statistical outliers, ranging from 0.2% to 0.5% by MS-DRG.

MAPPED REVENUE CODES TO COST CENTERS

We mapped revenue codes to hospital cost centers using the crosswalk of revenue codes reported on inpatient medical claims to cost centers reported in hospital cost reports as published in the FY 2014 final rule.[39] The CMS hospital cost centers used under the CMS methodology for establishing MS-DRG relative weights are Routine Days, Intensive Days, Drugs, Supplies & Equipment, Implantable Devices, Inhalation Therapy, Therapy Services, Anesthesia, Operating Room, Cardiology, Cardiac Catheterization, Laboratory, Radiology, MRIs, CT scans, Emergency Room, Blood and Blood Products, Labor and Delivery, and Other Services.

CONVERTED STANDARDIZED BILLED CHARGES TO ESTIMATED INTERNAL HOSPITAL COSTS

We grouped the standardized billed charges without statistical outliers by cost center and multiplied by the applicable national average CCRs to estimate hospital internal costs.[37,38]

TRANSPLANT ADMISSION CHARACTERISTICS

We defined three transplant admission characteristics as detailed below:

1. ICU stays were identified using the following revenue codes:
    - 0200 – General
    - 0201 – Surgical
    - 0202 – Medical
    - 0203 – Pediatric
    - 0204 – Psychiatric
    - 0207 – Burn Care
    - 0208 – Trauma
    - 0209 – Other
    - 0233 – ICU
2. As mentioned in the organ acquisition section, living donor kidney transplants were identified using revenue code 0811 (Acquisition of Body Components, Living Donor), which specifies the donor type for reporting hospital charges for organ acquisition. When revenue code 0811 was observed with other 08x revenue codes, or if an admission only had 08x revenue codes other than 0811 and 0812, the transplant donor type was identified as Unknown Donor Type.
3. Length of stay was calculated based on the number of days between the claim's admit date and discharge date, inclusive. We calculated the average length of stay, reporting both the arithmetic and geometric mean lengths of stay.

HOSPITAL INTERNAL COST, TOTAL ALLOWED COST, AND RELATED AMOUNTS

The average hospital internal cost and Medicare FFS total allowed cost and a breakdown of the average hospital IPPS hospital-specific adjustments, sequestration, and beneficiary cost-sharing were summarized using fields available in the 100% LDS, including:[42]

- CLM_PMT_AMT
- CLM_PASS_THRU_PER_DIEM_AMT
- CLM_UTLZTN_DAY_CNT
- CLM_PPS_CPTL_IME_AMT

- CLM_PPS_CPTL_DSPRPRTNT_SHR_AMT
- NCH_BENE_IP_DDCTBL_AMT
- NCH_BENE_PTA_COINSRNC_LBLTY_AM
- NCH_BENE_BLOOD_DDCTBL_LBLTY_AM
- CLM_UNCOMPD_CARE_PMT_AMT
- NCH_DRG_OUTLIER_APRVD_PMT_AMT
- FINL_STD_AMT
- Value Code 73 for Sequestration
- Value Code 18 for Operating DSH amount
- Value Code 19 for Operating IME amount

This report examines several types of cost which are defined here:

- Hospital internal cost includes service delivery costs that reflect the expenses incurred in the production of hospital services, such as wages, supplies, and utility costs. These costs are distinct from the specific amounts that hospitals receive as payments from the patient and/or payer.
- The Medicare FFS total allowed cost refers to the total amount that CMS sets under the IPPS for Medicare-participating providers and includes both the payer and patient pay amounts.
- Total adjusted allowed cost represents the total allowed cost under the IPPS excluding hospital-specific adjustments that are generally unrelated to care provided by hospitals specifically for patients admitted for kidney transplants. The total adjusted allowed cost excludes the IME, DSH, uncompensated care, and pass-through amounts. The sequestration amount is also removed since the hospital does not receive this portion of the total allowed costs. The impact of the wage index is not removed from the total adjusted allowed cost because all kidney transplants require some amount of labor.

ALLOWED-TO-COST AND ADJUSTED-ALLOWED-TO-COST RATIOS

The adjusted-allowed-to-cost ratio was calculated by dividing the total adjusted allowed cost by the estimated hospital internal cost for each MS-DRG. We used the total adjusted allowed cost because it is based on the total allowed cost for the admission (e.g., kidney transplant) but with sequestration and hospital-specific adjustments such as IME, DSH, uncompensated care, and pass-through amounts removed. This ratio provides an appropriate comparison to the hospital internal costs calculated from the standardized charges, which also had the hospital-specific and geographic adjustments removed. We did not remove the wage index impact from the total adjusted allowed cost because all kidney transplants require some amount of labor. This approach allowed the relativity of hospital reimbursement and internal costs among the kidney transplant MS-DRGs to be understood without being impacted by hospital-specific adjustments that could cause Medicare FFS total allowed costs for similar admissions to vary among individual hospitals based on other hospital characteristics that were generally unrelated to the specific kidney transplant admissions at those hospitals.

The allowed-to-cost ratio for kidney transplant admissions was calculated by dividing the total allowed cost by the estimated hospital internal cost for each MS-DRG. Unlike the adjusted-allowed-to-cost ratio, this metric includes the impact of the hospital-specific adjustments (e.g., IME, DSH, uncompensated care, and pass-through amounts) as well as the sequestration amount. This approach allowed the relativity of total allowed costs and hospital internal costs among the kidney transplant MS-DRGs to be understood from the perspective of the total amount for which the hospital receives compensation under the IPPS in association with a kidney transplant admission. This ratio was not intended to show hospital reimbursement specifically for the cost of care for kidney transplant admissions.

Caveats and limitations

This report was commissioned by Sanofi U.S. The findings and conclusions reflect the opinion of the authors; Milliman does not endorse any product or organization. If this report is reproduced, it should be reproduced in its entirety as sections taken out of context can be misleading. Milliman does not intend to benefit any third-party recipient of its work product.

Our analysis is based on Medicare eligibility and inpatient hospital claims present in the administrative claims database specified in the Data Sources and Detailed Methodology section of this report. We did not audit the data. Results for a specific hospital may vary substantially from the average characteristics of transplant admissions

presented in this report due to local practice patterns, area wage levels, cost-of-living adjustments, and other factors. Analyses from different years, different data sources, or using different methodologies may produce different results.

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As with any analysis, it is not possible to capture all factors that may be significant. No algorithms for identifying characteristics of admissions such as ICU stays and deceased donor organs are perfect, and we relied only on the information available in claims data, without reference to medical records.

Two of the authors, Dagny Grillis and Hanaa Siddiqi, are members of the American Academy of Actuaries and meet its qualification standards for this work.

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Appendix

This appendix includes six histograms that display the distribution of standardized billed charges, total allowed costs, and estimated hospital internal costs. The billed charges and total allowed costs were identified using fields in the LDS for each kidney transplant admission. However, the hospital internal costs are not included in the LDS. Those values were estimated according to CMS methodology by applying national CCRs to the standardized billed charges.

Figures A1 through A6 show the variation in standardized billed charges, total allowed costs, and estimated hospital internal costs for each MS-DRG and fiscal year. These are not necessarily reflective of the billed charges, allowed costs, or internal costs for any specific hospital, and readers should use caution when drawing any conclusions from these figures.

FY 2021

FIGURE A1: DISTRIBUTION OF STANDARDIZED BILLED CHARGES, TOTAL ALLOWED COSTS, AND HOSPITAL INTERNAL COSTS FOR KIDNEY TRANSPLANTS ASSIGNED TO MS-DRG 650 IN FY 2021

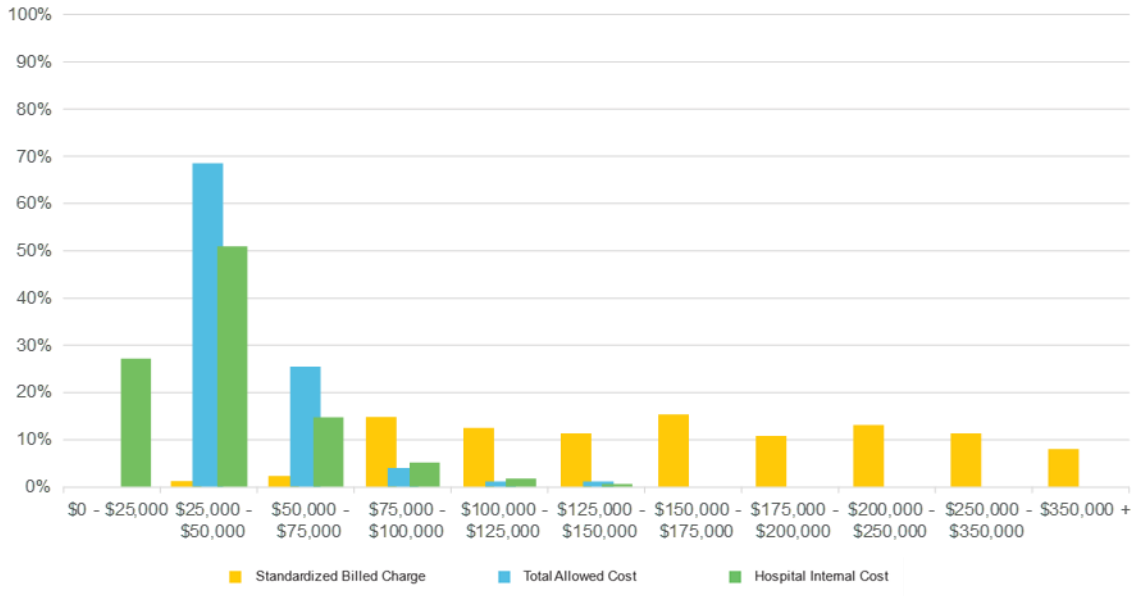


FIGURE A2: DISTRIBUTION OF STANDARDIZED BILLED CHARGES, TOTAL ALLOWED COSTS, AND HOSPITAL INTERNAL COSTS FOR KIDNEY TRANSPLANTS ASSIGNED TO MS-DRG 651 IN FY 2021

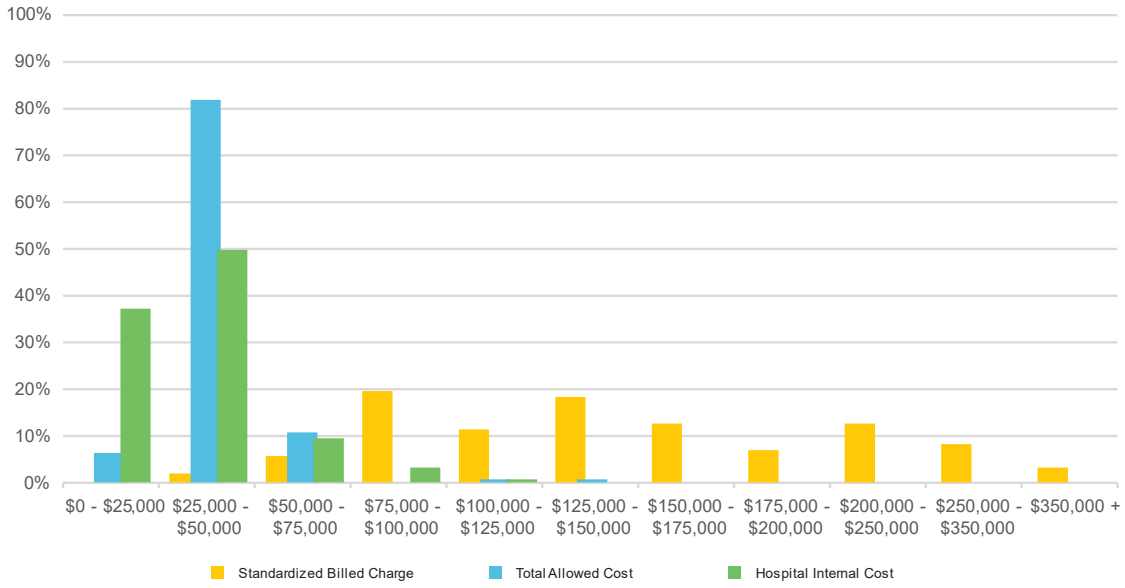
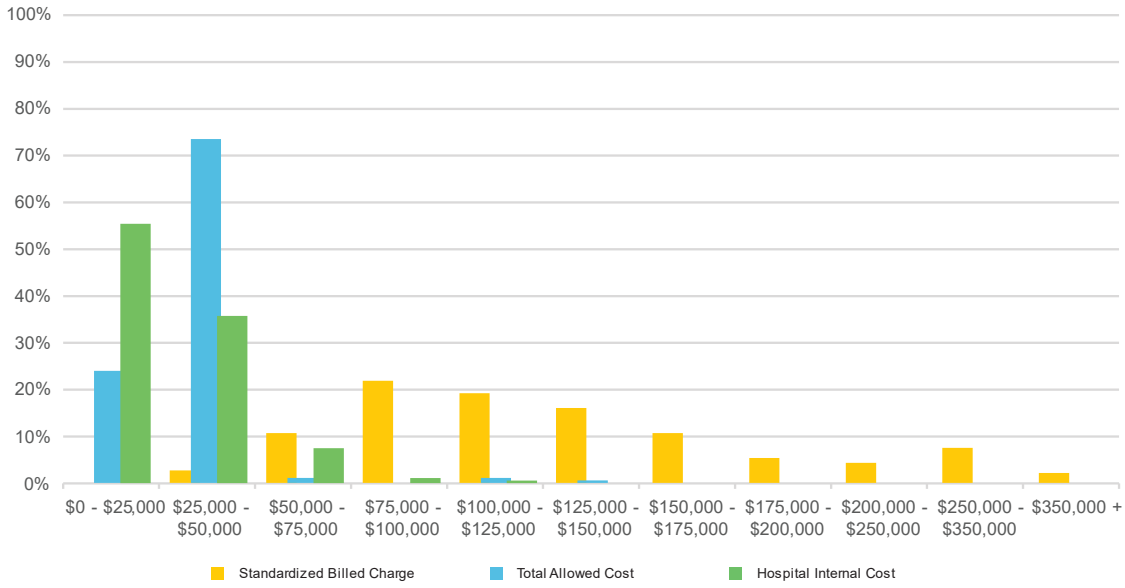


FIGURE A3: DISTRIBUTION OF STANDARDIZED BILLED CHARGES, TOTAL ALLOWED COSTS, AND HOSPITAL INTERNAL COSTS FOR KIDNEY TRANSPLANTS ASSIGNED TO MS-DRG 652 IN FY 2021



FY 2022

FIGURE A4: DISTRIBUTION OF STANDARDIZED BILLED CHARGES, TOTAL ALLOWED COSTS, AND HOSPITAL INTERNAL COSTS FOR KIDNEY TRANSPLANTS ASSIGNED TO MS-DRG 650 IN FY 2022

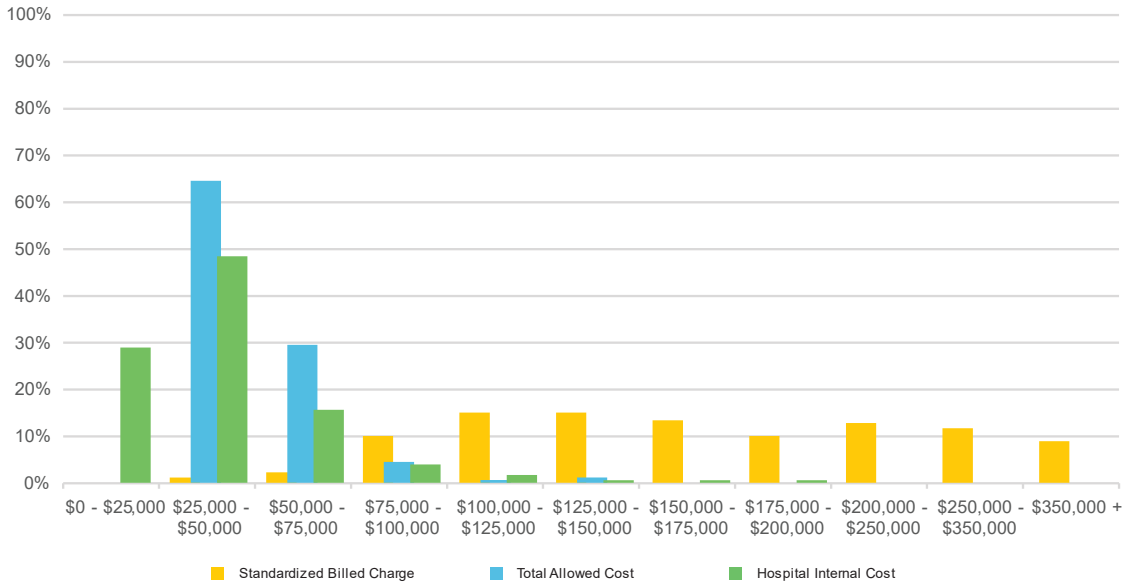


FIGURE A5: DISTRIBUTION OF STANDARDIZED BILLED CHARGES, TOTAL ALLOWED COSTS, AND HOSPITAL INTERNAL COSTS FOR KIDNEY TRANSPLANTS ASSIGNED TO MS-DRG 651 IN FY 2022

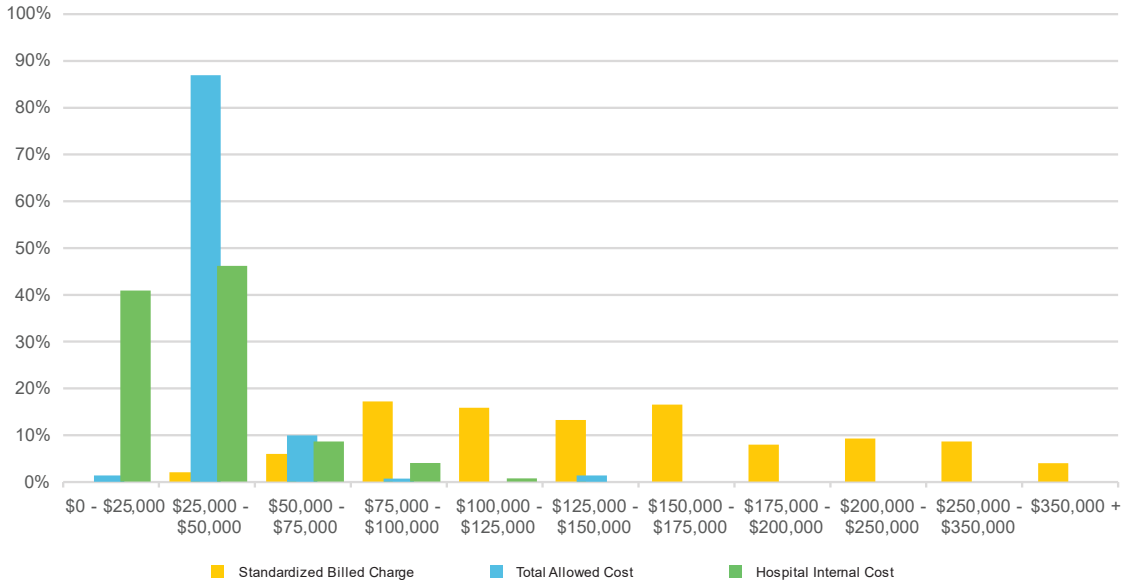
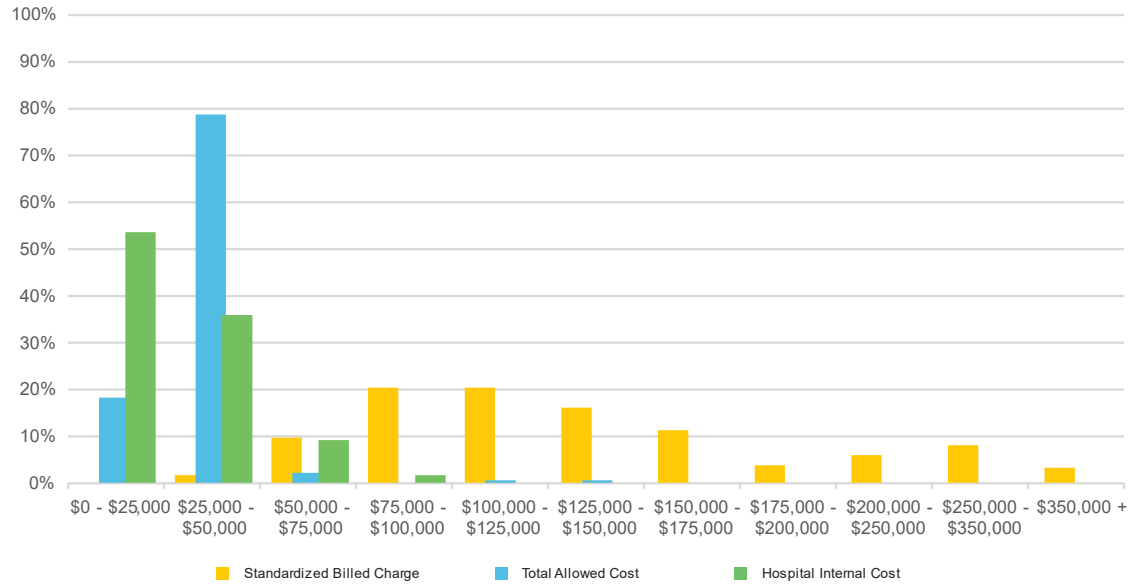


FIGURE A6: DISTRIBUTION OF STANDARDIZED BILLED CHARGES, TOTAL ALLOWED COSTS, AND HOSPITAL INTERNAL COSTS FOR KIDNEY TRANSPLANTS ASSIGNED TO MS-DRG 652 IN FY 2022



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