Research Report

Measuring Health Care Utilization in Medicare Advantage Encounter Data: Methods, Estimates, and Considerations for Research

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Executive Summary

This report describes (1) analytical methodologies, (2) estimates, and (3) technical considerations related to the measurement of health care utilization in Medicare Part C encounter data (ED) submitted by organizations offering Medicare Advantage (MA) plans to Medicare beneficiaries.

The primary aim of the report is to provide technical details for researchers on the structure and scope of ED and on the methodological steps and analytical decisions necessary to assess utilization of health care services using ED. We identify for researchers key considerations related to enrollment, differences in ED and Medicare claims data, and decisions that researchers must make about data field selection.

We also address the following research questions through the empirical analysis:

1. What was the average utilization of health care services by MA enrollees for 2015 and 2016 dates of services for the following five utilization categories?
   - inpatient hospital stays
   - outpatient hospital visits
   - emergency department visits
   - other outpatient facility visits
   - professional services visits.

2. Has average utilization changed from 2015 to 2016?

Key Findings

Table ES.1 displays average utilization per MA-enrolled beneficiary per year for 2015 and 2016. For 2015, we see the following utilization across the five service categories:

- an average of 0.231 inpatient hospital stays per beneficiary
- a higher number of outpatient hospital visits than inpatient hospital stays, at 3.397 per beneficiary on average
- an average of 0.594 emergency department visits per beneficiary
- an average of 0.609 other outpatient facility visits per beneficiary. This utilization category includes visits to outpatient facility settings other than outpatient hospital or emergency departments, such as ambulatory surgery centers (ASCs) and federally qualified health centers (FQHCs).
- an average of 21.095 professional visits per beneficiary. Professional services include services provided by physicians, other practitioners, and suppliers (e.g., laboratories) across all places of service.

Table ES.1. Average per-Beneficiary, per-Year Utilization of MA Enrollees, 2015 and 2016

Beneficiary Count and Service Types	2015	2016
Unique beneficiaries	17,693,955	18,531,315
Inpatient hospital stays	0.231	0.225*
Outpatient hospital visits	3.397	3.448*
Emergency department visits	0.594	0.605*
Other outpatient facility visits	0.609	0.623*
Professional visits	21.095	21.292*

Notes: The first row reports the number of unique beneficiaries contributing data to each year. The other rows report mean utilization per beneficiary per year, where the total utilization in each category is divided by the number of beneficiary-months and then multiplied by 12.
* indicates a difference in 2015 versus 2016 means that is statistically significant at $p<0.001$, using test statistics calculated from beneficiary-month utilization.
Source: RAND analysis of 2015 and 2016 ED accessed via CMS' Integrated Data Repository (IDR) (run dates 08/31/2018 - 09/02/2018).

The figures do not adjust for beneficiary demographic characteristics or health status. Regarding changes from 2015 to 2016, we observed a slight decrease in inpatient hospital stays (from 0.231 to 0.225 per enrollee) and a slight increase in professional visits (from 21.095 to 21.292 per enrollee). Outpatient facility visits, emergency department visits, and other outpatient facility visits increased slightly. While all of the 2015 to 2016 changes were statistically significant, the magnitudes of the changes were very small relative to the standard deviation of each measure.

Abbreviations

ASC	ambulatory surgery center
CCP	coordinated care plan
CMS	Centers for Medicare & Medicaid Services
CRR	chart review record
DMERC	Durable Medical Equipment Regional Carrier
ED	encounter data
ESRD	end-stage renal disease
FFS	fee-for-service
HCPCS	Healthcare Common Procedure Coding System
HMO	health maintenance organization
IDR	Integrated Data Repository
MA	Medicare Advantage
MAC	Medicare Administrative Contractor
MAO	Medicare Advantage Organization
MMP	Medicare-Medicaid plan
MSA	medical savings account
NPI	National Provider Identifier
PACE	Program of All-Inclusive Care for the Elderly
PFFS	private fee-for-service
POS	place of service
PPO	preferred provider organization
ResDAC	Research Data Assistance Center
RIF	research identifiable file
SNF	skilled nursing facility

1. Overview and Background on MA Encounter Data

Overview

This report describes (1) analytical methodologies, (2) estimates, and (3) technical considerations related to the measurement of health care utilization in Medicare Part C encounter data (ED) submitted by Medicare Advantage Organizations (MAOs) for their plan enrollees. We address the following research questions through the empirical analysis:

- What was the average utilization of health care services by Medicare Advantage (MA) enrollees for 2015 and 2016 dates of services for the following five service categories: inpatient hospital stays, outpatient hospital visits, emergency department visits, other outpatient facility visits, and professional services visits?
- Has average utilization changed from 2015 to 2016?

Background on Encounter Data

About one-third of Medicare beneficiaries were enrolled in MA plans offered by private insurers (called MAOs) in 2015.[1] MA plans must cover Medicare Part A and Part B services, often cover Part D prescription drug benefits, and may include non-Medicare supplemental benefits. Medicare pays MAOs a monthly per capita amount and, in turn, MAOs contract with and pay providers directly for services rendered.[2]

Unlike fee-for-service (FFS) Medicare, CMS (and its contractors) do not receive claims for payment from providers of health care services that provided care to MA beneficiaries. Instead, providers submit their claims for payment to MAOs directly. CMS requires MAOs to submit ED records to report items and services covered for MAO enrollees under their MA plans, regardless of how providers are paid. For example, MAOs that sub-capitate their providers for some or all services must still report those encounters to CMS, even though providers are not billing the MAO for every item and service.

CMS requires the ED records to be submitted using the national standard for health care transactions, the V12 837 5010 format, which is the same format used by Medicare for FFS claims data and by commercial payers. CMS instructions to ED record submitters can be found in CMS' *Encounter Data Submission and Processing Guide: Medicare Advantage Program.*[3]

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[1] For MA enrollment data, see CMS, "Medicare Enrollment Dashboard," November 15, 2018d, at https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/CMSProgramStatistics/Dashboard.html

[2] See the Medicare Payment Advisory Commission, "Medicare Advantage Program Payment System," Washington, D.C., October 2017, at http://medpac.gov/docs/default-source/payment-basics/medpac_payment_basics_17_ma_finalc1a311adfa9c665e80adff00009edf9c.pdf?sfvrsn=0

[3] CMS, *Encounter Data Submission and Processing Guide: Medicare Advantage Program*, Version 2.0, Washington, D.C., November 2018b, at https://www.csscoperations.com/internet/cssc4.nsf/files/ED_Submission_Processing_Guide_11132018.pdf/$FIle/ED_Submission_Processing_Guide_11132018.pdf

MAOs generally submit ED for the same range of bill types used for FFS claims. *Bill type* refers to the National Uniform Billing code set used in the 837 5010 format for institutional services.[4] For each bill type, ED include many of the same fields as are recorded for FFS claims data, including provider IDs, Healthcare Common Procedure Coding System (HCPCS) procedure codes, revenue center codes, dates of service, and diagnosis codes. For CMS' supplemental instructions to the national Technical Report Type 3 guides, which are the "TR3" guides with instructions for how to populate the institutional and professional 837 5010 formats, see CMS' *Encounter Data Submission and Processing Guide*.[5]

In addition to ED records, MAOs submit chart review records (using the 837 5010 format, with options for default data fields specified in the *Encounter Data Submission and Processing Guide*) to report diagnoses for the purposes of calculating risk scores. See Section 4 on *Considerations for ED Analysis* for a discussion of chart review records.

In July 2018, CMS released for the first time a 2015 ED standard analytic file available to researchers upon application to the Research Data Assistance Center (ResDAC). ResDAC began offering training for the use of these data in October 2018.

2. Data and Methods

This section describes the data, decisions, and assumptions necessary to conduct these analyses. Figure 2.1 depicts our analytical approach in five consecutive steps.

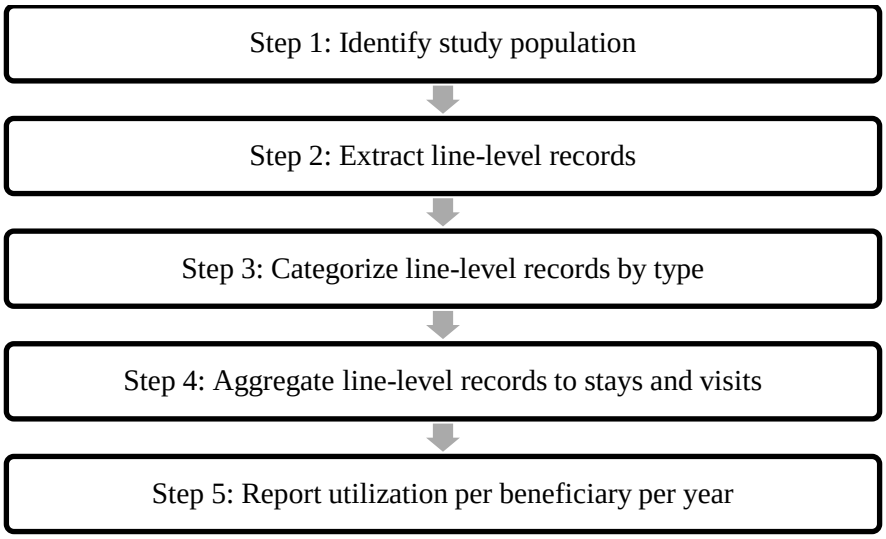
1. We defined a set of beneficiary-months as our population of interest, using enrollment data.
2. We extracted all of the ED headers and lines[6] with 2015 and 2016 dates of service for this population.
3. We categorized lines into utilization categories using a combination of bill type, revenue center codes, and other information available in ED.
4. We aggregated individual ED lines to the level of a stay or a visit.
5. We calculated utilization measures per beneficiary per year.

[4] ED do not include inpatient medical education or disproportionate-share no-pay bill types because these costs are carved out of the MA rates, by law. Claim type codes are used to identify institutional (inpatient and outpatient) items and services; these codes also exist for durable medical equipment. There are different claim type codes for FFS claims and MA ED.

[5] CMS, 2018b.

[6] Like claims data reported in the 837 5010 format, ED are structured such that individual services are reported at the "line" level and multiple lines can be submitted under the same header. Headers contain some information that applies to all lines under the header.

Figure 2.1. Analytical Approach Overview



We accessed ED via CMS' Integrated Data Repository (IDR), and we have provided names of the IDR data tables and variables in footnotes. However, IDR names may not be identical to all variable names in CMS' ED research identifiable files (RIFs), available through ResDAC.org.

Moreover, studies using the ED RIF files will not replicate precisely the figures in this report because ED are continuously updated in the IDR as CMS receives new records from MAOs, while ED RIFs are typically updated on an annual schedule. For this reason, we have also noted the run date for each set of results.[7]

Step 1: Identify Study Population

As a first step, we defined the beneficiaries and periods of time that contribute to our analyses. Because CMS data on enrollment in MA plans are maintained at the monthly level,[8] we chose to define our study population as a set of beneficiary-months, i.e., combinations of beneficiary identifiers[9] and calendar months. Our study population included all 2015 and 2016 beneficiary-months where all three of the following conditions applied:

1. The beneficiary was enrolled in either Medicare Part A or Medicare Part B.[10]

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[7] See Chapter 2, section B, "CCW Medicare Encounter Research Identifiable Files (RIFs)," in Chronic Condition Data Warehouse, *CCW Encounter Data User Guide*, July 2018, at https://www.ccwdata.org/web/guest/user-documentation, for information on the preliminary and final versions of ED RIF files.

[8] IDR source: BENE_FCT table.

[9] IDR sources: BENE_SK, GEO_SK, BENE_CVRG_TYPE_CD, CNTRCT_PTC_NUM, BENE_MDCR_STUS_CD, BENE_PTA_STUS_CD, BENE_PTB_STUS_CD, and CLNDR_DT.

[10] MA enrollees must be eligible for Part A and enrolled in Part B. However, for historical reasons, there are a few enrollees grandfathered into MA plans who may not be enrolled in Part B.

2. The beneficiary was enrolled in an MA contract.[11]
3. The current reason for entitlement was not related to end-stage renal disease (ESRD).[12]

We excluded ESRD beneficiary-months because utilization for this beneficiary subpopulation is notably different than utilization for other beneficiaries. We did not exclude ED records for beneficiaries in hospice status.[13]

Some beneficiaries (70.65 percent) contributed the maximum possible 24 beneficiary-months to our analyses, while others contributed fewer beneficiary-months for any of the following reasons:

1. The beneficiary was newly eligible for Medicare because of age or disability.
2. The beneficiary transitioned into MA from FFS or out of MA to FFS.
3. The beneficiary died.

For beneficiaries who had transitioned into MA from FFS or out of MA to FFS during our 2015 to 2016 study period, we excluded the FFS beneficiary-months from our analyses, but we included their months of MA enrollment. Finally, beneficiaries who died were included up to and including the month of death and excluded thereafter.

Selecting Beneficiary-Months by Plan Type

Next, we selected the subset of beneficiary-months where the beneficiary was enrolled in one of the following types of MA plans: local coordinated care plans (CCPs), regional CCPs, or private fee-for-service (PFFS) plans.[14] CCPs include health maintenance organization (HMO) and preferred provider organization (PPO) plans.[15] We excluded beneficiary-months for the third type of MA plans: medical savings account (MSA) plans. In 2015 and 2016, there were only a handful of MSA plan offerings, with less than 0.07 percent of all MA plan enrollees.

Beneficiary-months for the three other types of Medicare private health plans were also excluded from our analysis: cost plans, Program of All-Inclusive Care for the Elderly (PACE) organizations, and Medicare-Medicaid plans (MMPs). See Section 4 for descriptions of these plan types. Beneficiary-months excluded based on plan type represented 5.6 percent (n = 11,804,005) of total beneficiary-months in 2015 and a similar share in 2016.

Our final study population is shown in Table 2.1 (also see Table A.1 in the appendix). In 2016, 91.0 percent of beneficiary-months were enrolled in local CCP plans, and an additional 7.7 percent of beneficiary-months were enrolled in regional CCP plans.

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[11] We identified beneficiary-months enrolled in MA contracts as those with an MA contract number in the CNTRCT_PTC_NUM field from the BENE_FCT table.

[12] BENE_MDCR_STUS_CD is "10" or "20."

[13] There are very few hospice ED records. This is another analytical decision for researchers: whether to exclude ED records for beneficiaries in hospice status, since this benefit is paid on an FFS basis. MAOs continue to pay for items and services covered under an MA plan's supplemental benefit for their enrollees in hospice status.

[14] Typically, an MA contract includes plans (plan benefit packages) of the same type. For example, an MAO offering both CCPs and PFFS plans in New York will have separate contract IDs for the CCPs and the PFFS plans. We determined contract type from the BENE_CVRG_TYPE_CD field in the BENE_FCT view.

[15] Some CCPs are special needs plans (SNPs) that exclusively enroll beneficiaries with specific attributes established in law – institutionalized, dually eligible for Medicare and Medicaid, or having a certain chronic disease.

Table 2.1. Unique Beneficiaries by Plan Type and Calendar Year

MA Plan Type	Unique Beneficiaries, 2015	Unique Beneficiaries, 2016
Total (CCPs and PFFS plans)	17,693,955	18,531,315
Local CCPs	16,045,746	16,822,139
Regional CCPs	1,373,608	1,462,724
PFFS plans	274,601	246,452

Source: RAND analysis of ED accessed via CMS' IDR (run dates 08/31/2018 - 09/02/2018).

Step 2: Extract Line-Level Records

For each of these beneficiary-months, we identified and extracted all accepted[16] ED lines from the CLM_LINE table with the corresponding beneficiary ID[17] and a corresponding line-level "from" service date. Inpatient hospital lines were assigned to calendar months based on the header-level "from" service date because individual stays frequently cross from one calendar month into another and because the MA plan in which a beneficiary is enrolled at the time of admission is responsible for covering hospital stays. All other lines were assigned to calendar months based on line-level "from" service dates.[18] We extracted 1,336,349,389 lines for 2015 and 1,420,556,466 lines for 2016. Chart review records were excluded from this analysis because these records are used for purposes of risk-adjusted payments: to report additions or deletions of diagnosis codes.[19]

Step 3: Categorize Line-Level Records by Type

We assigned each line to a utilization category based on a combination of one or more of the following variables:

- Claim type indicates the overarching type of record (e.g., inpatient hospital, outpatient hospital, or professional). Claim type determines which fields are populated for the record.
- Revenue center code is used for facility claim types and identifies the division or unit within a facility that generated the line (e.g., radiology or emergency department).
- Healthcare Common Procedure Coding System (HCPCS) code indicates the specific health care service reported on the line (e.g., HCPCS code 33533, coronary artery bypass using a single arterial graft).
- Place of service (POS) is used for professional lines in ED records and indicates where the service was provided (e.g., physician office, ambulatory surgery center, or inpatient hospital).

[16] We used only those lines with an ED status code of "83" (which means "accepted"). Other lines may be rejected for a variety of reasons.

[17] BENE_SK is the IDR-generated field for beneficiary IDs. We extracted only final action lines. The ED standard analytic files consist of final action and non-final action records.

[18] Line-level service dates are occasionally missing. We imputed header-level dates in this case.

[19] See Section 4 for additional discussion on chart review records.

- National Provider Identifier (NPI) indicates the providers that delivered and billed for each service.[20]

Table A.2 in the appendix describes the mapping used to assign lines to the utilization categories. Table 2.2 reports the share of lines on the ED records assigned to each of the utilization categories in 2015 and 2016. The share of lines in each category was relatively similar between years. We further categorized professional lines into place of service (Table A.3) and into type of service (Table A.4) categories using HCPCS codes.

Table 2.2. Share of Lines by Utilization Category

Utilization Category	2015 Share of Lines	2016 Share of Lines
Inpatient Hospital	4.8%	4.6%
Professional	63.5%	63.3%
Outpatient Hospital	19.8%	20.0%
Emergency Department	1.1%	1.1%
Other Outpatient	3.7%	3.8%
Others (Not Analyzed)	7.1%	7.1%
Total	100.0%	100.0%*

Notes: "Others (Not Analyzed)" includes hospice, other inpatient facility (such as skilled nursing facilities and inpatient rehabilitation facilities), and durable medical equipment.
* The total is 99.9 percent due to rounding.
Source: RAND analysis of 2015 and 2016 ED lines accessed via CMS' IDR (July 19, 2018, run date).

Step 4: Aggregate Line-Level Records to Stays and Visits

We aggregated individual ED lines to measure inpatient stays, outpatient hospital visits, emergency department visits, other outpatient facility visits, and professional visits. Stay and visit-level measures are a more standardized approach to measuring utilization in cases where patients with different conditions may have very different counts of individual service lines.[21]

Inpatient Hospital Stays

We combined inpatient hospital header-level facility ED records with overlapping or adjacent service date ranges with the same billing provider NPI and beneficiary ID. The entire stay was assigned to the calendar month of the header-level "from" service date from the first header-level record. This approach combines same-day and next-day readmissions to the same hospital into a single stay.

[20] We used NPI to classify some records as "other outpatient" ASC facility records. If POS = 24 and CLM_TYPE = 4700 and the line rendering NPI or header billing NPI was institutional/organizational, then the record was reclassified as "other outpatient." If the line rendering NPI was missing, then we checked the header rendering NPI for organizational/institutional type of NPI for these ED records.

[21] Our approach to defining stays and visits also addresses potential duplicate records.

Outpatient Facility Visits

For outpatient hospital, emergency department, and all other outpatient facility categories, we defined a visit as follows: We combined the lines that had the same billing provider NPI, beneficiary ID, and service date (using the line-level "from" date) into a single unit representing a visit.[22] The visit was assigned to the calendar month of the "from" date. This approach separates into discrete visits some outpatient facility ED records that had multiple lines covering a range of service dates. That is, services reported on a single ED record could be split into more than one visit. For example, for an outpatient hospital encounter record that has five lines that match on beneficiary ID and billing provider NPI, but three of these lines have a "from" date of August 5, while the other two lines have a "from" date of August 6, these lines will be sorted into two separate outpatient hospital visits.[23] This scenario occurs most often for outpatient hospital observation stays.

Professional Visits

We also combined professional lines with the same billing provider NPI, beneficiary ID, and service date (using the line-level "from" date) into a single professional "visit" record. The visit was assigned to the calendar month of the service date. As with outpatient facility visits described above, this approach separates some records with multiple lines covering a range of different service dates into discrete visits.

Step 5: Report Utilization per Beneficiary per Year

We first calculated monthly utilization for each beneficiary for the following five main utilization measures:

- inpatient hospital stays
- outpatient hospital visits
- emergency department visits
- other outpatient facility visits
- professional visits.

We also calculated monthly utilization for each beneficiary for additional line-level utilization measures:[24]

- outpatient hospital services (facility lines)
- emergency department services (facility lines)
- other outpatient facility services (facility lines)

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[22] We considered two approaches to creating outpatient hospital visits: (1) combining outpatient hospital facility lines with the same beneficiary ID, service date, and billing provider NPI and (2) combining outpatient hospital facility lines with the same beneficiary ID and service date. Each approach has its limitations. Including billing provider NPI in the creation of visits could double-count instances in which multiple providers are involved in the delivery of care but bill under different NPIs. In contrast, not including billing provider NPI could combine distinct outpatient hospital visits into a single visit; an example would be if a person has a cardiologist appointment in an outpatient hospital department but also has an X-ray for an unrelated reason. Including the NPIs in the creation of visits resulted in 0.8 percent more outpatient hospital visits for CCPs and 0.9 percent more visits for PFFS plans in 2016 than if NPIs were not included.

[23] This scenario may be common in the case of observation visits.

[24] We did not exclude exact duplicate records (for example, duplicates on beneficiary ID, rendering NPI, HCPCS code and modifier, and service date).

- professional services (lines).

We calculated the mean and standard deviation for each per-beneficiary, per-month utilization measure, first with all CCP and PFFS beneficiary-months combined and then for local CCP, regional CCP, and PFFS beneficiary-months separately.

We used the per-beneficiary, per-month means, standard deviations, and sample sizes to calculate test statistics related to 2015 to 2016 changes in means. We calculated test statistics using utilization measured at the beneficiary-month level (rather than at the beneficiary-year level) because it is straightforward to calculate the standard deviation across beneficiary-months. In contrast, weighting or other steps would be necessary to calculate standard deviations when utilization is measured per beneficiary-year because individual beneficiaries can contribute between 1 and 12 months of data to our analyses.

We then calculated per-beneficiary, per-year utilization as follows:

1. We aggregated per-beneficiary, per-month utilization measures, separately for 2015 and 2016, and separately for all beneficiary-months and for local CCP, regional CCP, and PFFS beneficiary-months.
2. We divided aggregated utilization by the number of beneficiary-months by year and plan type.
3. We multiplied by 12 to rescale the per-month means to a per-year basis.

We report several descriptive statistics, separately for 2015 and 2016, using a unit for utilization (i.e., lines, stays, or visits) that corresponds to the measure, and for CCP and PFFS combined and separated:

1. the sum of lines, stays, or visits, as appropriate, over all beneficiaries in the year
2. the mean utilization per-beneficiary, per-year
3. the share of unique beneficiaries with utilization in each year.

3. Findings: Utilization Measures

Reporting Average Utilization by Service Category and Year

Table 3.1 reports descriptive statistics for utilization measures. The figures do not adjust for beneficiary demographic characteristics or health status. We found an average of 0.231 inpatient hospital stays per beneficiary in 2015. About 14 percent of beneficiaries had an assigned inpatient hospital stay in 2015 and slightly fewer beneficiaries had an inpatient hospital stay in 2016. Utilization of outpatient hospital visits was considerably higher. More than 60 percent of beneficiaries had at least one outpatient hospital visit in each year. Emergency department visits were an average of 0.594 visits in 2015. Finally, professional visits were very common, with more than 95 percent of beneficiaries having at least one professional visit in each year and an average of 21.292 visits per year in 2016.[25]

Utilization of outpatient hospital visits, emergency department visits, and other outpatient facility visits increased slightly from 2015 to 2016.

[25] Pairwise differences in 2015 versus 2016 means that are significant at $p<0.001$ are indicated in the tables.

Table 3.1 Descriptive Statistics by Utilization Category, 2015 and 2016

Utilization Category	2015 Total Utilization (N)	2015 Mean Utilization per Beneficiary per Year	2015 Share of Unique Beneficiaries with Utilization	2016 Total Utilization (N)	2016 Mean Utilization per Beneficiary per Year	2016 Share of Unique Beneficiaries with Utilization
Inpatient Hospital Stays	3,788,826	0.231	14.1%	3,888,210	0.225*	13.8%
Outpatient Hospital Visits	55,804,023	3.397	60.4%	59,484,105	3.448*	60.9%
Emergency Department Visits	9,767,258	0.594	28.2%	10,440,421	0.605*	28.5%
Other Outpatient Facility Visits	10,000,542	0.609	12.8%	10,752,197	0.623*	13.1%
Professional Visits	346,586,437	21.095	95.2%	367,341,605	21.292*	95.3%
Outpatient Hospital Lines	252,146,822	15.347	60.4%	271,003,164	15.708*	60.9%
Emergency Department Lines	14,269,140	0.869	28.2%	15,269,385	0.885*	28.5%
Other Outpatient Facility Lines	21,306,541	1.297	12.8%	23,343,871	1.353*	13.1%
Professional Lines	798,925,688	48.627	95.2%	845,879,346	49.030*	95.3%

Notes: "Total utilization" is the sum of stays, visits, or lines as appropriate across beneficiaries. "Mean utilization per beneficiary per year" is the mean utilization calculated by dividing total utilization in the year by the sum of beneficiary-months in the year and multiplying by 12. "Share of unique beneficiaries with utilization" refers to the share of beneficiaries with utilization in the year. Results are based on utilization from beneficiary-months where the beneficiary was enrolled in a CCP or PFFS plan.
* indicates a difference in 2015 versus 2016 means that is statistically significant with $p<0.001$ using test statistics calculated from beneficiary-month utilization.
Source: RAND analysis of 2015 and 2016 ED accessed via CMS' IDR (run dates 08/31/2018 - 09/02/2018).

Utilization Based on Outpatient Facility Lines

We separately calculated mean line-level outpatient hospital, emergency department, and other outpatient facility utilization as a complement to the visit-level measures described above. Measuring utilization in terms of lines rather than visits provides additional useful information because it is common to receive multiple procedures or other services that would be reported on separate lines during a single visit. In aggregate, the ratio of the line-level to visit-level 2016 means was 4.56 for outpatient hospital utilization and 1.45 for emergency department utilization.

Many of the same patterns in outpatient hospital and emergency department visit-level results are mirrored in the line-level results reported in Table 3.1. Other outpatient facility claim types (i.e., those that are not outpatient hospital or emergency department claim types) include those from clinics, stand-alone dialysis centers, outpatient rehabilitation facilities, and community mental health centers. The line-level average utilization in this category was small compared with line-level outpatient hospital utilization

but higher than line-level emergency department utilization. The mean number of lines increased modestly from 2015 to 2016 for all three utilization categories.

Utilization Based on Professional Lines

Professional services include services provided by physicians, other practitioners, and suppliers (e.g., laboratories) across all places of service. More than 95 percent of beneficiaries had at least one ED professional line per year (Table 3.1). We found an average of 48.627 professional lines per beneficiary per year in 2015. Utilization of professional services increased slightly from 2015 to 2016.

Approximately 25 percent of professional lines in each year were for laboratory/pathology HCPCS codes (see Table A.5 in the appendix). Evaluation and management visits accounted for approximately 15 percent of all professional lines in each year. Surgery services increased from 14.6 percent to 15.9 percent of professional lines from 2015 to 2016 (a 10 percent relative increase). Otherwise, the mix of professional lines contributing to the total did not change substantively from 2015 to 2016, although many of the differences in 2015 versus 2016 mean lines per beneficiary per year were statistically significant.

In terms of place of service, we found that more than half of professional lines in each year were in the office place of service, with smaller shares in the inpatient hospital and outpatient hospital settings (9 percent and 7 percent, respectively; see Table A.6). As with the type of service results above, the mix of professional lines across places of service did not shift significantly from 2015 to 2016, although many of the individual 2015 versus 2016 differences in means were statistically significant because of the large number of beneficiary-months in our analyses.

4. Considerations for ED Analysis

Here we discuss key considerations in using ED for analysis of health care in the MA program. We have identified each of these considerations through the process of developing specifications and programs to measure MA health care utilization. Most of the discussion in this section will be relevant to other applications of ED using the ED standard analytic files.

Enrollment

Several analytical decisions involved in the use of ED for utilization and other research areas are discussed in this section: what plan types to analyze, how to approach possible mismatches in contract enrollment, and addressing enrollment switching.

Plan Types

Organizations offering Medicare private health plans may have one or multiple contracts with CMS (identified by a unique contract ID), and under each contract there may be one or multiple plan benefit packages or "plans" (identified by a 3-digit plan ID). Generally, an MAO's contract IDs are not only organized by geographic area, but also by plan type, e.g., an MAO offering both CCPs and PFFS plans in New York will have separate contract IDs for these CCP and PFFS plans. Contract IDs begin with H or R followed by 4 numerals. Contract IDs beginning with H are assigned to MA local contracts, cost

contracts, PACE organizations, and demonstrations, such as Medicare-Medicaid plans (MMPs). Contract IDs beginning with R are assigned to MA regional PPO contracts (also known as RPPOs).

By law, there are three types of MA plans: (1) coordinated care plans (CCPs), including both local and regional plans; (2) private fee-for-service (PFFS) plans; and (3) medical savings account (MSA) plans. Other Medicare private health plan types are cost plans, PACE organizations, and MMPs.

- Cost plans (§1876 Cost HMOs/CMPs and §1833 Health Care Prepayment Plans [HCPPs]) are required to submit ED for all items and services included in the annual Cost Reports submitted to CMS.
- Program of All-Inclusive Care for the Elderly (PACE organizations) are required to submit encounters for services provided beginning January 1, 2013, for which the organization collects a claim form.
- Medicare Medicaid Plans (MMPs). For information on MMPs (MA demonstrations), see the CMS website at https://www.cms.gov/Medicare-Medicaid-Coordination/Medicare-and-Medicaid-Coordination/Medicare-Medicaid-Coordination-Office/.[26]

Mismatches in Enrollment Information

We identified two main approaches to calculating aggregate utilization at the contract level. In the first approach, all utilization for a beneficiary in a given calendar month is assigned to the contract listed in the beneficiary enrollment table for that beneficiary-month. In the second approach, utilization is assigned to the contract listed on the ED record itself. In general, the contract numbers identified via these two approaches matched. In an exploratory analysis using June 2014 professional lines, we found that the contract IDs derived from the enrollment table versus ED records matched 99.97 percent of the time. Of the remaining 0.03 percent, nearly all (99.5 percent) of these ED records did not have a matching record in the enrollment data for the beneficiary-month, typically because of data lags.[27]

For the analyses in this report, we used the first approach, whereby all utilization in a calendar month is assigned to a contract based on the CMS enrollment table of enrollment data. In the extremely rare case that a beneficiary has records submitted under two contracts (which may occur prior to final reconciliation for a payment year), this approach avoids the complication of partitioning utilization within a month across contracts and avoids a related decision on whether beneficiaries with utilization submitted by multiple contracts should be counted in the denominator of one or multiple contracts for the purposes of calculating utilization rates. However, the contract listed in the ED record is the contract that submitted the record for that beneficiary, so for certain research questions, the second approach may be more appropriate.

Enrollment Switching

Beneficiaries' enrollment status may change within a given analysis year (including switches from MA to FFS Medicare, from FFS Medicare to MA, and between different MA contracts). We performed exploratory analyses to see how often Medicare beneficiaries switched contracts. In 2014, 2.3 percent (1.3 million) out of all 56 million Medicare beneficiaries switched from FFS Medicare to MA, while less than

[26] CMS, "About the Medicare-Medicaid Coordination Office," last modified August 8, 2018a.

[27] Mismatches between ED records and CMS enrollment tables are caused by data lags in updating enrollment records. This is another decision point for researchers, depending on the research questions, because the contract ID on the ED record indicates which MAO paid for the item or service.

1 percent switched from MA to FFS Medicare. Less than 1 percent of beneficiaries switched between MA contracts.

Because switching between FFS Medicare and MA is not directly relevant to the analyses that we describe in this report, we decided to allow beneficiaries with at least one month of enrollment in an MA plan to be included our analysis. This means that for 2015, beneficiaries could contribute from 1 to 12 months, and the same for 2016. Most MA-enrolled beneficiaries (70.65 percent) contributed the maximum possible 24 beneficiary-months to our analyses. Other MA-enrolled beneficiaries contributed fewer beneficiary-months because of new enrollment in MA, a transition out of MA, death, or a combination of the scenarios.

Note that we also allowed beneficiaries to contribute to multiple contracts and contract types over time if they switched MA contracts. Researchers should assess whether this approach or stricter continuous enrollment criteria are appropriate for their specific analyses.

Differences Between ED and Medicare FFS Claims Data

MA Risk Adjustment and Service Types

As noted in the CMS User Guide for ED RIF files, researchers should keep in mind that CMS uses diagnoses from a subset of ED record types to calculate risk scores for payment: inpatient, outpatient, and professional records.[28] "Given that the purpose and collection of ED differs from FFS claims data, the availability and consistency of claims-level variables may also differ from FFS data," in particular for skilled nursing facility (SNF), home health, and durable medical equipment encounters.

Claim and Bill Types

Both ED and Medicare FFS claims data distinguish between different types of services or settings using claim type and bill type fields. For example, outpatient hospital facility records are bill type 13 in both data sources, and are claim type 4013 in ED and claim type 40 in Medicare FFS claims data.

Researchers can reasonably categorize utilization using claim type only. We opted to use additional revenue center codes, HCPCS codes, and other information in addition to claim type to create more granular utilization categories (see Table 2.2). Our approach sometimes reassigns utilization from a primary claim type category (such as outpatient hospital) to another category (such as emergency department). The assignment rules that we developed for ED are broadly similar to those that are frequently used for analysis of Medicare FFS claims, with three exceptions:

1. There are no ED equivalents for the following Medicare FFS claims bill types: 61 (inpatient full encounter claims), 62 (MA indirect medical education/graduate medical education claims), 63 (MA no-pay claims), and 64 (MA paid as FFS claims).
2. There is no analog in FFS for the ED bill type 89 (special facility – other).
3. FFS claim types 71, 72, 81, and 82 distinguish between professional records that are submitted by Medicare Administrative Contractors (MACs) versus Durable Medical Equipment Regional Carriers (DMERCs) and between professional records that are for durable medical equipment, prosthetics, orthotics and supplies versus other professional services. ED claim types do not

[28] Page 22, Chapter 4, section B, "Limitations of Encounter Data," in Chronic Condition Data Warehouse, *CCW User Guide: Medicare Encounter Data Files*, July 2018, Version 1.0, at https://www.ccwdata.org/web/guest/user-documentation

distinguish between MACs and DMERCs because these are not relevant for Medicare Part C, although claim types 4700 and 4800 do distinguish between professional services and durable medical equipment.

Chart Review Records

MAOs can submit chart review records to CMS to add or delete diagnoses that contribute to risk adjustment. Chart review records (CRRs) are also submitted using the 837 5010 format and are stored as ED records; they can be linked to another ED record or unlinked. Conceptually, CRRs do not represent utilization; as the name indicates, these records are used to report (add and/or delete) diagnoses for payment purposes. For researchers interested in including CRRs in an analysis, see CMS' *Encounter Data Submission and Processing Guide*, Chapter 2 and Chapter 3, section 3.6, for information on CRRs.[29]

Comparability of Reporting Requirements

MAOs are required to report all items and services provided to MA enrollees under their plans. For example, an MA plan may offer coverage of additional inpatient days as a supplemental benefit under a plan; an MA plan may also elect to provide, as part of a plan's Medicare-covered benefits, coverage of post-hospital SNF care without a prior qualifying hospital stay of three days. Thus, CMS' instructions to MAOs have the potential to result in the collection of a broader set of services that are not covered or paid in the FFS Medicare program compared with what we suspect we observe in FFS Medicare claims data for the same services. This creates a potential mismatch between measured utilization in ED and Medicare FFS claims data.

In contrast, while Medicare FFS claims data should include records for most services for which providers were paid (plus FFS no-pay bills for specific situations), there are likely important gaps in FFS claims for services where payment is unlikely or impossible. Providers can submit claims for services that are not covered by Medicare, for example, when their delivery system requires that a certain HCPCS be recorded or billed even when it is not a Medicare-covered service. Because of the ad hoc and voluntary nature of FFS reporting for these non-covered services, there is no guarantee that Medicare FFS claims data include <u>all</u> services provided to FFS Medicare enrollees.

In addition, not all MA benefit categories are included in ED. For example, benefits not reportable in the 837-I (institutional) or 837-P (professional) formats, such as preventive dental benefits, are not collected by CMS even though MA plans can cover them as non-Medicare supplemental benefits.

We allowed all items and services reported on ED records – including those for HCPCS that are not paid under the FFS Medicare program – to contribute to our estimates of utilization. Researchers working with ED or comparing ED and Medicare FFS claims data should carefully consider decisions related to inclusion or exclusion of services that are and are not covered under original Medicare.

[29] CMS, 2018b.

Data Field Considerations

Service Date Ranges

We found that line-level service date ranges (i.e., "from" and "through" dates) were sometimes missing for ED lines. We imputed header-level dates in these cases. Relatedly, a small share of ED lines had dates that spanned more than one day and, in some cases, many days. We also found that line-level date ranges may span multiple days in ED.

Line-level data ranges are more common when a single line is being used to report multiple units of service (see the next section). In these cases, we suggest that researchers should not attempt to allocate services to specific service dates within the reported line-level date ranges. For this report, we used the line-level "from" date to assign line-level records to calendar months. This approach may misallocate some services to an earlier month than is correct.

Units of Service Field

We based our utilization measures on lines rather than on the units of service field on each line because we found that the units of service field was sometimes used to report multiple instances of the same service on a single ED line. Our exploratory research also suggests that further investigation is needed to understand whether outlier unit values represent different reporting practices across MAOs.

5. Discussion

This report presents technical details for researchers on the structure and scope of MA ED and on the methodological steps and analytical decisions necessary to assess utilization of health care services using ED. We found slight changes in utilization measured in ED from 2015 to 2016, including a decrease in inpatient stays and increases in professional and outpatient hospital visits. Our estimate of inpatient utilization approximates results from other sources of data on utilization by beneficiaries enrolled in MA plans. For example, we found 0.23 inpatient hospital stays per beneficiary per year across all MA plan types while Curto et al. (2017), reported 0.25 per beneficiary per year using 2010 data.[30] Using earlier non-encounter data, Landon et al. (2012) found 0.22 inpatient discharges per MA beneficiary per year, and Petterson et al. (2016) found 0.19 inpatient admissions per MA beneficiary per year.[31]

[30] Vilsa Curto, Liran Einav, Amy Finkelstein, Jonathan Levin, and Jay Bhattacharya, "Healthcare Spending and Utilization in Public and Private Medicare," NBER Working Paper No. 23090, January 2017. Curto et al. (2017) analyzes MA utilization using data provided by the Health Care Cost Institute. The Health Care Cost Institute data consist of 2010 claims paid by three Medicare Advantage insurers (Aetna, Humana, and United Healthcare), which together cover almost 40 percent of MA enrollees.

[31] B. E. Landon, A. M. Zaslavsky, R. C. Saunders, L. G. Pawlson, J. P. Newhouse, and J. Z. Ayanian, "Utilization of Services in Medicare Advantage Versus Traditional Medicare Since the Passage of the Medicare Modernization Act," *Health Affairs*, Vol. 31, No. 12, December 2012, pp. 2609–2617; Stephen Petterson, Andrew Bazemore, Yalda Jabbarpour, and Peter Wingrove, *Understanding the Impact of Medicare Advantage on Hospitalization Rates: A 12-State Study*, Washington, D.C.: Robert Graham Center, March 2016.

The small decline from 2015 to 2016 in MA inpatient utilization (from 0.231 to 0.225 stays per beneficiary) is consistent with a general decline in utilization of inpatient hospital stays in FFS Medicare and the U.S. health care system more broadly. For example, FFS Medicare inpatient stays per Part A enrollee declined by 15 percent from 2008 through 2013.[32] Other published estimates of MA utilization that directly map to our utilization categories are sparse. Curto et al. (2017) reported 0.46 emergency department visits per beneficiary per year using 2010 data, while we found about 0.60 emergency department visits per beneficiary per year in 2015 and 2016. Future analyses of ED will allow for further comparisons of utilization in the MA program.

[32] Centers for Medicare & Medicaid Services, "Medicare Utilization Section," last modified November 15, 2018c, at https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/CMSProgramStatistics/2013/Utilization.html#Medicare%20Outpatient%20Facility

Appendix

Table A.1. Number of Study Beneficiary-Months and Unique Beneficiaries by Calendar Year

Category	Beneficiary-Months, 2015	Beneficiary-Months, 2016	Unique Beneficiaries, 2015	Unique Beneficiaries, 2016
Total (CCPs and PFFS plans)	197,154,466	207,028,535	17,693,955	18,531,315
Local CCPs	179,229,713	188,398,130	16,045,746	16,822,139
Regional CCPs	14,869,896	15,864,316	1,373,608	1,462,724
PFFS plans	3,054,857	2,766,089	274,601	246,452

Source: RAND analysis of 2015 and 2016 ED accessed via CMS' IDR (run date 08/31/2018 - 09/02/2018).

Table A.2. Study Utilization Categories

Claim Type	Claim Type Description	Criteria	Utilization Category
4011	Medicare Part C Hospital Inpatient (Including Medicare Part A)	Excluding lines with emergency department and ambulance revenue center codes	Inpatient Hospital
4011	Medicare Part C Hospital Inpatient (Including Medicare Part A)	Lines with emergency department revenue center codes only	Emergency Department
4012	Medicare Part C Hospital Inpatient (Medicare Part B only)	Excluding lines with emergency department and ambulance revenue center codes	Outpatient Hospital
4012	Medicare Part C Hospital Inpatient (Medicare Part B only)	Lines with emergency department revenue center codes only	Emergency Department
4013	Medicare Part C Hospital Outpatient	Excluding lines with emergency department, ambulance, hospice, and home health revenue center codes	Outpatient Hospital
4013	Medicare Part C Hospital Outpatient	Lines with emergency department revenue center codes only	Emergency Department
4014	Medicare Part C Hospital Laboratory Services Provided to Non-patients	Excluding lines with emergency department and ambulance revenue center codes	Outpatient Hospital
4014	Medicare Part C Hospital Laboratory Services Provided to Non-patients	Lines with emergency department revenue center codes only	Emergency Department
4022	Medicare Part C SNF Skilled Nursing Inpatient (Medicare Part B only)	Excluding lines with ambulance revenue center codes	Other Outpatient
4023	Medicare Part C SNF Skilled Nursing Outpatient	Excluding lines with ambulance revenue center codes	Other Outpatient

Claim Type	Claim Type Description	Criteria	Utilization Category
4041	Medicare Part C Religious Nonmedical Health Care Institutions - Hospital Inpatient	Excluding lines with emergency department and ambulance revenue center codes	Inpatient Hospital
4041	Medicare Part C Religious Nonmedical Health Care Institutions - Hospital Inpatient	Lines with emergency department revenue center codes only	Emergency Department
4071	Medicare Part C Clinic RHC Rural Health	All lines	Other Outpatient
4072	Medicare Part C Clinic ESRD Renal Dialysis Hospital Based or Independent	All lines	Other Outpatient
4074	Medicare Part C Clinic ORF Outpatient Rehab Facility	All lines	Other Outpatient
4075	Medicare Part C Clinic CORF Comprehensive Outpatient Rehab Facility	All lines	Other Outpatient
4076	Medicare Part C Clinic CMHC Community Mental Health Centers	All lines	Other Outpatient
4077	Medicare Part C Clinic FQHC Federal Qualified Health Center	All lines	Other Outpatient
4079	Medicare Part C Clinic – Other	All lines	Other Outpatient
4083	Medicare Part C Special Facility ASC Ambulatory Surgery Center	All lines	Other Outpatient
4085	Medicare Part C Special Facility CAH Critical Access Hospital	Excluding lines with emergency department and ambulance revenue center codes	Outpatient Hospital
4085	Medicare Part C Special Facility CAH Critical Access Hospital	Lines with emergency department revenue center codes only	Emergency Department
4089	Medicare Part C Special Facility - Other	Excluding lines with ambulance revenue center codes	Other Outpatient
4700	Medicare Part C Professional	Excluding lines with ambulance HCPCS codes (A****) and ambulatory surgery center facility lines.	Professional
4700	Medicare Part C Professional	Ambulatory surgery center facility lines only	Other Outpatient

Notes: Emergency department revenue center codes are 0450-0459 and 0981. Ambulance revenue center codes are 0540-0549. Hospice revenue center codes are 0115, 0125, 0135, 0145, 0155, 0235, and 0650-0659. Home health revenue center codes are 0560-0609. We defined ambulatory surgery center facility lines as professional lines (i.e., those with claim type 4700) with an ambulatory surgery center place of service (24) and an institutional line or header-level rendering NPI or header-level billing NPI.

Table A.3. Professional Line Place of Service Categories

Major Place of Service Codes	Description
11	Office
12	Home
13	Assisted Living Facility
21	Inpatient Hospital
19, 22	Outpatient Hospital
23	Emergency Department, Hospital
24	Ambulatory Surgical Center
31	Skilled Nursing Facility
60	Mass Immunization Center
65	ESRD Facility
81	Independent Laboratory
10, 27-30, 43-48, 58-59, 63-64, 73-80, 82-98	Unassigned POS
01-09, 14-18, 20, 25, 26, 32-34, 41, 42, 50-57, 61, 62, 71, 72	Other Valid POS
Other	Invalid POS

Table A.4. Professional Line Type of Service Categories

HCPCS Codes	Type of Service Category Description
99201-99215	Evaluation & Management Visits
99216-99499	Other Evaluation & Management Services
00001-00999	Anesthesiology
10000-69999	Surgery
70000-79999	Radiology
80000-89999	Laboratory / Pathology
90281-99099, 99500-99607	Medicine
Other	Other HCPCS

Table A.5. Descriptive Statistics for MA Professional Lines, by Type of Service, 2015 and 2016

Type of Service	2015 Total Lines (N)	2015 Mean Lines per Beneficiary per Year	2015 Share of Unique Beneficiaries with Lines	2016 Total Lines (N)	2016 Mean Lines per Beneficiary per Year	2016 Share of Unique Beneficiaries with Lines
Total (All types of service)	798,925,688	48.627	95.2%	845,879,346	49.030*	95.3%
Laboratory/ Pathology	204,479,814	12.446	76.7%	210,055,085	12.175*	76.7%
Medicine	129,701,845	7.894	80.7%	136,138,217	7.891	80.7%
E&M Visits	125,075,036	7.613	89.5%	130,966,402	7.591*	89.5%
Surgery	116,691,566	7.103	78.2%	134,939,278	7.822*	78.2%
Other HCPCS	88,217,442	5.369	75.3%	91,099,064	5.280*	75.3%
Other E&M Services	70,269,980	4.277	54.4%	75,217,007	4.360*	54.4%
Radiology	61,216,400	3.726	66.4%	64,338,857	3.729	66.4%
Anesthesiology	4,971,333	0.303	14.7%	5,453,993	0.316*	14.7%

Notes: "Total lines" is the sum of professional lines across beneficiaries. The sum of lines across type of service categories does not precisely match the total row because of different IDR run dates. "Mean lines per beneficiary per year" is the mean number of professional lines calculated by dividing total utilization by the sum of beneficiary-months and multiplying by 12. "Share of unique beneficiaries with lines" refers to any in the year. Results are based on utilization from beneficiary-months where the beneficiary was enrolled in a CCP or PFFS plan. E&M = evaluation and management.

* indicates a difference in 2015 versus 2016 means that is statistically significant with $p<0.001$ using test statistics calculated from beneficiary-month utilization.

Source: RAND analysis of 2015 and 2016 ED accessed via CMS' IDR (run dates 08/31/2018 - 09/02/2018).

Table A.6. Descriptive Statistics for MA Professional Lines, by Place of Service, 2015 and 2016

Place of Service	2015 Total Lines (N)	2015 Mean Lines per Beneficiary per Year	2015 Share of Unique Beneficiaries with Lines	2016 Total Lines (N)	2016 Mean Lines per Beneficiary per Year	2016 Share of Unique Beneficiaries with Lines
Total (All POS)	798,925,688	48.627	95.2%	845,879,346	49.030*	95.3%
Office	440,469,888	26.810	91.3%	471,908,375	27.353*	91.3%
Independent Laboratory	162,846,064	9.912	59.2%	161,755,476	9.376*	59.6%
Inpatient Hospital	68,761,974	4.185	17.7%	72,148,020	4.182	17.6%
Outpatient Hospital	53,926,329	3.282	48.0%	58,754,951	3.406*	48.5%
Emergency Department	26,869,613	1.635	28.7%	29,904,729	1.733*	29.0%
Home	20,296,269	1.235	16.7%	24,227,507	1.404*	18.3%
Other Valid POS	17,451,181	1.062	13.7%	19,517,003	1.131*	14.4%
Skilled Nursing Facility	7,086,137	0.431	4.1%	7,513,153	0.435*	4.1%
Assisted Living Facility	1,301,390	0.079	0.8%	1,459,894	0.085*	0.8%
Ambulatory Surgical Center	718,009	0.044	1.8%	596,299	0.035*	1.5%
Mass Immun. Center	438,791	0.027	1.3%	394,113	0.023*	1.1%
Invalid POS	318,069	0.019	1.2%	0	0.000	0.0%
Unassigned POS	109,886	0.007	0.3%	0	0.000	0.0%
ESRD Facility	29,816	0.002	<0.1%	28,383	0.002*	<0.1%

Notes: "Total lines" is the sum of professional lines across beneficiaries. "Mean lines per beneficiary per year" is the mean number of professional lines calculated by dividing total utilization by the sum of beneficiary-months and multiplying by 12. "Share of unique beneficiaries with lines" refers to any in the year. Results are based on utilization from beneficiary-months where the beneficiary was enrolled in a CCP or PFFS plan. The sum of lines across type of service categories does not precisely match the total row because of different IDR run dates.
* indicates a difference in 2015 versus 2016 means that is statistically significant with $p<0.001$ using test statistics calculated from beneficiary-month utilization.
Source: RAND analysis of 2015 and 2016 ED accessed via CMS' IDR (run date 08/31/2018 - 09/02/2018).

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