



Cataract Surgery in the Medicare Merit-Based Incentive Payment System

Episode-Based Cost Measure Development and Evaluation

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Objective: To characterize the development and performance of a cataract surgery episode-based cost measure for the Medicare Quality Payment Program.

Design: Claims-based analysis.

Participants: Medicare clinicians with cataract surgery claims between June 1, 2016, and May 31, 2017.

Methods: We limited the analysis to claims with procedure code 66984 (routine cataract surgery), excluding cases with relevant ocular comorbidities. We divided episodes into subgroups by surgery location (Ambulatory Surgery Center [ASC] or Hospital Outpatient Department [HOPD]) and laterality (bilateral when surgeries were within 30 days apart). For the episode-based cost measure, we calculated costs occurring between 60 days before surgery and 90 days after surgery, limited to services identified by an expert committee as related to cataract surgery and under the influence of the cataract surgeon. We attributed costs to the clinician submitting the cataract surgery claim, categorized costs into clinical themes, and calculated episode cost distribution, reliability in detecting clinician-dependent cost variation, and costs with versus without complications. We compared episode-based cost scores with hypothetical “nonselective” cost scores (total Medicare beneficiary costs between 60 days before surgery and 90 days after surgery).

Main Outcome Measures: Episode costs with and without complications, clinician-dependent variation (proportion of total cost variance), and proportion of costs from cataract surgery-related clinical themes.

Results: We identified 583 356 cataract surgery episodes attributed to 10 790 clinicians and 8189 with ≥ 10 episodes during the measurement period. Most surgeries were performed in an ASC (71%) and unilateral (66%). The mean episode cost was \$2876. The HOPD surgeries had higher costs; geography and episodes per clinician did not substantially affect costs. The proportion of cost variation from clinician-dependent factors was higher in episode-based compared with nonselective cost measures (94% vs. 39%), and cataract surgery-related clinical themes represented a higher proportion of total costs for episode-based measures. Episodes with complications had higher costs than episodes without complications (\$3738 vs. \$2276).

Conclusions: The cataract surgery episode-based cost measure performs better than a comparable nonselective measure based on cost distribution, clinician-dependent variance, association with cataract surgery-related clinical themes, and quality alignment (higher costs in episodes with complications). Cost measure maintenance and refinement will be important to maintain clinical validity and reliability.

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In 2015, Congress passed the Medicare Access and Children’s health insurance program Reauthorization Act to reduce costs by rewarding high-quality, cost-efficient care.^{1–4} Eligible clinicians choose between the following 2 options: (1) Merit-based Incentive Payment System (MIPS)

and (2) advanced alternative payment models that require clinicians to bear financial risk and regulatory burden. Most ophthalmologists opt for MIPS (89.4% of eligible ophthalmologists in a recent 2017 Medicare analysis).⁵ Under MIPS, fee-for-service payments are adjusted using a

composite score with 4 components: quality, clinical practice improvement activities, meaningful use of certified electronic health record technology (promoting interoperability), and resource use (cost).^{6,7} By 2022, clinicians with poor scores risk losing up to 9% of Medicare revenues annually, whereas clinicians with good scores may receive up to 9% in bonus. The financial impact of the cost component will grow over time; it was weighted at 10% for the first (2018) performance period and will represent 20% of the MIPS final score for the 2021 performance period.^{8,9}

To implement the MIPS score cost component, the Centers for Medicare and Medicaid Services (CMS) is developing episode-based cost measures for specific conditions and episodes of care. Previously, clinicians were responsible for the full amount of health care spending by each of their patients over a given time period, e.g., Medicare Spending Per Beneficiary and Total Per Capita Cost.^{6,7,10} These are broad, population-based nonselective measures, frequently including costs for nonophthalmology-related services, whereas episode-based cost measures are designed to count only services that are directly influenced by the attributed provider within a specific episode of care.¹¹

Cataract surgery was 1 of the first episode groups developed into a cost measure, in recognition of its high impact. It is the most common surgical procedure among older United States adults, with ~ 3 million surgeries performed each year, and is estimated to account for > \$3.4 billion in annual Medicare spending.^{12,13} As the only ophthalmology-specific cost measure in MIPS to date, it has a substantial potential impact on ophthalmologist reimbursement.

An expert committee including ophthalmologists, an optometrist, an anesthesiologist, and a nurse anesthetist was convened by the CMS' measure developer contractor, Acumen, LLC, to develop a feasible and practical cataract surgery episode-based cost measure for MIPS implementation. Here, we describe the development process, discuss rationale and supporting data for committee decisions measure specifications, and evaluate measure performance compared with a hypothetical broad nonselective cost measure. This information has relevance both for understanding the cataract surgery episode-based cost measures and for informing future development of other episode-based measures in ophthalmology and beyond.

Methods

Episode-Based Cost Measure Development

Clinical Subcommittee and Measure Development Process.

Episodes were constructed with Medicare claims data only, with costs defined as the total amount paid by Medicare parts A and B fee-for-service claims, including beneficiary deductibles and coinsurance. An Ophthalmology Disease Management Clinical subcommittee—10 clinician experts nominated from 8 clinical organizations, including the American Academy of Ophthalmology, the American Optometric Association, American Society of Cataract and Refractive Surgery, and American Society of Retina Specialists—was convened to provide recommendations for

cost measure specifications. Field testing was conducted on the basis of preliminary episode specifications, using Medicare claims data from June 1, 2016, to May 31, 2017.^{11,14,15} All clinicians who attributed ≥ 10 episodes during the measurement period received a confidential Field Test Report and had the opportunity to give feedback on the measure construction. The Clinical subcommittee refined the measure based on feedback and field-testing data (Fig 1) (Additional details in Supplemental Appendix).

Episode Construction. Final episode specifications are provided in Table S1 (available at www.ophthalmologyscience.org). The subcommittee defined the Current Procedural Terminology/Health Care Common Procedure Coding System code 66984 (routine cataract removal with intraocular lens implantation) as the “trigger” for an episode. Each episode was attributed the clinician billing the 66984 claim. Clinicians were identified via a unique Taxpayer Identification Number (TIN) and National Provider Identifier, and corresponding clinician groups identified by TIN.

To ensure clinical homogeneity, the subcommittee excluded episodes for Medicare beneficiaries with relevant ocular comorbidities coded within 120 days before trigger (Tables S2A, B, available at www.ophthalmologyscience.org). Excluded comorbidities were based on previous exclusions under Physician Quality Reporting System measures. Surgeries performed at a location other than an Ambulatory Surgery Center (ASC) or Hospital Outpatient Department (HOPD) were also excluded from consideration, as were episodes without a primary surgeon or if surgery was performed on a beneficiary who died before the end of the episode window, had noncontinuous part B enrollment, or was enrolled in part C (because of potential unobserved events/services).

To fairly compare and report costs across similar populations and settings, episodes were divided into 4 subgroups using the following 2 mutually-exclusive criteria: (1) site of service (ASC vs. HOPD) and (2) unilateral or bilateral surgery. The rationale for the site of service subgroups was because some clinicians may not have access to an ASC—reflecting regional availability, employer contractual agreements, or health plan contracting arrangements. The rationale for laterality subgroups reflected that some services (e.g., preoperative examinations and testing) may be applied to a second surgery performed in close succession. Episodes were considered bilateral if second-eye cataract surgery occurred within 30 days of the first; all other episodes were considered unilateral.

Subgrouping based on “comanagement” arrangements (i.e., episodes managed by the surgeon alone, versus with another ophthalmologist or optometrist assisting in preoperative and postoperative care) were also considered. However, because clinicians were only attributed to episodes if they billed the cataract surgery trigger code and because field testing showed little cost difference between comanaged and noncomanaged episodes, these subgroups were removed after field testing. In the final specifications, 87.1% of clinician groups and 83.7% of individual clinicians still achieved 10-case minimum after all exclusions and subgroups were applied.

Cataract surgery-related services were identified between 60 days before trigger and 90 days after trigger—long enough to include complications but short enough to ensure grouped services could be reasonably influenced by the attributed clinician. The after trigger window was selected for consistency with the postoperative 90-day global period, and the before trigger window was selected from data indicating the presence of a clinic visit (evaluation and management or eye examination Current Procedural Terminology code) for 50% of episodes within 30 days and 77% of episodes within 60 days before trigger.

Assigned services, specifically selected for cataract surgery relevance (Table S1), were divided into 5 major clinical themes,

designed to represent clinically-relevant cost categories: cataract surgery-related office visits, complications/return to operating room, office-based diagnostic testing, office-based procedures, and other ancillary care (including anesthesia, part B/clinician-administered medications, and injections).

Risk adjustment was used to adjust costs for factors outside a clinician’s control, including patient case-mix. Models incorporated variables for patient age, reason for Medicare eligibility, comorbid conditions (from CMS-Hierarchical Condition Category version 22 2016 Risk Adjustment Model, [Table S3](#), available at www.ophtalmologyscience.org),^{16,17} -GC modifier (indicating involvement of a trainee, to avoid penalizing clinicians engaged in teaching resident surgeons), and episodes with new patients (Evaluation and Management codes 99201–99205) versus established patients (99211–99215). The latter category was included to avoid penalizing clinicians with a referral-based practice who disproportionately treat new patients. Centers for Medicare and Medicaid Services-Hierarchical Condition Category risk adjustment variables were included for cross-measure consistency and for broad general representation of systemic health cost drivers. Risk adjustment models did not include sex or race/ethnicity, concordant with CMS’ current standards for risk adjustment in cost measures. Social risk factors were tested and found to have minimal impact on the measure.¹⁸ Each subgroup had separate risk adjustment models and cost calculations, and performance was reported by the subgroup.

Episode-based versus Nonselective Cost Measures

We compared the performance of the cataract surgery episode-based cost measure versus a nonselective measure with the same trigger code but incorporating all costs, regardless of whether under the influence of the attributed clinician. We constructed these measures using Medicare parts A and B claims during the study period (June 1, 2016 to May 31, 2017). The episode-based cost measure included costs for assigned services from the Clinical subcommittee input process detailed above. The nonselective measure included costs for all parts A and B services billed within the episode window (60 days before trigger and 90 days after trigger). Both nonselective and episode-based cost measures used standardized costs, accounting for differences in regional variation.

For each measure, we used risk-adjusted costs to evaluate the performance of clinicians who attributed ≥ 10 events. Specifically, we calculated the observed-to-expected (O/E) ratio—unadjusted (observed) costs divided by adjusted (expected) costs for an event. Observed-to-expected ratio of < 1 signified events less costly than expected, whereas $O/E > 1$ signified events more expensive than expected. We defined each clinician’s performance score as the average of O/E ratios for attributed events and calculated their adjusted average episode cost by multiplying their performance score by the national average episode cost. For each episode, we calculated the proportion of costs that could be categorized into a clinical theme.

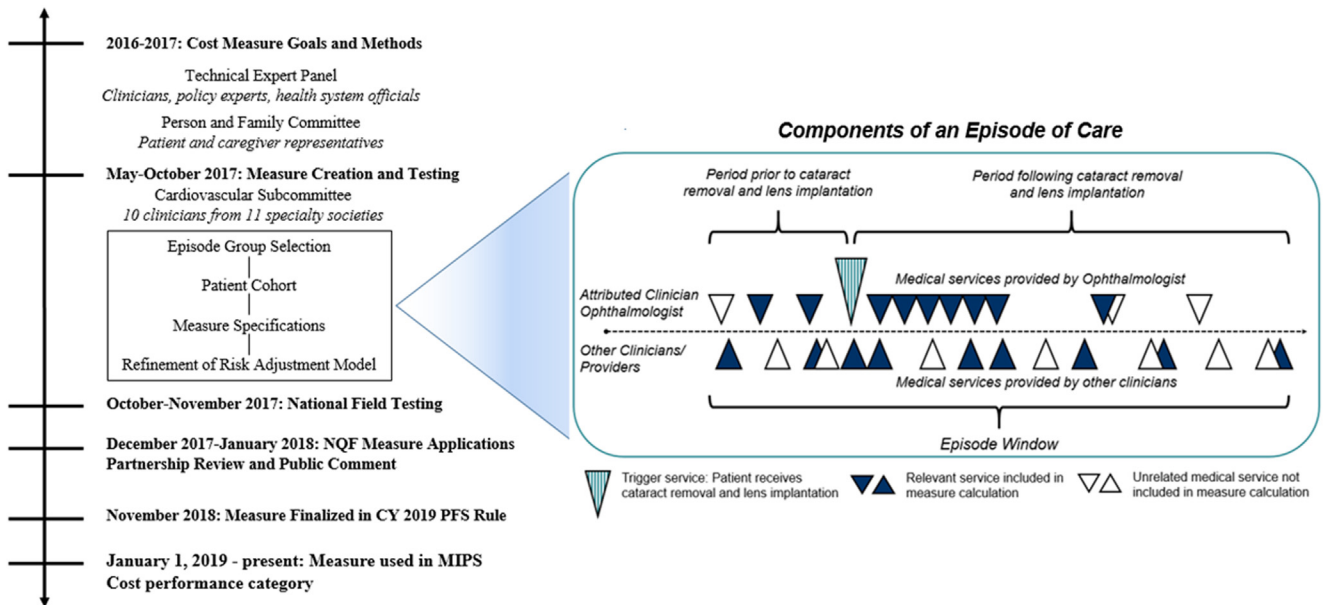


Figure 1. Unadjusted distribution of mean provider (Taxpayer Identification Number) costs for episode-based versus nonselective measures. This is a simplified timeline of episode development. The Technical Expert Panel and the Clinical subcommittee convened several times over this time period. The Technical Expert Panel and the Person and Family Committee provided broad guidance to developing measures with a substantial impact on beneficiaries, clinicians, and Medicare spending. The Subcommittee provided detailed recommendations regarding the following: the clinical scenario to evaluate, the combination of Medicare claim codes that indicate the start of an episode (the trigger rules), the logic to identify the responsible clinician (attribution), patient attributes requiring risk adjustment or measure exclusion, the timeframe to measure costs (episode window), and the specific medical services to include in the cost calculation (service assignment). Measure construction is illustrated in the schematic as “Components of an Episode of Care.” The goal of this episode of care is to measure the attributed ophthalmologist and include only relevant medical services (blue solid triangles). Unrelated services such as influenza admission or dermatology appointments (white triangles) were excluded from the cost calculation. The measure underwent national field testing among all eligible clinicians and was revised based on these feedbacks. The measure was proposed and finalized in the Physician Fee Schedule. Measure specifications are available online. CY = calendar year; PFS = physician fee schedule; MIPS = Merit-based Payment System; NQF = National Quality Forum.

Table 5. Episode Group Characteristics and Beneficiary Demographics

Characteristic	All Episodes N (%) or Mean (SD)*	ASC/Bilateral* Subgroup N (%) or Mean (SD) [†]	ASC/Unilateral Subgroup N (%) or Mean (SD) [†]	HOPD/Bilateral* Subgroup N (%) or Mean (SD) [†]	HOPD/Unilateral Subgroup N (%) or Mean (SD) [†]
Total number of episodes	583 356	152 008	262 444	47 584	121 320
Total number of beneficiaries	513 803	152 008	214 714	47 584	100 766
Number of clinicians with ≥ 1 episode	10 790	5798	7211	3477	5337
Number of clinicians with ≥ 10 episodes	8189	3312	5147	1338	2933
Age (yrs)					
0–64	25 857 (4.4)	5821 (3.9)	10 832 (4.1)	2328 (4.9)	6876 (5.7)
65–69	150 557 (25.8)	43 312 (28.5)	66 791 (25.5)	12 304 (25.9)	28 150 (23.2)
70–74	171 215 (29.4)	47 241 (31.1)	76 704 (29.2)	14 022 (49.5)	33 248 (27.4)
75–79	132 758 (22.8)	33 983 (22.4)	59 675 (22.7)	11 013 (23.1)	28 087 (23.2)
80–84	70 029 (12.0)	15 549 (10.2)	32 383 (12.3)	5618 (11.8)	16 479 (13.6)
85–89	26 758 (4.6)	5172 (3.4)	12 916 (4.9)	1933 (4.1)	6737 (5.6)
90–94	5545 (1.0)	854 (0.6)	2806 (1.1)	343 (0.7)	1542 (1.3)
≥ 95	637 (0.1)	76 (0.1)	337 (0.1)	23 (0.1)	201 (0.2)
Sex					
Male	217 354 (37.3)	55 117 (36.3)	100 425 (38.3)	16 780 (35.3)	45 032 (37.1)
Female	366 002 (62.7)	96 891 (63.7)	162 019 (61.7)	30 804 (64.7)	76 288 (62.9)
Race/ethnicity					
Asian	9802 (1.7)	1722 (1.1)	5217 (2.0)	428 (0.9)	2435 (2.0)
Black	33 496 (5.7)	6660 (4.4)	15 483 (5.9)	2096 (4.4)	9259 (7.6)
Hispanic	7164 (1.2)	1265 (0.8)	3648 (1.4)	357 (0.8)	1894 (1.6)
White	513 601 (88.0)	138 035 (90.8)	228 687 (87.1)	43 325 (91.1)	103 554 (85.4)
Other	12 026 (2.1)	2388 (1.6)	6040 (2.3)	810 (1.7)	2788 (2.3)
Unknown	7265 (1.3)	1938 (1.3)	3369 (1.3)	568 (1.2)	1390 (1.2)
Average Number of Comorbidities [‡]	1.07 (1.37)	0.98 (1.31)	1.06 (1.36)	1.06 (1.36)	1.20 (1.47)
Reason for Medicare eligibility					
Age	509 918 (87.4)	135 154 (88.9)	230 884 (88.0)	41 123 (86.4)	102 757 (84.7)
End-stage renal disease	1224 (0.2)	229 (0.2)	552 (0.2)	77 (0.2)	366 (0.3)
Dual eligible	518 (0.1)	85 (0.1)	236 (0.1)	27 (0.1)	170 (0.1)
Disabled	71 696 (12.3)	16 540 (10.9)	30 772 (11.7)	6357 (13.4)	18 027 (14.9)

ASC = Ambulatory Surgery Center; HCC = Hierarchical Condition Category; HOPD = Hospital Outpatient Department; SD = standard deviation

*Bilateral episodes are those with right and left eye cataract surgery (2 cataract surgery trigger codes) occurring ≤ 30 days apart in the same patient.

[†]N (%) for categorical variables, mean (SD) for continuous variables, % for categorical variables, and SD for continuous variables.

[‡]A complete list of HCC comorbidities is provided in Table S3 (available at www.ophtalmologyscience.org).

Table 6. Distribution of Episode Costs by Subgroup

Episode Cost Score Mean (SD)	Episode Cost Score Percentile							
	1st	10th	25 th	50th	75th	90th	99th	
All episodes	\$2876 (\$265)	\$2130	\$2682	\$2750	\$2828	\$2962	\$3151	\$3834
ASC/bilateral*	\$3790 (\$250)	\$3441	\$3638	\$3684	\$3728	\$3795	\$3945	\$5098
ASC/unilateral	\$2065 (\$203)	\$1796	\$1908	\$1944	\$1994	\$2104	\$2357	\$2766
HOPD/bilateral*	\$4977 (\$519)	\$3632	\$3810	\$4962	\$5175	\$5270	\$5326	\$5738
HOPD/unilateral	\$2657 (\$320)	\$1882	\$2140	\$2573	\$2694	\$2778	\$2943	\$3582

ASC = Ambulatory Surgery Center; HOPD = Hospital Outpatient Department; SD = standard deviation.

*Bilateral episodes are those with right and left eye cataract surgery (2 cataract surgery trigger codes) occurring ≤ 30 days apart in the same patient.

Episode Costs with and without Complications

We identified codes indicative of cataract surgery complications and categorized them into clinically-relevant categories: broken posterior capsule, dropped lens, intraocular lens repositioning/removal/exchange, retinal tear or detachment repair, endophthalmitis, and cystoid macular edema (Table S4, available at www.opthalmologyscience.org). We evaluated the observed episode costs and O/E ratio for each category, and for episodes with any versus no complication codes.

Statistical Analyses

We evaluated means, frequencies, and percentages for episode characteristics by subgroup. We evaluated episode costs by subgroup and clinician characteristics, and plotted histograms of average observed costs for episode-based and nonselective measures.

We also calculated a metric to assess reliability—that is, how well a measure captures differences from clinician versus patient-level factors (statistical “noise”). For each attributed clinician’s episode-based and nonselective measures, total variance in attributed costs was divided into clinician-dependent variation (i.e., between-clinician variance because of differences in individual clinicians’ care) and case-mix variation (i.e., within-clinician variance because of patient case-mix differences outside of individual clinician influence). We then determined the proportion of total variance reflected by clinician-dependent variation. A larger fraction (closer to 1) suggests that the measure adequately captures systematic differences between the attributed clinician versus other clinicians.

To further compare episode-based and nonselective measures, we ranked clinicians by performance scores and stratified them into quintiles (quintile 1 being best-performing [low cost] and quintile 5 being worst-performing [high cost]). This allowed us to identify clinicians who were classified in different performance quintiles via episode-based versus nonselective measure approaches and determine the proportion of clinicians who were “low cost” (quintiles 1 and 2) or “high cost” (quintiles 4 and 5) using 1 measure approach but not the other. We also evaluated the proportion of costs attributed to each clinical theme among clinicians who were reclassified between measures. All analyses adhered to the tenets of the Declaration of Helsinki.

Results

Episode Characteristics and Demographics

We identified 583 356 cataract surgery episodes representing 513 803 beneficiaries and attributed to 10 790 clinicians

(TIN-National Provider Identifiers) among 5526 clinician groups (TINs) (Table 5). Among the 10 790 clinicians with ≥ 1 episode, 8189 clinicians had ≥ 10 episodes during the study period. Most surgeries were performed in an ASC (71%, $n = 414\ 452$) and were unilateral (66%, $n = 383\ 764$). The smallest subgroup was bilateral surgeries performed in an HOPD (8% of episodes, $n = 47\ 584$). Most beneficiaries were White (88%, $n = 513\ 601$), women (63%, $n = 366\ 002$), and Medicare-eligible because of age (87%, $n = 509\ 918$). Mean age was 74 years, with the largest proportion (29.4%, $n = 171\ 215$) of beneficiaries aged 70 to 74 years.

Cataract Surgery Episode Costs

Among individual clinicians with ≥ 10 cataract surgery episodes (8189 clinicians), the mean episode cost was \$2876, ranging from \$2130 (first percentile) to \$3834 (99th percentile). Costs were higher for surgeries performed in an HOPD versus ASC (Table 6), consistent with higher facility fees. We observed similar mean costs among clinicians regardless of their number of episodes, with only a \$40 difference in mean episode cost between clinicians with 10 to 19 episodes and those with ≥ 300 episodes (Table 7).

Nonselective versus Episode-Based Costs

Overall costs were higher for the nonselective measure (mean episode cost \$6488, ranging from \$4739 [first percentile] to \$8864 [99th percentile]). The distribution of unadjusted costs was much wider for nonselective compared with episode-based measure estimates (Fig S2, available at www.opthalmologyscience.org). Across all subgroups, the clinician-dependent variation reliability metric was consistently higher for the episode-based measure (0.94 vs. 0.39 for the nonselective measure), suggesting that it is better at capturing variance under clinician influence (Fig 3). Measured clinician performance also differed between the 2 measure approaches; 72% of clinicians fell into different performance quintiles with each approach. Among clinicians who were high-cost (quintiles 4 and 5) under the nonselective measure, 19.4% ($n = 1589$) were no longer high-cost under the episode-based cost measure. And among clinicians who were low cost (quintiles 1 and 2) under the nonselective measure, 19.9% ($n = 1630$) were no longer

Table 7. Episode Costs and Clinician Characteristics*

	Episode Cost Score				
	All Episodes Mean (SD)	ASC/Bilateral [†] Mean (SD)	ASC/Unilateral Mean (SD)	HOPD/Bilateral [†] Mean (SD)	HOPD/Unilateral Mean (SD)
All clinicians	\$2876 (\$265)	\$3790 (\$250)	\$2065 (\$203)	\$4977 (\$519)	\$2657 (\$320)
Clinician census region					
Northeast	\$2885 (\$270)	\$3842 (\$309)	\$2072 (\$209)	\$5002 (\$536)	\$2625 (\$274)
Midwest	\$2885 (\$253)	\$3783 (\$259)	\$2070 (\$222)	\$5024 (\$485)	\$2674 (\$257)
South	\$2866 (\$261)	\$3797 (\$247)	\$2043 (\$179)	\$4947 (\$540)	\$2676 (\$358)
West	\$2880 (\$280)	\$3741 (\$181)	\$2095 (\$221)	\$4902 (\$508)	\$2620 (\$335)
Unknown	\$2884 (\$380)	\$3895 (\$316)	\$2111 (\$265)	—	\$2360 (\$477)
Clinician risk score quintile [‡]					
1 st	\$2931 (337)	\$3751 (\$252)	\$2045 (\$212)	\$4889 (\$580)	\$2649 (\$287)
2 nd	\$2869 (\$274)	\$3792 (\$249)	\$2062 (\$206)	\$4896 (\$572)	\$2639 (\$307)
3 rd	\$2871 (\$243)	\$3815 (\$283)	\$2065 (\$203)	\$5079 (\$443)	\$2369 (\$322)
4 th	\$2862 (\$213)	\$3786 (\$235)	\$2068 (\$192)	\$4923 (\$568)	\$2689 (\$364)
5 th	\$2856 (\$252)	\$3795 (\$234)	\$2079 (\$204)	\$5100 (\$346)	\$2672 (\$304)
Number of episodes					
10–19	\$2904 (\$317)	\$3838 (\$325)	\$2095 (\$235)	\$4972 (\$526)	\$2642 (\$320)
20–39	\$2894 (\$301)	\$3809 (\$269)	\$2068 (\$202)	\$5044 (\$468)	\$2644 (\$284)
40–59	\$2874 (\$269)	\$3790 (\$254)	\$2069 (\$203)	\$5013 (\$482)	\$2653 (\$300)
60–79	\$2874 (\$269)	\$3790 (\$254)	\$2069 (\$203)	\$5003 (\$491)	\$2598 (\$297)
80–99	\$2885 (\$265)	\$3785 (\$216)	\$2074 (\$211)	\$4977 (\$502)	\$2598 (\$302)
100–199	\$2873 (\$246)	\$3753 (\$186)	\$2064 (\$198)	\$4708 (\$655)	\$2676 (\$310)
200–299	\$2848 (\$249)	\$3795 (\$205)	\$2061 (\$204)	\$5133 (\$102)	\$2805 (\$385)
≥ 300	\$2864 (\$246)	\$3687 (\$84)	\$2021 (\$202)	—	\$3015 (\$508)

ASC = Ambulatory Surgery Center; HOPD = Hospital Outpatient Department; SD = standard deviation.

*Among clinicians with ≥ 10 episodes.

[†]Bilateral episodes are those with right and left eye cataract surgery (2 cataract surgery trigger codes) occurring ≤ 30 days apart in the same patient.

[‡]Based on the average of expected costs for each of a clinician’s attributed episodes determined from risk adjustment modeling.

low-cost under the episode-based cost measure (Table S8, available at www.opthalmologyscience.org).

Clinical Themes and Clinician Cost Performance

Cataract surgery-related office visits, office-based testing, and other ancillary care (anesthesia, medications, and injections) accounted for the largest shares of total costs

(5.0%, 3.4%, and 6.6%, respectively, representing n = 48, 33, and 63 of 958 clinicians). Other than facility costs—which cost measure subgroups adjusted for—the balance of assigned costs in episode-based cost measures were attributed to cataract surgery-related clinical themes (Table S9, available at www.opthalmologyscience.org). Cataract surgery-related clinical theme categories represented a substantially higher proportion of costs for the

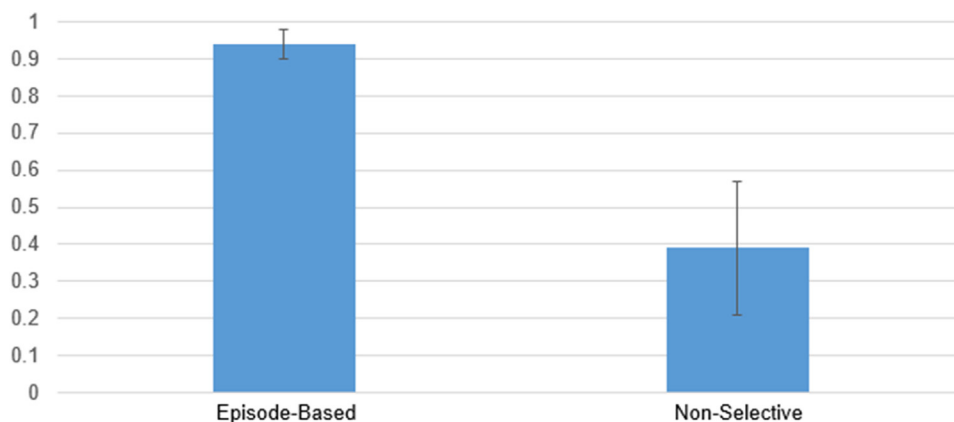


Figure 3. Episode-based versus nonselective cost measure mean reliability. The reliability metric was calculated as a fraction of clinician-dependent variation to case-mix variation, in which clinician-dependent variation is between-clinician variance (because of differences in individual clinicians’ care) and case-mix variation is within-clinician variance (because of patient case-mix differences outside of individual clinician influence). Thus, a value closer to 1.0 better reflects cost differences that are influenced by individual clinicians’ care.

Table 11. Cost Scores among Episodes with and without Complications

Episodes*	Episode Cost Mean (SD)	Score Percentile							Mean-Observed/Expected Cost Ratio
		1st	10th	25th	50th	75th	90th	99th	
All	\$3029 (\$1101)	\$1604	\$1825	\$2001	\$2807	\$3736	\$4702	\$5569	1.00
No complication codes	\$2276 (\$630)	\$1462	\$1750	\$1857	\$2014	\$2651	\$2897	\$5094	0.96
Any complication codes	\$3738 (\$970)	\$1873	\$2182	\$3456	\$3716	\$3941	\$5315	\$5701	1.04
Broken posterior capsule	\$4535 (\$869)	\$2364	\$3357	\$3987	\$4506	\$5245	\$5511	\$6306	1.25
Dropped lens	\$4326 (\$970)	\$2150	\$3118	\$3526	\$4399	\$5248	\$5423	\$6176	1.46
IOL repositioning/removal/exchange	\$4221 (\$903)	\$2167	\$3163	\$3579	\$3944	\$5130	\$5410	\$5964	1.51
Retinal tear/detachment repair	\$3711 (\$1098)	\$1596	\$2387	\$2647	\$3903	\$4412	\$5167	\$6230	1.21
Endophthalmitis	\$3487 (\$1075)	\$1744	\$2197	\$2635	\$3379	\$4104	\$5076	\$6312	1.26
Cystoid macular edema†	\$2885 (\$264)	\$2121	\$2682	\$2760	\$2850	\$2974	\$3162	\$3806	1.05

CPT = Current Procedural Terminology; HCPCS = Healthcare Common Procedure Coding System; IOL = intraocular lens; SD = standard deviation.

*Complication categories based on the codes listed in Table S4 (available at www.opthalmologyscience.org).

†Cystoid macular edema is identified from diagnosis codes (not CPT/HCPCS), and part D services such as eye drops are not included in cost calculations (not included in initial measure specifications); therefore, the reported episode mean cost may not reflect all complication-related costs.

episode-based versus nonselective cost measure (Table S10, available at www.opthalmologyscience.org).

Surgical Complications and Clinician Cost Performance

Mean costs were higher for episodes with any complication code than those without (\$3738 vs. \$2276; Table 11). Even after risk adjustment, the mean O/E cost ratio was higher for episodes with complications (1.04 vs. 0.96). These differences were even more striking for episodes with specific complications. For example, episodes with codes suggesting a broken posterior capsule (anterior vitrectomy) had a mean cost of \$4535 and O/E ratio of 1.25, and episodes with codes suggesting intraocular lens repositioning/removal/exchange had a mean cost of \$4221 and O/E ratio of 1.51.

Discussion

A cataract surgery episode-based cost measure was developed by expert consensus and iterative refinement to produce a clinically-relevant measure for use in MIPS. The constructed measure was limited to costs for preoperative and postoperative evaluation, management, and testing, surgical costs, and costs reflecting measurable complications under the clinician's control. Over an episode window spanning 60 days preoperatively and 90 days postoperatively, risk-adjusted costs were attributed to the ophthalmologist performing cataract surgery. Episodes were divided into subgroups for comparisons and reporting, based on ASC versus HOPD setting and unilateral versus bilateral surgery. We find 8189 individuals attributed clinicians with ≥ 10 episodes in the initial evaluation of this cost measure, with a mean episode cost of \$2876.

Cost measures better discriminate performance when the cost variation can be isolated to factors reasonably under attributed clinician influence. By evaluating comparable surgical populations, excluding costs unrelated to cataract surgery, and risk adjusting for patient factors beyond the

clinician's control, more of the measured variation reflects clinician practice as opposed to patient-level variation or random noise. Compared with a nonselective measure, the episode-based cost measure for cataract surgery performs better in reliability and clinical alignment, and clinicians had higher proportions of services falling into cataract surgery-related clinical theme categories, including complications and subsequent operating room or office-based procedures. Although complications are not completely avoidable, rates can be reduced by best practices. Our results likely underestimate performance improvement for episode-based compared with nonselective cost measures because attribution and risk adjustment was also clinically refined for episodes.

Cost measures have previously been criticized for a "poor track record in identifying efficient patients and practices;"³ however, episode-based cost measures hold promise for fairer attribution by comparing similar clinicians caring for similar patient populations. These measures were developed via systematic guidance from clinician stakeholders, field testing, and feedback—to ensure clinical face validity, clear attribution, clinical coherence, transparency and comprehensibility, utility and actionability, and minimized reporting burden. Episode-based cost measures can hold clinicians accountable for health care costs under their control, while avoiding penalization for costs outside their control. Furthermore, these episode-based cost measures align with quality metrics because clinically-relevant adverse events were selected for service assignment and episodes with complication codes had higher mean cost scores.

The cataract episode-based cost measure is limited by the absence of prescription drug costs (e.g., Medicare Part D), the inclusion of which would require careful modeling and validation to fairly attribute costs to clinicians who may have a different mix of patients with and without part D coverage. This is an important consideration for future iterative measure refinement. Furthermore, although they do not subject clinicians to additional reporting mechanisms, episode-based cost measures are subject to inherent

limitations of administrative claims data, including potential coding inaccuracies, incomplete data capture, and limited sensitivity or granularity in diagnosis and procedure information. However, although there will inevitably remain opportunities for clinicians to “game” the system, careful consideration was given to constructing episodes with fair and representative service assignments, and our mean episode cost in this analysis period was comparable with the reported 2019 mean-observed cataract surgery episode cost (\$3149.29).¹⁹ Use of Medicare claims additionally ensures that measures will be available to all clinicians, without an added reporting burden. And given the direct financial implications of reporting, we are optimistic that the MIPS cost measures may improve coding accuracy for included conditions and services. The cataract surgery episode-based cost measure was evaluated and endorsed by the National Quality Forum (measure #3509).²⁰

Merit-based Incentive Payment System episode-based cost measures also represent an effort toward greater transparency in Medicare reimbursement, so that individual clinicians and clinician groups are informed of metrics for episode cost calculations as well as specific services and service categories driving their episodes costs away from the national average. Future iterations of cost measures will

continue to engage clinicians for feedback, allowing opportunities for measuring refinement in areas such as service assignment and risk adjustment. Stakeholders have expressed interest in evaluating new services, incorporating additional data such as prescription medications, and more closely linking cost measures to quality measures. This initial cataract surgery episode-based cost measure marks an important first step.

The initial development of a MIPS cataract surgery episode-based cost measure demonstrates clinical validity and reliability by fairly attributing clinically-relevant costs to the ophthalmologist surgeon and capturing cost variance within the clinician’s influence. The episode-based cost measure performs better than a comparable nonselective cost measure based on cost distribution, association with cataract surgery-related clinical theme categories, and quality alignment (higher costs among episodes with complications). Episode-based cost measures represent an important step in Medicare’s efforts to engage clinicians, fairly constrain costs, and incentivize value. Development and cost assignment decisions for the cataract surgery episode-based cost measures offer a potential model for future cost measures in ophthalmology and beyond.

Footnotes and Disclosures

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Data collection: Pershing, Sandhu, Do, Choradia, Lin, Leoung, Shah, Liu, Lee, Lam, Macurdy, Nagavarapu, Bhattacharya.

Analysis and interpretation: Pershing, Sandhu, Uwilingiyimana, Glasser, Morgenstern, Do, Choradia, Lin, Leoung, Shah, Liu, Lee, Fairchild, Lam, Macurdy, Nagavarapu, Bhattacharya.

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Abbreviations and Acronyms:

ASC = Ambulatory Surgery Center; **CMS** = Centers for Medicare and Medicaid Services; **HOPD** = Hospital Outpatient Department; **MIPS** = Merit-based Incentive Payment System; **O/E** = observed-to-expect; **TIN** = Taxpayer Identification Number.

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