COSTAWARE METHODOLOGY

Delaware Health Care Commission

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Delaware *CostAware* Data Sources and Methodology

Overview

The Delaware Health Care Commission (DHCC) is reporting estimates of the cost of health care services for state residents generated based on data from the Health Care Claims Database (HCCD), a robust source of data for Delaware residents that includes claims submitted by the state's largest health insurance payers.

Cost estimates reflect the average amounts paid (by the payer and the patient) based on claims data from the HCCD. Cost estimates reflect both insurance payments and patient payments including copay, coinsurance, and deductible amounts.

The purpose of the *CostAware* website is to summarize results of these cost analyses and highlight variation in the cost of medical services in Delaware. Many factors contribute to health care cost variation including differences in clinical practice, billing practices, contractual relationships and payment systems used by health insurers. *CostAware* does not yet explore how these factors of variation impact Delaware's medical costs. In addition to cost analyses, *CostAware* also provides utilization measures. Quality measures were generated by the Centers for Medicare and Medicaid Services (CMS) from data reported by hospital systems and Accountable Care Organizations (ACO) operating in Delaware.

The launch of *CostAware* is an important first step toward increasing the transparency of Delaware's health care systems. Improving health care transparency is an outgrowth of Governor John Carney's 2018 Executive Order 25, which established health care cost and quality benchmarks in Delaware. Understanding variation in cost, utilization and quality of care is necessary to identify opportunities to improve patient experience, population health and to identify opportunities to control health care costs and the rate of growth. These are Delaware's goals related to the Triple Aim.

This document provides a brief overview of the HCCD database, and the methods used to generate the cost and utilization measures reported on *CostAware*.

Data Source: The Delaware Health Care Claims Database (HCCD)

The Delaware Health Care Claims Database (HCCD) is powered by Delaware Health Information Network (DHIN). It is a collection of health care claims, enrollment, and provider data from Medicare, Medicaid, and some of the larger commercial health insurers in the State of Delaware. It is Delaware's All Payer Claims Database (APCD) and is the largest repository of claims data Delaware has with over seven years of data for over 690,000 Delaware residents. Visit the APCD Council's website to learn more about APCDs.

The purpose of the HCCD is to facilitate data-driven, evidence-based improvements in access, quality, and cost of health care. The HCCD is a tool to promote and improve public health through increased transparency of claims data and information. The HCCD can also help lawmakers and decision makers identify areas for quality improvement and expanded access; understand and quantify health system performance and the impact of health care transformation; and provide meaningful comparisons with actionable information to support policy and consumer decisions. For more information on DHIN and

the HCCD visit: [Delaware Health Care Claims Database - Delaware Health Information Network (dhin.org)](dhin.org).

Definitions and Acronyms

- **CC / MCC**: Complications or Comorbidities/Major Complications or Comorbidities. Used most often with Diagnostic Related Groups (see MS-DRGs)
- **CMS**: The Centers for Medicare and Medicaid Services
- **CPT Codes**: Current Procedural Terminology (CPT) codes developed and maintained by the American Medical Association (AMA) and used as a standard to identify and categorize medical procedures.
- **EID:** The DHIN Enterprise Identifier (EID) for each individual in the database.
- **MS-DRGs**: Medicare Severity Diagnosis Related Groups – A system used to categorize hospital inpatient procedures for patients receiving the same service and with similar clinical characteristics. It is designed to support reimbursement and account for the severity of illness and associated costs of care to allow for meaningful comparisons across states, regions, health systems, and populations.
- **Paid per Visit**: The paid per visit amount is a calculated average as the sum of the insurance paid amount and member paid amounts, divided by the number of visits to generate an average cost. The insurer paid amount refers to the amount paid for the procedure or service as submitted by the insurer. Member paid amount refers to the sum of co-insurance, copay, and deductible amounts paid by the member.
- **Utilization per 1,000**: Utilization per 1,000 persons is an industry standard calculation that allows for normalized comparisons. This rate is calculated by summing the utilization (either claims or visits depending on the analysis) and dividing by the relevant number of members in the HCCD database. This provides an average per-individual utilization count which is then multiplied by 1,000.
- **Visit**: Refers to a set of related claims for an individual on a specific date of service.

General Methodology Notes

Treatment of Outliers: Outliers refer to values that do not reflect typical costs for a service or episode and may occur for several reasons including incomplete data or human error. Outlier values are either very high or very low relative to typical costs and will impact the accuracy and relevance of average cost estimates if not removed from the analysis.

The *CostAware* methodology first removes zero dollar claims because these are uncommon and the HCCD lacks complete information on uncompensated care. The remaining claims for each service or episode are then grouped by insurance type (commercial insurance, Medicare Advantage, Medicaid) and assigned to providers based on the billing provider identifier (National Provider Identifier, or NPI). Costs for these claims are then ranked from highest to lowest and the top and bottom percentile are removed from the analysis. With the outliers removed, average costs for each service or episode are calculated by provider for each insurance type. This process generates average cost estimates that more accurately reflect typical costs.

Denominator Calculation for Utilization Rates**:** This information is used for the per 1,000 members utilization rate calculations and reflects the number of unique **EIDs** (Enterprise IDs) assigned using

DHIN's Initiate matching process, as opposed to the number of member IDs provided by insurers. *CostAware* results reflect members who live in Delaware; out-of-state residents are excluded.

Payer Information: Payers refers to and includes commercial health plans, Delaware Medicaid and Managed Care Organizations and Medicare Advantage Plans. Medicare Fee for Service (FFS) data will be added to *CostAware* when it becomes available. The following were also excluded from all *CostAware* measures and reports because they do not represent comprehensive health care coverage: Medicare Supplemental (Medigap) plans, Qualified Medicare Beneficiaries (dually eligible members), and Vaccines for Children Recipients. *CostAware* average cost estimates also exclude entities reporting only pharmacy claims (CVS, Express Scripts), health plans no longer operating in Delaware, and claims for members living out of state.

Risk Adjustment: Average costs for specific medical services and episodes of care presented on *CostAware* are not risk adjusted. They are actual average costs calculated based on HCCD data as submitted to DHIN by Delaware health care payers. The Total Cost of Care (TCOC) measures are risk adjusted using the Johns Hopkins Adjusted Clinical Groups (ACG)® System. This software models and predicts an individual's health over time using existing data from medical claims, electronic medical records, and demographics like age and gender. Risk adjustment considers all diagnoses and services received over a defined period.

Methodology for Specific Medical Services

CostAware includes estimates of average costs and utilization rates (per 1,000 persons) based on claims data from the Delaware Health Care Claims Database (HCCD). Calculations reflect data for Delaware residents and measures were generated for all payer types unless otherwise noted. Average cost estimates exclude denied claims and claims for services with a zero paid amount. The cost estimates reflect claims for both facility and professional services where appropriate (imaging procedures and colonoscopy).

Procedures Codes: Specific medical services reported on *CostAware* are identified based on American Medical Association (AMA) Current Procedural Terminology (CPT) codes. Because some services are similar or may have multiple CPT codes, such as doctor visits, a distribution analysis was performed to identify the most common code for a particular procedure. Individuals with clinical expertise were consulted to confirm CPT code choices. In some cases, multiple CPT codes were used to identify a single service. Multiple codes were combined in generating a cost estimate only if the average cost of the service was similar across codes. The following codes were used to identify specific services reported on *CostAware.*

Services		Procedure Codes
Imaging	Head CT	70450, 70460, 70470
	Screening Mammography	77067
	Lumbar Spine MRI	72148, 72158
Lab Tests	Blood Count: Complete (CBC) automated (Hgb, Hct, RBC, WBC, and platelet count) and automated differential WBC	85025

	Hemoglobin A1c	83036 and 83037
Doctor Visits	New Patient	99201-99205 = Office Visit, New
	Established Patient	99211-99215 = Office Visit, Established
Other	Colonoscopy[1]	45378 and 45380
	Emergency Department (ED) Visits	Place of service is '23' (Emergency Room Hospital) OR procedure code 99281-99285 (excludes claims with an admission diagnosis or an admission date to only include ED visits that did not result in a hospital admission). 99281 and 99282 – Mild Severity 99283 – Medium Severity 99284 and 99285 – High Severity

For individual services, the average cost was calculated based on the appropriate CPT code(s) by payer type. Because these individual services are coded separately, variation across payer types and unnamed providers is relatively low.

Average costs for Imaging services (MRI, CT Scan, Mammogram) reflect payments to the facility taking the image as well as for professional services to review and interpret the results. Colonoscopy average cost estimates also reflect multiple services. These estimates do not include costs for other, unrelated services received by the patient on the same day.

Average cost estimates are presented by payer type and can be compared across de-identified Accountable Care Organizations (ACOs) to highlight variation in the Delaware health care marketplace. Because primary care practices belonging to ACOs may not have onsite imaging facilities or their own labs, these services are often provided at other locations. When this occurs, the cost of an imaging procedure or lab service is assigned to the patient's ACO based on patient attribution. As an example, Jane Doe receives an MRI at the independent Anonymous Imaging Center. Because Jane is attributed to a physician practice associated with ACO 1, the cost of Jane's MRI is assigned to ACO 1 for purposes of reporting the average cost.

For the initial release of *CostAware*, patients were attributed to individual primary care practices based on their respective NPIs. Practices were then assigned to ACOs based on NPIs and publicly available ACO practice rosters. ACO level *CostAware* measures were calculated as weighted averages of individual practice values using the number of attributed patients as weights. A methodology that supports more granular reporting will be developed in collaboration with Delaware payers and providers for future releases of *CostAware*. ACO groupings were chosen to be consistent with the CMS quality measures displayed on the *CostAware* website. CMS reports this data by ACO.

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[1] Note: Utilization rate for Colonoscopy is not reported because we lack a clear denominator.

ACOs are groups of doctors, hospitals, and other health care providers, who come together voluntarily to provide coordinated, high-quality care to their patients. ACOs establish financial incentives for providers to promote best practice care to the right persons at the right time while improving patients' overall health care experiences. The ACO initiative is a major piece in Delaware's Road to Value – a plan to transform the way that health care is delivered and paid for in the state. For more information on the Road to Value, visit: https://www.choosehealthde.com/Road-to-Value.

Average cost estimates presented on *CostAware* do not distinguish between what is paid to the facility, ACO, physician or other providers who treated the patient.

Methodology for Episodes

Some medical procedures require multiple services from different providers. Episodes of care combine these services to create a single estimate of average cost. *CostAware* includes estimates of average costs and the number of episodes performed based on Health Care Claims Database (HCCD) data for calendar year 2019. Calculations reflect Delaware residents and measures were generated for all payer types unless otherwise noted. Average cost estimates exclude denied claims and episodes with a zero paid amount. The average cost per episode reflects claims for facility and professional services provided during the inpatient hospital stay, e.g., all claim activity between the admission and discharge dates.

MS-DRGs: Episodes were defined based on assignment of Medicare Severity Diagnosis Related Groups (MS-DRGs) to hospital inpatient claims data. MS-DRGs were originally developed by CMS and are used to categorize patients with similar clinical characteristics undergoing common hospital procedures to support reimbursement and allow for meaningful comparisons of costs across states, regions, health systems and populations. Currently, cases are classified into MS-DRGs for payment under the Inpatient Prospective Payment System (IPPS) based on the following information reported by the hospital: the principal diagnosis, up to 24 additional diagnoses, and up to 25 procedures performed during the hospital stay. Procedures often have multiple MS-DRGs to reflect the presence (or absence) of Complications or Comorbidities/Major Complications or Comorbidities (CC/MCC) and other clinical differences. For purposes of *CostAware,* episodes were identified based on MS-DRG codes without CC/MCC because these best reflect typical patient experience and average costs. The following MS-DRGs were used to identify and define the episodes of care reported on *CostAware*.

Episodes	Code(s)
C-Section	MS-DRG 785: Cesarean section with sterilization without CC/MCC MS-DRG 788: Cesarean section without sterilization without CC/MCC

Percutaneous Coronary Intervention (PCI)	MS-DRG 247: Percutaneous cardiovascular procedure with drug-eluting stent without MCC MS-DRG 249: Percutaneous cardiovascular procedure with drug-eluting stent without MCC MS-DRG 251: Percutaneous cardiovascular procedure without coronary artery stent or AMI without MCC
Knee and Hip Replacement	MS-DRG 468: Revision of Hip or Knee Replacement without MCC/CC MS-DRG 470: Major Joint Replacement or Reattachment of Lower Extremity Without MCC
Vaginal Delivery	MS-DRG 798: Vaginal Delivery W Sterilization/D&C without CC/MCC MS-DRG 807: Vaginal Delivery without Sterilization/D&C without CC/MCC

For episodes, average costs were estimated based on MS-DRG assignment and reflect multiple services associated with the procedure that were performed and billed during the inpatient hospital stay (e.g., between the admission and discharge dates) by payer type. Because episode cost estimates reflect payments for multiple services and providers, variation across payer types and unnamed hospitals is generally larger than that for specific medical services.

MS-DRG assignments identify patients who had a particular episode (or procedure) on a particular date. Each episode is further identified by a "common key," which is a combination (or concatenation) of patient EID, date of service and place of service. This common key is then used to identify claims for all services the patient received between the hospital admission and discharge dates. The cost of all services provided during this period are added together to generate a cost estimate for each episode.

The common key is also used to assign episodes to payers (commercial insurance, Medicare Advantage, Medicaid) and, along with the billing provider NPI, used to identify the hospital where the procedure was performed. Episodes are then assigned to unnamed hospitals, the total cost per episode is calculated and divided by the number of episodes to generate an average cost estimate for each hospital.

Average cost estimates are presented by payer type, highlight variation in the Delaware health care marketplace, and can be compared across unnamed hospitals. The average cost estimates do not distinguish between what is paid to the hospital, physicians or other providers who treated the patient.

Methodology for Total Cost of Care
CostAware includes measures capturing variation in the average Total Cost of Care (TCOC) for patients attributed to Delaware ACOs. In addition to estimates of the risk adjusted average TCOC (per member per month), the methodology generates index values that measure relative efficiency and the separate impacts of prices and medical service utilization. TCOC measures reflect all services delivered to patients

on an annual basis regardless of care setting or provider type. Calculations reflect data for Delaware residents represented in the Health Care Claims Database (HCCD) for calendar year 2019.

HealthPartners: The HealthPartners Total Cost of Care (TCOC) methodology is person-based, population-centered, and facilitates meaningful comparisons of cost and efficiency in treating patients across states, regions, health systems, provider groups and other dimensions. The methodology was endorsed by the National Quality Forum (NQF) in 2012 and again in 2017 for application to commercial health plan claims data. HealthPartners is applied separately to pediatric and adult populations and generates measures of TCOC overall, by service category (Inpatient [IP], Outpatient [OP], Professional, and Prescriptions [Rx]) and finer levels of granularity. Specific metrics produced include Average TCOC (per member per month) and Total Cost, Resource Use, and Price Index scores that support comparisons on a risk-adjusted and attributed-patient basis. Detailed information on the HealthPartners TCOC methodology and measures can be found here: https://www.healthpartners.com/about/improving-healthcare/tcoc/.

Application of the HealthPartners TCOC measures requires:
Commercial health plan claims data that includes allowed amounts (defined as the sum of insurance payment + patient copay + coinsurance + deductible). Provider charged amounts cannot be used in the calculations. HCCD commercial claims data provided by DHIN includes the insurance payments, copay, coinsurance, and deductible amounts needed to calculate the allowed amount and was used to produce the measures reported on *CostAware.*
To attribute patients to primary care providers, practices and ACOs, DHIN applied an attribution methodology based on consensus criteria and specifications developed to support the work of the Delaware Primary Care Reform Collaborative (PCRC) and other state initiatives. The consensus criteria establish the codes used to identify primary care services, providers, and sites of care. Patients are attributed to the primary care provider they visited most frequently during a two-year (24-month) lookback period. In that case of a tie, the patient is attributed to the primary care provider they visited most recently.
Application of MS-DRGs to hospital inpatient claims data. DHIN applied the 3M MS-DRG software tools to HCCD hospital inpatient claims data.
Risk adjustment at the patient level. The NQF endorsement is based on Johns Hopkins ACG® System. DHIN applied the ACGs to the HCCD patient level data.

HealthPartners Measures reported by ACO on *CostAware*

TCOC Measures	Notes
Average Total Cost of Care (TCOC)	Risk-adjusted estimate of the average TCOC (per member per month) of treating patients attributed to a specific ACO. TCOC reflects services received by patients across care settings and provider types and measures relative cost efficiency in treating patients.

Total Cost Index (TCI)	The TCI for a specific ACO facilitates comparisons to the average across all Delaware ACOs (benchmark). ACOs with a TCI > 1.0 have higher than average costs; ACOs with TCI < 1 have lower costs and may be more efficient in providing care to patients.
Resource Use Index (RUI)	Captures the impact of service utilization on TCOC. RUI > 1 indicates higher than average service utilization in caring for patients. RUI helps identify opportunities to improve care coordination.
Price Index (PI)	Captures the impact of prices on TCOC. PI > 1 indicates higher than average prices or reimbursement rates for services. PI helps identify cost drivers and opportunities to reduce costs.

Quality Measures

CostAware includes publicly available quality measures for hospitals and Accountable Care Organizations (ACOs) generated and published by the Centers for Medicare and Medicaid Services (CMS). These CMS sources are described in additional detail below.

Hospital Quality Measures: CMS Hospital Compare – The Centers for Medicare and Medicaid Services (CMS) provides public information on how well hospitals provide recommended care to their patients. The CMS Hospital Compare Measures reported on *CostAware* are summarized in the table below. This information can help consumers make better informed decisions about where to seek health care. For more information, see: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/HospitalCompare.

CMS Domain	Measure	Data Collection Period	Population
Readmission	30-day hospital-wide all-cause unplanned readmission (Hospital-Wide Readmission)	July 1, 2018 - June 30, 2019	Medicare Fee-For-Service beneficiaries
Complications	Rate of complications for hip/knee replacements	April 1, 2016 - March 31, 2019	Medicare beneficiaries
Timely/Effective Care	Elective births - Percent of those giving birth whose deliveries were scheduled too early (1-2 weeks early), when a scheduled delivery was not medically necessary	January 1, 2019 - December 31, 2019	Adult Patients

Patient Experience	Overall rating of hospital (Percent of patients who gave their hospital a rating of 9 or 10)	January 1, 2019 - December 31, 2019	Adult Patients

Hospitals are shown as better than average, below average, and near average. These ratings indicate how a hospital compares to the national average. If a hospital is within 5% of the national average, it is considered near the average. Results differing by more than 5% in either direction are considered either better or below average.

Medicare Shared Savings Program – Participating ACOs must report quality data to CMS after the close of every performance period. CMS measures every ACO's quality performance using standard methods. Quality measures span four domains: patient/caregiver experience, care coordination/patient safety, preventive health, and at-risk populations. For more information visit: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/sharedsavingsprogram/program-data.

Data Collection Period	Population
January 1, 2019 – December 31, 2019	Medicare beneficiaries attributed to physicians in Medicare Shared Savings Program ACOs

Medicare Shared Savings Program Domain	Measure	Details
Patient Experience	**Getting timely care, appointments, and information**	Data collected via the Consumer Assessment of Healthcare Providers and Systems (CAHPS) for ACOs Survey
Preventative Health	**Breast Cancer Screening**	Percentage of women 50 - 74 years of age who had a mammogram to screen for breast cancer
Chronic Disease Care	**Depression Remission at 12 Months**	The percentage of adolescent patients 12 - 17 years of age and adult patients 18 years of age or older with major depression or dysthymia who reached remission 12 months (+/- 60 days) after an index event.

Chronic Disease Care	**Hemoglobin A1c Poor Control**	Percentage of patients 18 - 75 years of age with diabetes who had hemoglobin A1c > 9.0% during the measurement period. Note that a lower performance rate is indicative of better quality
Chronic Disease Care	**Statin Therapy for the Prevention and Treatment of Cardiovascular Disease**	Percentage of the following patients—all considered at high risk of cardiovascular events—who were prescribed or were on statin therapy during the measurement period: - Adults aged ≥ 21 years who were previously diagnosed with or currently have an active diagnosis of clinical atherosclerotic cardiovascular disease (ASCVD); OR - Adults aged ≥ 21 years who were previously diagnosed with or currently have an active diagnosis of clinical atherosclerotic cardiovascular disease (ASCVD); OR - Adults aged 40 - 75 years with a diagnosis of diabetes with a fasting or direct LDL-C level of 70-189 mg/dL

Data Quality

Data submitted by payers to the Delaware HCCD is validated using a 5-step process that occurs over several weeks after receiving monthly files. The DHIN team uses automated reporting processes that aid in the review of results for each step in the validation process: Staging, Level 1, Claims Versioning, Level 2, and Data Enhancements. If any step shows unexpected results, DHIN and the payer collaborate to understand and reconcile the unexpected result. Most cases can be explained due to normal variation in the claims data. Sometimes data must be corrected and resubmitted by the payer to address the issue. Data in the HCCD Analytic Warehouse are generally updated quarterly with a data lag of 90 days.

Staging	Level 1	Versioning	Level 2	Data Enhancements	Analytic Warehouse
File Integrity • File reconciliation • Processing viability	File Specification compliance • Data type • Format • String length • Code sets • % completed • Orphaned claims	Many adjudications to one claim • Medical • Pharmacy	Reasonableness Check • Descriptive statistics • Distributions • Critical reporting elements • National and state comparisons	Calculated Elements (open source and proprietary) • Age groups • Care settings • Johns Hopkins ACG risk score • Episode grouper • 3M MS-DRG	Move to Production

Validating the Data Enhancements and their Use in *CostAware* Reports

The DHIN Analytics team leveraged the Johns Hopkins University ACG® System, 3M MS-DRG episode grouper (a component of the 3M™ Core Grouping Software), Delaware consensus patient attribution parameters, and the HealthPartners' Total Cost of Care and Resource Use Framework (TCOC) to develop inputs to generate the *CostAware* measures. To complete each set of enhancement output files, a data engineer followed the instructions provided by the software developer to install the required software and extract input data files from the HCCD according to vendor specifications using Amazon Redshift.

The data engineer created the input files based on the developer's instructions by aggregating the member eligibility, pharmacy, medical claim, and provider data and capturing primary diagnoses, admission and discharge dates, date of service through, date of service from, procedure codes, cost or reimbursement data, patient EID, and provider NPI number. Once the input files were created according to specifications, the data engineer uploaded the input files to the enhancement software (MS-DRG, ACGs, HealthPartners) to generate output files which in turn were used as inputs to produce the *CostAware* measures and reports.

After the output files were generated, a Quality Assurance analyst followed a QA checklist to review the output files and compare results against expected values based on validation criteria established by the software developers. Examples of validation steps performed by the QA analyst included:

- Researching instances where a discharge date is not associated with an admission date suggesting the patient may not have undergone an inpatient procedure.
- Ensuring that episodes assigned an MS-DRG had valid admission and discharge dates to support accurate calculations of associated costs.
- Confirming that weighted values used and produced by the ACG and HealthPartners tools are assigned correctly to records in the output files and that results are within expected ranges.
- Identifying records that should be removed from the input files due to missing or incomplete data, invalid procedure or diagnosis codes, or secondary payer claim status.
- Validating the accuracy of enhancement outputs against direct queries of the HCCD data and verifying that key values align across platforms and are within expected ranges.
- Validating enhancement output files against external sources to ensure consistency with similar analysis projects and established industry benchmarks (e.g., verify that results based on HCCD data align with the distribution of DRGs in other databases).

Validating the Cost and Utilization Measure Output

All output was reviewed for consistency and quality by multiple data analysts before and after being displayed on the *CostAware* site. Structured Query Language or SQL code used to extract the data needed to calculate *CostAware* measures from enhancement output files and the HCCD was reviewed by multiple project analysts to ensure accuracy. The reasonableness of measure outputs was assessed by comparing values to results generated based on other sources of similar information and established benchmarks when available. When suspected anomalies were identified, investigation into potential causes was performed and corrections applied where appropriate. Measures were also compared to similar results generated based on direct queries of the HCCD database to assess alignment and the reasonableness of values.