



HEALTH CARE
COST INSTITUTE

2018 Health Care Cost and Utilization Report

Analytic Methodology

2018 V2.0

February 24, 2020

Note: This analytic methodology is appropriate for the 2018 Health Care Cost and Utilization Report, as our methods are continually refined. Interested parties are encouraged to refer to the appropriate methodology and report. The version corrects an error in appendix table 4.4.

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1. Introduction

For the 2018 Health Care Cost and Utilization Report, the Health Care Cost Institute (HCCI) presented national and subnational benchmarked statistics of health care spending, utilization, prices, and service-mix intensity for the population of individuals younger than 65 and covered by employer-sponsored private health insurance (ESI). The data behind these statistics came from a national, multipayer, commercial health care claims database containing information provided by four major insurers. As of July 2019, HCCI held approximately 1 billion commercial medical and pharmacy claims per year, representing the health care activity of more than 50 million individuals per year for the years 2007 through 2018. This document, the latest in a series of analytic methodologies from HCCI, describes in detail the methods used to transform raw claims into descriptive statistics presented in the annual report.

For the annual Health Care Cost and Utilization reports HCCI produces an analytic subset of its database, consisting of all non-Medicare claims on behalf of beneficiaries younger than age 65, covered by ESI and whose claims were filed with a contributing health plan between 2014 and 2018. Figure 1 shows the process used to clean the employer-sponsored health insurance claims data. It included categorizing claims, flagging chronically ill populations, calculating utilization, and determining service-mix weights. The data are made representative of the national population younger than 65 and having ESI using population weights based on U. S. Census Bureau data. A completion method was used to estimate the components of claims that were incomplete at the end of the reporting period for data from the years of 2017 and 2018. In most cases, no adjustment was performed for inflation, so the estimated dollars in these reports are nominal unless otherwise stated.



FIGURE 1: PROCESS FLOW



A note on premiums

*HCCI does not report on premiums or their determinants. For more information on health insurance premiums and the multiple factors that affect them (including health care expenditures; insured, group, and market characteristics; benefit design; and the regulatory environment), see Congressional Budget Office, *Private Health Insurance and Federal Policy*,¹ and Kaiser Family Foundation and Health Research & Education Trust, *2018 Employer Health Benefits Survey*.²⁹*

Changes in the methodology

Compared to earlier versions, HCCI's updated analytic methodology (2018V1.0) had the following changes.

- *An analysis decomposing spending growth into various factors is included. Details on the methodology are include in Section 3.7 of this document.*
- *The potential impact of prescription drug rebates on total prescription drug spending is examined using data from the state of Massachusetts. The data for this analysis are included in Appendix 4.11*
- *Measures of out-of-pocket price are reported for each sub-category of spending. Out-of-pocket price is defined as the average amount for which individuals receiving a service were liable. Calculated as the sum of out-of-pocket spending in a service category divided by the number of people who received a service in that category. In contrast to spending per person and out-of-pocket spending per person, the denominator varies by service category.*
- *For the 2018 analytic dataset, 2014, 2015, and 2016 data were considered complete, and no actuarial adjustment was performed. The 2017 and 2018 claims were actuarially completed using the new data.*



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- *The average intensity weights were changed to reflect updates to diagnosis-related groups (DRGs), relative value units (RVUs), and ambulatory payment classifications (APCs) by the Centers for Medicare and Medicaid Services (CMS) in 2017.*



2. Methods

2.1 Data collection

HCCI has access to health care claims data for approximately 50 million Americans in every year between 2007 and 2018 who have commercial health insurance coverage. This dataset was developed from de-identified claims data that were compliant with the Health Insurance Portability and Accountability Act (HIPAA) and included the allowed amounts (actual prices paid) to providers for services. To produce the findings in the 2018 Health Care Cost and Utilization Report, HCCI used an analytic subset of its data consisting of all eligible claims for insureds younger than age 65, covered by either fully-insured or self-insured employer-sponsored health insurance (ESI). The final analytic subset consisted of approximately 40 million covered lives per year, for the years 2014 through 2018 (Table 1). The claims used in the 2018 report include a total of 2.6 billion claim lines and represent the health care activity of about 26% of all individuals younger than 65 covered by ESI, making this one of the largest data collections on the privately insured ever assembled.

TABLE 1: ANALYTIC SUBSET FOR 2018 REPORT – TOTAL COVERED LIVES BY CALENDAR YEAR

<u>Year</u>	<u>Covered Lives</u>
2014	39,500,000
2015	39,000,000
2016	40,000,000
2017	41,800,000
2018	41,500,000

Source: HCCI, 2020. Notes: Data refer only to HCCI holdings of claims for beneficiaries covered by employer-sponsored health insurance and younger than age 65. HCCI datasets include additional data on the individually insured, Medicare Advantage, and other covered beneficiaries not used in these reports. Data rounded to the nearest 100,000.

Between January 2019 and July 2019, each contributing insurer updated the 2017 claims data they previously submitted in addition to providing new data from 2018. HCCI's data manager confirmed the data integrity of each claims file (membership, medical, and pharmacy) in each year with the appropriate data contributor.



From these base datasets, a single analytical dataset was constructed for analysis using the process shown in Figure 1. Analysis of the analytic dataset is described in Section 3.

2.2 Claims categorization

At the highest level, claims data were grouped into four major service categories: inpatient facility, outpatient facility, professional procedure, and prescription drugs and devices. Claims were also divided into several subservice categories: acute inpatient, which excludes skilled nursing facilities, hospice, and ungroupable claims; outpatient facility visits; outpatient-other claims; brand prescriptions; and generic prescriptions. Claims were further classified into detailed service categories (see Appendix Tables 4.1, 4.3, 4.4, and 4.5).

Inpatient facility claims were from hospitals, skilled nursing facilities (SNFs), and hospices, where there was evidence that the insured stayed overnight (Figure 2). The outpatient facility category contained claims that did not include an overnight stay but included observation and emergency room claims (Figure 3). Both outpatient and inpatient claims were for only the facility charges associated with such claims. HCCI classified professional procedure services provided by physicians and non-physicians according to the industry's commonly used procedure codes (Figure 4), and the claims were grouped into five provider type categories: primary care physicians (PCPs), nurse practitioners and physician assistants, non-PCP medical doctors (MDs), providers that are not MDs/NPs/PAs, and unknown and facility claims. Prescription claims were coded into 30 therapeutic classes and grouped as either generic or brand name prescriptions (Figure 4).

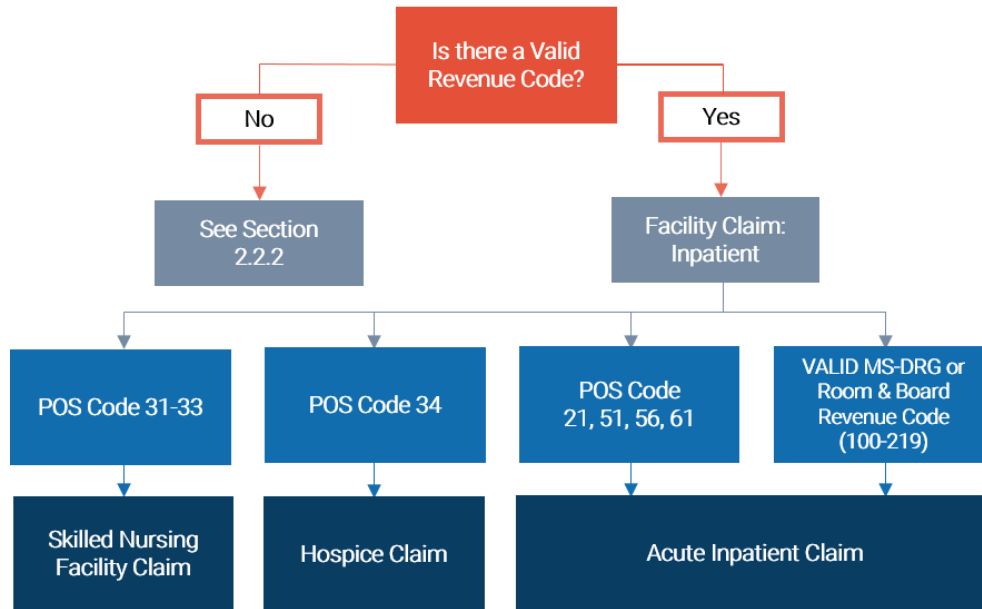
2.2.1 Facility claims

Claims that were billed by place of service were categorized as "facility claims." Medical claims with a valid revenue code were assumed to be facility claims. In absence of that, claims were assumed to be professional procedure claims. Once processed, facility claims were grouped into two major service categories—inpatient and outpatient (Figure 2 and Figure 3).

FIGURE 2: FACILITY CLAIMS PROCESS, INPATIENT



HCCI Claims Processing Methodology: Inpatient Facility Claims



2.2.1.1 Inpatient facility claims

Inpatient services are rendered when patients are kept overnight for treatment but not observation (Figure 2). The inpatient services category included claims with the following criteria: place of service (POS) codes 21, 51, 56, and 61; a valid Medicare Severity Diagnosis-Related Group (MS-DRG) code (V32); or a room and board revenue code of 100-219. This category also included skilled nursing facility (SNF) and hospice claims.

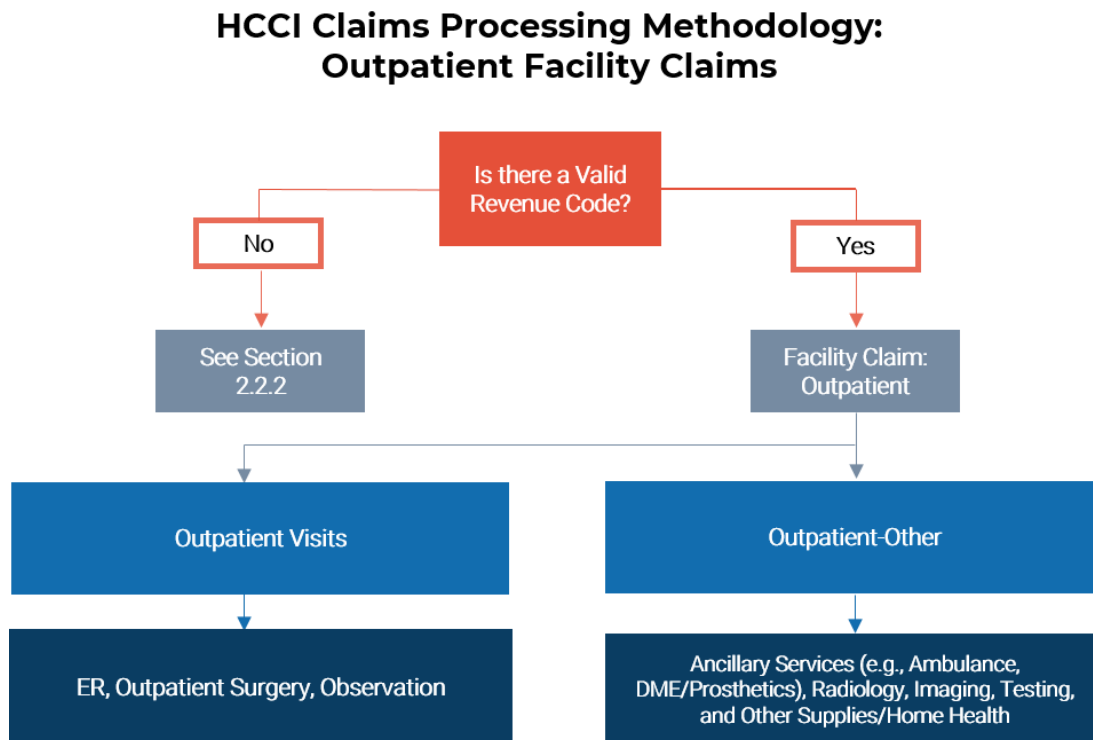
- *Inpatient claims were further classified into four detailed service categories based on the MS-DRG code: medical, surgical, labor/deliveries/newborns, or mental health and substance use (Appendix Table 4.1).*
- *Inpatient services were also grouped into mutually exclusive major diagnostic categories (MDCs), developed from ICD-9-CM or ICD-10-CM diagnostic codes, as appropriate (Appendix Table 4.2).*
- *SNF and hospice: SNFs provide nursing and rehabilitation services, often following an acute inpatient hospital stay. This category was used when the*



POS code was 31-33.³ Hospice is special care provided by a program or facility for the terminally ill. This category was used when the POS code was 34.

- Some inpatient facility claims could not be categorized as described above; these claims were treated as ungroupable. Less than 0.1% of inpatient claims were ungroupable.
- Inpatient claims excluding SNF, hospice, and ungroupable claims were grouped in the subservice category acute inpatient claims.

FIGURE 3: FACILITY CLAIMS PROCESS, OUTPATIENT



2.2.1.2 Outpatient facility claims

Outpatient services are rendered by sections of a hospital providing medical services that do not require an overnight stay or hospitalization (e.g., emergency room (ER), outpatient surgery, observation). These services can also be provided at freestanding



outpatient facilities, including free-standing surgical centers, ambulatory surgical centers (ASCs), and clinics with certain diagnostic testing technologies (e.g., MRIs). These outpatient facilities all file Health Care Financing Administration (HCFA) 1500 form with insurers. The outpatient category was used for all facility claims not characterized as inpatient (Figure 3).

- *Outpatient claims were classified into subservice categories based on both revenue code and the Current Procedural Terminology/Healthcare Common Procedure Coding System (CPT/HCPCS) code. Outpatient claims may have multiple services billed on the same claim, so a hierarchy was used to determine which detail line to use for categorization (Appendix Table 4.3).*
- *The categories with the highest-ranking values were ER, outpatient surgery, and observation. Claims with these services were categorized as the subservice category “outpatient visits”, in which all the detailed records on the claim were grouped together in a single visit and assigned to the detailed service category with the highest hierarchy value (Appendix Table 4.3).*
- *Outpatient services not categorized as ER, outpatient surgery, or observation were counted as “outpatient-other.” Therefore, each service on the claim was categorized and counted separately. This included laboratory/pathology and radiology services, as well as claims without the presence of a revenue code for services with CPT/HCPCS codes for durable medical equipment/prosthetics/supplies (DME) and ambulance services. Hospice procedures given as outpatient services, home health, and miscellaneous outpatient services are also included in this category.*



2.2.2 Professional procedure and prescription claims

2.2.2.1 Professional procedure claims

Professional procedure claims are claims filed by a health care professional for medical services provided. Claims with no valid revenue code were assumed to be a professional procedure claim, unless otherwise noted.

Claims were classified into HCCI's professional procedure detailed categories based on their CPT/HCPCS code (Appendix Table 4.4). Exceptions to the professional procedure codes were all facility-administered drugs (CPT/HCPCS codes J0000–J9999) and were mapped to the administered drugs detailed service category within professional procedures, regardless of whether a revenue code was present on the claim. The professional procedure category also includes facility claims for some independent clinics, such as small private practices, and multi-specialty clinics (e.g., offering primary care and x-rays). Clinics included in the professional procedure category did not file a HCFA 1500 with insurers.

If information was available, the claim was then also categorized by the provider's specialty (Appendix Table 4.4). Physicians were categorized as primary care providers if they were coded as family practice, geriatric medicine, internal medicine, pediatrics, or preventive medicine.

2.2.2.2 Prescription drug claims

Prescription drug and device pharmacy claims were categorized as either brand or generic based on their National Drug Code (NDC). Any drug unidentifiable as either brand or generic was grouped as "uncategorized". These uncategorizable drugs were included in the overall prescription drug trends, but not included as a subservice category of prescriptions. Administered drugs and any devices identified as professional procedures rather than scripts were categorized as professional procedures (Appendix Table 4.4). Prescription claims were grouped into one of the 30 American Hospital Formulary Service (AHFS) therapeutic classes based on the claim's NDC. Prescriptions are then mapped to HCCI's detailed service categories (Appendix Table 4.5). AHFS therapeutic classes are developed and maintained by the American Society of Health-System Pharmacists.⁴ Prescriptions were further classified into sub-detailed classes, based upon their six-digit AHFS class code.



2.3 Chronic conditions categorization

The dataset includes flags for five chronic conditions. The methodologies for the chronic condition groupings are as follows.

2.3.1 Diabetes

Individuals with diabetes were identified using codes based on the 2004 Dictionary of Disease Management Terminology (DDMT).⁵ (See Appendix Table 4.6 for codes). For each year between 2014 and 2018, insureds were flagged as having diabetes mellitus if there was a diagnosis in a DDMT diabetes category for (1) two professional services during the year, (2) one or more ER visits, or (3) one or more inpatient admissions. Once an insured was flagged as having diabetes, he or she was flagged in all subsequent years. Radiology and laboratory claims were excluded from the diabetes methodology, as these can be used for screening purposes.

2.3.2 Hypertension

Individuals with four types of hypertension were identified: essential hypertension on primary diagnosis, essential hypertension on other diagnosis, secondary hypertension on primary diagnosis, and secondary hypertension on other diagnosis. (See Appendix Table 4.7 for codes). If a relevant code was present in any of the inpatient, outpatient, or physician setting claims then the insured was flagged as having hypertension in that year. A hypertension flag for an insured could change from year to year.

2.3.3 Asthma

Individuals were identified as having asthma if a relevant code was present on any inpatient, outpatient, or physician setting claim (see Appendix Table 4.8 for codes). Once an insured was flagged as having asthma, he or she was flagged in all subsequent years.



2.3.4 Attention Deficit Hyperactivity Disorder

Individuals were identified as having attention deficit hyperactivity disorder (ADHD) if there was a relevant code present on any inpatient, outpatient, or physician setting claim (see Appendix Table 4.9 for codes). Once an insured was flagged as having ADHD he or she was flagged in all subsequent years.

2.3.5 Congestive Heart Failure

An individual was flagged as having congestive heart failure (CHF) if a relevant code was present on an inpatient, outpatient, or physician setting claim (see Appendix Table 4.10). The CHF flag could change year to year.

2.4 Grouping and counting methodologies

2.4.1 Unit counting (utilization) methodology

To determine the utilization count, reimbursements for claims were analyzed. In the following rules, reimbursement refers to any monetary payment to a provider, whether a professional procedure provider, facility, or pharmaceutical vendor.

- *If the reimbursement dollars for an admission, visit, or procedure were equal to 0, the utilization count was set at 0.*
- *If the reimbursement dollars for an admission, visit, or procedure were less than 0, the utilization count was set at minus 1. Negative reimbursement amounts occur from claim reversals, making it important to reverse the utilization count as well.*
- *If the reimbursement dollars for an admission, visit, or procedure were greater than 0, the utilization count was set at 1.*

Service category-specific rules are as follows:

- *Inpatient facility: acute, SNF, and hospice*



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- *If multiple claims had the same patient identification, facility categorization (inpatient, SNF, or hospice), and provider with overlapping or contiguous admission or discharge dates, they were grouped into one admission.*
- *The length of stay was determined as the discharge date less the admission date, if that was equal to zero the length of stay is equal to one day. If multiple claims were combined into one admission, the discharge date used was the latest discharge date among all claims; the admission date used was the earliest admission date among all the claims.*
- *Admissions were multiplied by the average intensity weight for the admission type in the year to reflect changes in service-mix. Section 2.4.2 describes the service-mix weights methodology.*
- **Outpatient facility**
 - *For ER, outpatient surgery, and observation claims (outpatient visits):*
 - *a visit was defined as all claims for the same patient, same provider, and same beginning service date;*
 - *if a claim had multiple beginning service dates among its various detail claim lines, the earliest date was used as the beginning service date for the entire claim.*
 - *For all other outpatient claims, utilization counts were record counts adjusted for the reimbursement dollars (as described above). These are referred to as outpatient-other counts.*
 - *Visits and procedures were multiplied by the average intensity weight for the visit or procedure type in the year to account for changes in service-mix. Section 2.4.2 describes the service-mix weights methodology.*



- *To get a total outpatient utilization, the counts were weighted by their average share of outpatient spending over the period and then summed.*
- **Professional services**
 - *For all professional services claims, utilization counts were record counts adjusted for the reimbursement dollars and are referred to as professional procedure counts.*
 - *Professional services counts were multiplied by the average intensity weight for the procedure type in the year to account for change in service-mix. Section 2.4.2 describes the service-mix weights methodology.*

- **Prescriptions**

Prescription drug utilization counts were the number of filled days of a prescription dispensed by a pharmacy. It does not include drugs administered by providers (which are in the professional services category). This provides a standard unit, since differing classes of scripts may be for different lengths of time, which could obscure changes in prescription utilization if the number of filled scripts was instead counted. For example, one month of birth control is 28 filled days, while a round of antibiotics might be 14 filled days. We do not adjust prescription drug utilization for changes in the mix of drugs used.

2.4.2 Service-mix weights methodology

The high-level and detailed service categories aggregate spending and utilization across groups of services. Each year, the mix of services in each category can change. To facilitate comparisons across years, a service-mix weighting methodology is applied. In general, for three of the four high-level service categories (the exception being prescription drugs), weights were applied based on the intensity of a service, reflecting the complexity of the service provided or the level of resources required for treatment. The following section provides details on how service-mix weights were assigned by service category. Our methodology bears some resemblance to that employed in Dunn,



*Liebman, and Shapiro.*⁶

2.4.2.1 Acute inpatient facility: excluding SNF, hospice, and ungroupable

SNF, hospice, and ungroupable claims were excluded when weighting inpatient facility claims, as these do not have service-mix weights. This limited inpatient categorization is referred to as the “acute inpatient”. Each acute inpatient admission was assigned an MS-DRG or DRG code to which a weight was assigned. CMS assigns every DRG a weight based on the average costs to Medicare of patients classified in that DRG. The weight reflects the average level of resources expended for the average Medicare patient in that DRG relative to the average level of resources for all Medicare patients. DRGs that are more expensive to treat get a higher weight and vice versa. In this way, DRG weights reflect intensity of treatment. For the 2018 Health Care Cost and Utilization Report the weights were updated to use the 2018 CMS weights.

2.4.2.2 Outpatient facility

To weight outpatient facility claims, each claim line was mapped to a payment code in the Ambulatory Payment Classification (APC) system based on the CPT/HCPCS code on the claim line. The APC weights used were updated to the 2018 CMS weights.

For claims that could not be mapped to an appropriate APC, weights were assigned based on relative value units (RVUs) for facility procedure codes. RVUs, which are based on the resources required to complete each service, are determined by the American Medical Association and published by CMS. RVU weights were adjusted as were APC weights, based on the difference between calendar year 2018 RVU conversion factor and calendar year 2018 APC base rate.

2.4.2.3 Professional services

Each professional service was mapped to a CPT/HCPCS code (Appendix Table 4.4) and was assigned an RVU, either facility or non-facility, based on the place of service. Professional services are provided in various settings – hospitals, outpatient facilities, and physician offices. The RVUs were updated to the 2018 weights, as published by the CMS. Commercial adjustments were made to account for professional services not commonly seen in Medicare claims and for certain professional services such as anesthesia. The commercial modifiers are proprietary; therefore, HCCI cannot publish them.



2.4.3 Methodology for imputing missing weights

For outpatient procedure and professional service claim lines that were not assigned weights using the methods described, an analysis was conducted to impute a weight. Weights were not imputed for inpatient admissions. The imputation analysis followed these key steps:

- *Step 1: A detailed service category was determined for each procedure code or revenue code requiring a gap fill (referred to as imputed codes).*
- *Step 2: The average price paid and average APC/RVU weight for each detailed service category were calculated based on the claims with assigned weights.*
- *Step 3: Outpatient or professional procedure weight data (as described in Section 2.4.2) from the first half of the most recent year and second half of the previous year were combined. This helps account for seasonal changes.*
- *Step 4: A universal gap fill weight table was created from the Step 1 data.*
- *Step 5: The gap-filled weights from the table were applied to all payers, for all years.*

2.5 Adjustment methodologies

2.5.1 Claims completion methodology

Claims data reflect health care services performed (i.e., claims incurred) in the year noted. Claims generally require time for submission to the payer, processing, and payments to the provider (sometimes called the claim payment lag time or run-out period).

Completion is a standard actuarial practice designed to allow for the calculation of utilization, prices, expenditures, and intensity of health care services when a full set of claims is not available. Services that have outstanding claims may have a missing or incomplete record. Completion allows for the estimation of the cost impact of the outstanding claims to avoid undercounting or under-projecting trends.

Completion factors varied by type of measure (i.e., dollars, unit counts, and intensity weights) and detailed service category (i.e., subgroups within the service categories).



See Appendix Tables 4.3, 4.4, and 4.5 for the detailed service category definitions. The factors were based on historical claims payment patterns specific to the HCCI dataset. They were developed using a standard actuarial model for incurred-but-not-paid analysis, as described by Bluhm.⁷

For the 2018 Health Care Cost and Utilization Report, claims incurred from January 1, 2017 through December 31, 2018 and paid through May 31, 2019 (for one payer) and June 30, 2019 (for the other payers) were collected. An adjustment was needed to account for the remaining 2017 and 2018 medical claims that would be paid after May 31 or June 30, 2019. Prescriptions were considered complete and were not adjusted with completion factors. Claims from 2014-2016 were assumed to be fully adjudicated.

2.5.2 Population weighting methodology

For HCCI's estimation process of the total ESI population, the American Community Survey (ACS) was used to establish a distribution of the population covered by commercial health insurance demographic and geographic characteristics (Appendix Table 4.8).⁸

To develop demographic and geographic weights, the 5-year averages from the ACS non-public health insurance population survey along with single year ESI population estimates as annual adjustments were used.

Demographic and geographic divisions used were as follows:

- *geographic divisions: Core-Based Statistical Area–Metropolitan Statistical Area (CBSA-MSA) and state. Counties that did not map to a CBSA-MSA code – namely, rural counties – were aggregated into a single area by state such that each state had a single “rural area” of counties. Individuals in the dataset may have had more than one state or CBSA listed. This could be due to an insured moving during the year or overlap of CBSAs (e.g., Virginia, Maryland, and the District of Columbia); this affected less than 1 percent of individuals in the dataset;*
- *age divisions: younger than 6 years of age, 6–17, 18–24, 25–44, and 45–64 (Individuals older than age 64 were excluded); and*



- *gender divisions.*

The distribution of the ESI population for these 4,130 distinct age, gender, and geographic categories was developed and used for all years.

age-gender-geo weight = (ACS population for the age-gender-geo category measured) / (ACS national population estimate)

The HCCI data were also aggregated by geographic division, age division, and gender. This enabled the development of weights using the survey-based targets discussed earlier. The weights were applied to insureds and claims, resulting in representative estimates of the national ESI population younger than age 65.

The methodology also accounts for the possibility that some individuals will move CBSAs or change age groups within a year. Individuals are grouped into an age-gender-geo group for the proportion of time spent in that group. For example, if an individual lived half of the year in CBSA1 and half of the year in CBSA2, they would be counted as 0.5 of a covered life in each CBSA.

To account for yearly population fluctuations, the data were also adjusted using a yearly ACS weighting factor.



3. Analysis

The analytic dataset was composed of information on expenditures, prices paid, utilization, and intensity for insureds younger than 65 and covered by ESI. The statistics were weighted by geography-age-gender to be nationally representative. Analyses consisted of summary statistics on spending and the components of spending.

Demographic flags were included for:

- *four US census regions (West, Northeast, Midwest, and South);*
 - *nine US census divisions (New England, Mid-Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, Pacific);*
 - *50 states and the District of Columbia;*
- *five age subgroupings (ages 0–18, 19–25, 26–44, 45–54, and 55–64);*
 - *four children age subgroupings (ages 0-3, 4-8, 9-13, 14-18); and*
- *gender.*

HCCI divided claims into four service categories: inpatient facility, outpatient facility, professional services, and prescriptions. Within those categories were subservice and detailed services:

- *five subservice categories (acute inpatient, without skilled nursing facility, hospice, and ungroupable claims; outpatient visits; outpatient-other; generic prescriptions; and brand name prescriptions);*
- *multiple detailed service categories (e.g., emergency room visits); and*
- *multiple sub-detailed prescription categories based on AHFS prescription classes.*

In the 2018 Health Care Cost and Utilization Report Appendix, HCCI produced report



tables for the service subservice categories, consisting of: annual expenditures per capita, annual out-of-pocket expenditures per capita, utilization per 1,000 insureds, average service intensity, and average service-mix-adjusted prices, and expanded these metrics to include gender, geographic, and age group-level statistics. Definitions of terms used in the report can be found in the glossary.

3.1 Population membership

Membership in the ESI population is calculated as the total number of months individuals are insured. From this insured-years are calculated by member months divided by 12, to estimate 12 months of coverage or the cost for a year of health care.

3.2 Annual expenditures per capita

Per capita health care spending on people with ESI is calculated by summing in each year all the weighted dollars directly spent on health care services for filed claims and dividing that amount by the number of insured-years. By this method, the per capita health expenditures in the report estimates the cost per insured, even for insureds who did not use health care services.⁹ This metric is a subset of overall national health care spending and may not be comparable to other metrics of national spending because it covers only persons having group ESI and younger than 65 years.

Similar methods were used to calculate expenditures per capita out-of-pocket (the dollars paid by members for health services through copayments, co-insurance, and deductibles) and expenditures per capita by payers.

3.3 Decomposition of expenditures per capita

In the annual Health Care Cost and Utilization Reports, estimated health care expenditures were determined by the amount of services used (utilization) and the prices paid to providers for each service. Spending trends were decomposed into a utilization trend and a price trend to determine the major drivers of the health care cost curve.



3.4 Utilization per 1,000 insured

In the annual Health Care Cost and Utilization Reports, HCCI calculated utilization rates per 1,000 insureds. The utilization measure was produced by summing for each service category the admissions, visits, or procedures, after accounting for changes in service-mix, as well as the number of filled prescription days. Prescription drug utilization does not reflect changes in the mix of products used. The resulting amount was divided by the number of insured-years. This provided a per-individual utilization count by service category, which was then multiplied by 1,000. Total utilization reflects the spending weighted sum of inpatient, outpatient, professional procedures, and prescription utilization. We use the average spending share over the 2014 to 2018 period as the spending weight.

3.5 Average price per service

In the annual Health Care Cost and Utilization Reports, HCCI calculated average price per service by dividing total expenditure by total utilization (inclusive of volume and service-mix intensity) per service or subservice category. By this method, the derived calculation includes the “prices” paid by the payer and the insured out of pocket.

3.6 Length of stay

Starting in the 2013 Health Care Cost and Utilization Report, HCCI added a metric for measuring the length of inpatient admissions in days. The number of days stayed for an admission is calculated as the date of discharge minus the date of admission, if these dates are the same days then length of stay is set equal to one (see section 2.4.1). This method of calculating the number of days is consistent with how health plan benefits are designed and collected. Length of stay for admission categories is then calculated by dividing the total number of days in an inpatient service, subservice, or detailed service category by the utilization of that category. This results in the average length of stay in days for each service, subservice, and detailed service inpatient category.



3.7 Spending growth decomposition, 2014-2018

To measure the contribution of different factors to cumulative spending growth from 2014 to 2018, all dollar amounts were first converted to 2018 dollars using CPI-U. Next, the change in average spending per member was decomposed into three components: service price effect, age/gender composition effect, and utilization effect. The terms were defined as follows.

Average spending per member:

$$PCSpending_t = \sum_g shr_{t,g} \sum_c (\overline{p}_{t,g,c} * q_{t,g,c})$$

Where,

- *t* is the year
- *g* is the age-gender group
- *c* is the high-level service category

Change in spending:

$$\begin{aligned} PCSpending_t - PCSpending_{t-1} &= \sum_g shr_{t,g} \sum_c (\overline{p}_{t,g,c} * q_{t,g,c}) - \sum_g shr_{t-1,g} \sum_c (\overline{p}_{t-1,g,c} * q_{t-1,g,c}) \\ &= \sum_g \sum_c (shr_{(t,g)} - shr_{(t-1,g)}) * \overline{p}_{(t-1,g,c)} * q_{(t-1,g,c)} \\ &\quad + shr_{(t,g)} * q_{(t-1,g,c)} * (\overline{p}_{(t,g,c)} - \overline{p}_{(t-1,g,c)}) \\ &\quad + shr_{(t,g)} * \overline{p}_{(t,g,c)} * (q_{(t,g,c)} - q_{(t-1,g,c)}) \end{aligned}$$

Where, the first term is the “age/gender effect”, the second term is the “service price effect”, and the third term is the “quantity effect”. The quantity effect, reflects changes in intensity-adjusted utilization beyond those attributed to changes in the composition of the population.



4. Appendix

4.1 Acute inpatient facility detailed service categories and corresponding MS-DRG codes [V34.0]

Medical	Surgical and Transplant	Labor & Deliveries	Mental Health & Substance Use	Newborns
52-103	1-17	765-768	876	789-795
121-125	20-42	774 & 775	880 - 887	
146-159	113-117	783-788	894 - 897	
175-208	129-139	796-798		
280-316	163-168	805-807		
368-395	215-274			
432-446	326-358			
533-566	405-425			
592-607	453-520			
637-645	570-585			
682-700	614-630			
722-730	652-675			
754-761	707-718			
776-782	734-750			
808-819	769 & 770			
831-849	799-804			
862-872	820-830			
913-923	853-858			
933-935	901-909			
945-951	927-929			
963-965	939-941			
974-977	955-959			
	969 & 970			
	981-989 & 998			



4.2 Mapping to MS-DRG codes

MDC	Major Diagnostic Category Description	MS-DRG
1	<i>Nervous system</i>	020–103
2	<i>Eye</i>	113–125
3	<i>Ear, Nose, Mouth, & Throat</i>	129–159
4	<i>Respiratory System</i>	163–208
5	<i>Circulatory System</i>	215–316
6	<i>Digestive System</i>	326–395
7	<i>Hepatobiliary System & Pancreas</i>	405–446
8	<i>Musculoskeletal System & Connective Tissue</i>	453–566
9	<i>Skin, Subcutaneous Tissue, & Breast</i>	570–607
10	<i>Endocrine, Nutritional, & Metabolic System</i>	614–645
11	<i>Kidney & Urinary Tract</i>	652–700
12	<i>Male Reproductive System</i>	707–730
13	<i>Female Reproductive System</i>	734–761
14	<i>Pregnancy; Childbirth</i>	765–788, 796–798, 805-807, 817-819, 831-833
15	<i>Newborns & Neonates (Perinatal Period)</i>	789–795
16	<i>Blood, Blood-Forming Organs, & Immunological Disorders</i>	799–804, 808-816
17	<i>Myeloproliferative Diseases & Disorders</i>	820–830, 834-849
18	<i>Infectious & Parasitic Disease & Disorders</i>	853–872
19	<i>Mental Diseases & Disorders</i>	876–887
20	<i>Alcohol/Drug Use or Induced Mental Disorders</i>	894–897
21	<i>Injuries, Poison, & Toxic Effects of Drugs</i>	901–923
22	<i>Burns</i>	927–935
23	<i>Factors influencing Health Status</i>	939–951
24	<i>Multiple Significant Trauma</i>	955–965
25	<i>Human Immunodeficiency Virus Infections</i>	969–977
PR	<i>Transplants</i>	001–017
AL	<i>Extensive Procedures Unrelated to Principal Diagnosis</i>	981-989, 998-999



4.3 Outpatient facility service categories mapping to CPT/HCPCS/revenue codes/hierarchies

<i>HCCI Sub-service Category</i>	<i>HCCI Detailed Service Category</i>	<i>Revenue Codes Mapping (standard UB92 codes only)</i>	<i>CPT/HCPCS Codes Mapping (standard 2018 codes)</i>	<i>Hierarchy Ranking</i>
<i>Visits</i>	<i>Emergency Room</i>	<i>450-452; 456; 459</i>	<i>99281-99292; 99466-99476</i>	<i>1</i>
	<i>Outpatient Surgery</i>	<i>360– 362; 367; 369; 481; 490; 499; 790; 799</i>	<i>10021-36410; 36420-58999; 60000-69990; 92920-92944; 93501-93581; 0016T-0261T; 0392T-0393T</i>	<i>2</i>
	<i>Observation</i>	<i>760-762; 769</i>	<i>99217–99220</i>	<i>3</i>
<i>Other</i>	<i>Miscellaneous Outpatient Services</i>	<i>420-424; 429-434; 439-444; 449; 480; 482-483; 489; 650-659; 720-724; 729-732; 739; 800-804; 809; 820-826; 829-835;</i>	<i>59000-59899; 90801-90899; 90935-90999; 92626-92633; 92950-93352; 93600-93799; 97001-98943; A4651-A4660; A4927-A4932; E1500; E1699 H0001-H2037</i>	<i>4</i>



<i>HCCI Sub-service Category</i>	<i>HCCI Detailed Service Category</i>	<i>Revenue Codes Mapping (standard UB92 codes only)</i>	<i>CPT/HCPCS Codes Mapping (standard 2018 codes)</i>	<i>Hierarchy Ranking</i>
		839-845; 849-855; 859; 880-882; 889; 900-919; 944-945; 1000-1006		
	<i>Radiology Services</i>	320-324; 329-333; 335; 339-344; 349-352; 359, 400-404; 409; 610-619	70010-77063; 77071-79999; 96401-96571; G6001-G6017; R0070-R0076	5
	<i>Lab/Pathology</i>	300-307; 309-312; 314; 319	36415-36416; 80047-89398; P2028-P9615; 0001M-0008M; 0001U-0015U	6
	<i>Ambulance</i>	A0021-A0999		7
	<i>DME/Prosthetics/Supplies</i>	A4206-A4650; A4661-A4926; A4933-A9999;		8



<i>HCCI Sub-service Category</i>	<i>HCCI Detailed Service Category</i>	<i>Revenue Codes Mapping (standard UB92 codes only)</i>	<i>CPT/HCPCS Codes Mapping (standard 2018 codes)</i>	<i>Hierarchy Ranking</i>
		<i>E0100- E1499; E1501- E1698; E1700- E8002; K0001- K0903; L0100- L9999</i>		
	<i>Home Health¹</i>	<i>99500- 99602</i>		9

¹Outpatient facility claims with Type of Bill Codes of 300-399 were assigned to the Home Health detailed service category.



4.4 Professional services detailed service categories mapping to CPT/HCPCS codes

HCCI Sub-Detailed Service Category	HCCI Detailed Service Category	CPT/HCPCS Code Range
Administered Drugs, including Chemo Drugs	Administered Drugs	B4164-B5200; C9014-C9030; C9032-C9257; C9275; C9279-C9290; C9292-C9298; C9399-C9460; C9462-C9478; C9480-C9497; C9742; G0260; G0293; G3001; G9017-G9036; J0120-J9999; M0075-M0076; M0300; Q0138-Q0181; Q0515; Q2004-Q2034; Q2040-Q2043; Q2049-Q2050; Q3025-Q3028; Q4074-Q4082; Q5101-Q9950; Q9980; Q9991-Q9993; Q9995; S0012-S0194; S0197; S4989-S5014; S5550-S5553; S5565-S5571
Administration of Drugs	Administration of Drugs	90460-90461; 90471-90474; 96360-96440; 96446-96450; C8957; G0008-G0010; G0259; G8006; G8009; G8012; G8152; G8170; G8219; G8450; G8459; G8461; G8463; G8468; G8473; G8482; G8506; G8579; G8582; G8585; G8598; G8600; G8629-G8630; G8633; G8696; G8702; G8709-G8711; G8799; G8809; G8816; G8859-G8860; G8864; G8868-G8870; G8895; G8916-G8917; G8927; G8935; G8967; G9141; G9189; G9201; G9205-G9206; G9221-G9223; G9245; G9300-G9302; G9315; G9450; G9518; Q0081-Q0085; Q0510-Q0514; S2083; S4981; S5035-S5036; S5497-S5523; S9061; S9325-S9379; S9401; S9430; S9490-S9504; S9537-S9810; T1502-T1503



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HCCI Sub-Detailed Service Category	HCCI Detailed Service Category	CPT/HCPCS Code Range
Allergy	Other	95004-95199
Anesthesia	Anesthesia	00100-02020; 99100-99140; 99151-99157; 0062T; 0067T; 0077T; 0084T; 0144T-0150T; 0170T; 0334T-0336T; 0338T-0340T; 0343T; 0345T
Cardiovascular Consultations	Other	92920-93998; G9157; 0381T-0386T
Emergency Room/Critical Care	Other	99281-99292; 99466-99476
Immunizations	Other	90281-90399; 90465-90470; 90476-90750; G9142; Q2035-Q2039; S0195
Inpatient Visits	Other	99217-99239; 99304-99340; 99477-99482
Office Visits	Office Visits	99201-99215; 99341-99355; 99358-99360
Ophthalmology	Other	92002-92499; 99177; V2020-V2799
Pathology/Lab	Pathology/Lab	00099; 80047-89398; P2028-P9615; 0001M-0013M; 0001U-0079U
Physical Medicine	Other	97001-98943
Preventive Visits	Preventive Visits	99381-99397; 99415-99416; 99460-99464
Psychiatry & Biofeedback	Other	90785-90911; 96960-96961; 0359T-0374T
Radiology	Radiology	70010-79999; A9515; A9520; A9575; A9587-A9599; A9606; G6001-G6017; R0070-R0076; 0347T-0354T
Surgery	Surgery	10021-69990 excluding 36415-36416; 0016T-0059T; 0071T-0076T; 0078T-0081T; 0085T-0143T; 0155T-0169T; 0171T-0261T; 0308T; 0375T-0377T; 0387T-0393T; 0406T-0416T; 0419T-0499T; 0501T-0508T
Miscellaneous Professional Services	Other	Other codes not listed above



4.5 Prescription detailed service categories matching to AHFS class

AHFS Class	HCCI Detailed Service Category
<i>Antihistamine Drugs</i>	<i>Other</i>
<i>Anti-Infective Agents</i>	<i>Anti-Infective Agents</i>
<i>Antineoplastic Agents</i>	<i>Other</i>
<i>Autonomic Drugs</i>	<i>Other</i>
<i>Blood Derivatives</i>	<i>Other</i>
<i>Blood Formulation, Coagulation, and Thrombosis</i>	<i>Other</i>
<i>Cardiovascular Drugs</i>	<i>Cardiovascular Drugs</i>
<i>Cellular Therapy</i>	<i>Other</i>
<i>Central Nervous System Agents</i>	<i>Central Nervous System Agents</i>
<i>Contraceptives (foams, devices)</i>	<i>Other</i>
<i>Dental Agents</i>	<i>Other</i>
<i>Diagnostic Agents</i>	<i>Other</i>
<i>Disinfectants (for objects other than skin)</i>	<i>Other</i>
<i>Electrolytic, Caloric, and Water Balance</i>	<i>Other</i>
<i>Enzymes</i>	<i>Other</i>
<i>Respiratory Tract Agents</i>	<i>Respiratory Agents</i>
<i>Eye, Ear, Nose, and Throat Preparations</i>	<i>Eye, Ear, Nose, and Throat Preparations</i>
<i>Gastrointestinal Drugs</i>	<i>Gastrointestinal Drugs</i>
<i>Gold Compounds</i>	<i>Other</i>
<i>Heavy Metal Antagonists</i>	<i>Other</i>
<i>Hormones and Synthetic Substitutes</i>	<i>Hormones and Synthetic Substitutes</i>
<i>Local Anesthetics</i>	<i>Other</i>
<i>Oxytocics</i>	<i>Other</i>
<i>Radioactive Agents</i>	<i>Other</i>
<i>Serums, Toxoids, and Vaccines</i>	<i>Vaccines, Serums, and Toxoids</i>
<i>Skin and Mucous Membrane Agents</i>	<i>Skin and Mucous Membrane Agents</i>
<i>Smooth Muscle Relaxants</i>	<i>Other</i>
<i>Vitamins</i>	<i>Other</i>
<i>Miscellaneous Therapeutic Agents</i>	<i>Other</i>
<i>Devices</i>	<i>Other</i>
<i>Pharmaceutical Aids</i>	<i>Other</i>



4.6 Diabetes codes

HCCI used the following codes to identify members with diabetes. The ICD-9-CM Codes were identified according to guidelines set down in the Dictionary of Disease Management Terminology (DDMT). The ICD-10-CM Codes were based on the CMS publication of the code descriptions and the General Equivalence Mappings (GEMs).

Description	ICD-9-CM Codes
<i>Diabetes mellitus</i>	250.xx
<i>Polyneuropathy in diabetes</i>	357.2
<i>Diabetic retinopathy</i>	362.0X
<i>Diabetic cataract</i>	366.41
<i>Insulin pump status</i>	V45.85
<i>Fitting/adjustment of insulin pump, insulin pump titration</i>	V53.91
<i>Encounter for insulin pump training</i>	V65.46
<i>Mechanical complications, due to insulin pump</i>	996.57
Description	ICD-10-CM Codes
<i>Type 1 diabetes mellitus</i>	E10
<i>Type 2 diabetes mellitus</i>	E11
<i>Other specified diabetes mellitus</i>	E13
<i>Presence of insulin pump (external) (internal)</i>	Z96.41
<i>Encounter for fitting and adjustment of insulin pump</i>	Z46.81
<i>Breakdown (mechanical) of insulin pump, initial encounter</i>	T85.614A
<i>Displacement of insulin pump, initial encounter</i>	T85.624A
<i>Leakage of insulin pump, initial encounter</i>	T85.633A
<i>Other mechanical complication of insulin pump, initial encounter</i>	T85.694A
Description	CPT/HCPCS Codes
<i>Diabetic outpatient self-management training services, individual or group</i>	G0108–G0109
<i>Insulin injection, per 5 units</i>	J1815
<i>Destruction of extensive or progressive retinopathy, one or more sessions, cryotherapy, diathermy, photocoagulation</i>	67227–67228



4.7 Hypertension codes

HCCI used the following codes to identify members with hypertension. The ICD-9-CM Codes were identified according to guidelines set down in the Clinical Classifications Software (CCS). The ICD-10-CM Codes were based on the CMS publication of the code descriptions and the General Equivalence Mappings (GEMs).

Description	ICD-9-CM Codes
Essential hypertension	401.1; 401.9
Hypertension with complications and secondary hypertension	401.0; 402.xx; 403.xx; 404.xx; 405.xx; 437.2
Description	ICD-10-CM Codes
Essential hypertension	I10
Hypertension with complications and secondary hypertension	I11.x; I12.x; I13.xx; I15.x; I67.4; N26.2

4.8 Asthma codes

Description	ICD-9-CM Codes
Asthma	493.xx
Description	ICD-10-CM Codes
Asthma	J45

4.9 Attention Deficit Hyperactivity Disorder codes

Description	ICD-9-CM Codes
Attention-deficit or hyperkinetic syndrome of childhood	314.xx
Attention or concentration deficit	799.51
Frontal lobe and executive function deficit	799.55
Description	ICD-10-CM Codes
Attention deficit hyperactivity disorders	F90
Attention and concentration deficit	R41.840
Frontal lobe and executive function deficit	R41.844



4.10 Congestive Heart Failure codes

<i>Description</i>	<i>ICD-9-CM Codes</i>
<i>Rheumatic heart failure (congestive)</i>	<i>398.91</i>
<i>Heart failure</i>	<i>428.xx</i>
<i>Description</i>	<i>ICD-10-CM Codes</i>
<i>Rheumatic heart failure</i>	<i>I09.81</i>
<i>Heart failure</i>	<i>I50</i>

4.11 Prescription drug rebate data

<i>Source</i>	<i>Rebates as a Share of Gross Pharmacy Spending</i>				
	<i>2014</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>	<i>2018</i>
<i>Center for Health Information Analysis, State of Massachusetts¹⁰</i>	<i>6.5%</i>	<i>9.5%</i>	<i>10.7%</i>	<i>12.9%</i>	<i>15.6%</i>
<i>Altarum¹¹</i>			<i>12.0%</i>		
<i>Department of Managed Health Care, State of California¹²</i>			<i>10.7%</i>	<i>10.5%</i>	



Notes

¹ Congressional Budget Office. *Private Health Insurance Premiums and Federal Policy*. February 11, 2016. Available from: <https://www.cbo.gov/publication/51130>.

² Kaiser Family Foundation and Health Research & Educational Trust, "2018 Employer Health Benefits Survey." <https://www.kff.org/health-costs/report/2018-employer-health-benefits-survey/>.

³ Centers for Medicare and Medicaid Services. *Medicare Claims Processing Manual: Chapter 26: Completing and Processing Form CMS-1500 Data Set [Internet]*. Baltimore (MD): CMS; 2011 Dec [cited 2012 May 18]. Available from: <https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Downloads/clm104c26.pdf>.

⁴ McEvoy, Gerald K., ed. *AHFS Drug Information 2010*. Bethesda, MD: American Society of Health-System Pharmacists, 2010. Print.

⁵ Duncan, I.G., ed. *Dictionary of Disease Management Terminology*. Washington, DC: Disease Management Association of America, 2004.

⁶ Dunn, Abe, Eli Liebman, and Adam Hale Shapiro. "Developing a Framework for Decomposing Medical-Care Expenditure Growth: Exploring Issues of Representativeness." *Measuring Economic Sustainability and Progress*. 2012.

⁷ Bluhm, W. F., ed. *Group Insurance*. 4th ed. Winsted: ACTEX Publications, Inc; 2003. P. 811-27. The specific methodology is proprietary and not owned by HCCL.



⁸ U.S. Department of Commerce. U.S. Census Bureau. American Community Survey [Internet]. Washington (DC): Census; Available from: <https://www.census.gov/programs-surveys/acs/>.

⁹ To calculate total prices paid for total expenditures per capita, the insured (co-payments, coinsurance, and deductibles) and payer expenditures per capita are summed. For inpatient, outpatient, and professional claims, prices paid are calculated for all members who have medical insurance. For prescription claims, prices paid are calculated for all members with medical and prescription insurance.

¹⁰ Calculated using data from the Center for Health Information Analysis, State of Massachusetts, "Annual Report on the Performance of the Massachusetts Health Care System" for 2017 through 2019. Available from: http://www.chiamass.gov/annual-report/?_ga=2.88182555.1443192041.1576609192-1511595466.1576609192

¹¹ Altarum, "The Impact of Prescription Drug Rebates on Health Plans and Consumers," April 2018. Available at: https://altarum.org/sites/default/files/Altarum-Prescription-Drug-Rebate-Report_April-2018.pdf.

¹² Department of Managed Health Care, State of California, "Prescription Drug Cost Transparency Report (SB 17), Measurement Year 2017." Available at: <https://www.dmhc.ca.gov/Portals/0/Docs/DO/SB17Report.pdf>.