HCCI HEALTH CARE COST INSTITUTE

Healthy Marketplace Index:

Medical Service Category Price Index

Comparing medical service category prices within and across geographies and over time

Issue Brief #13

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KEY FINDINGS

Prices increased in all three medical service categories from 2012 through 2014

Outpatient prices experienced the largest growth, while physician prices saw the smallest increase.

Substantial variation was found within service categories

Although there was variation in all three service categories across CBSAs, the widest distribution was in the outpatient price index.

Inpatient prices were moderately correlated with outpatient prices

CBSA-level inpatient and outpatient facility prices were moderately correlated; physician services prices were generally unrelated to facility prices.

For a second year, the Health Care Cost Institute (HCCI), with Robert Wood Johnson Foundation funding, has calculated a set of measures collectively referred to as the Healthy Marketplace Index (HMI). These metrics will be reported in a series of HCCI issue briefs. The metrics can be used to compare various aspects of price, competition, and productivity of health care markets over time and to compare across geographic areas.

In this issue brief, we report price indices for three medical service categories – inpatient, outpatient, and "physician", which includes all professional service claims such as nurse practitioner and physician assistant as well as physician services. (See "Medical Service Category Definitions" for more detail.) The indices can be used to identify price changes over time in a service category or used to compare prices across geographic areas in each year. The analysis population was the employer-sponsored insurance (ESI) members under age 65 for the years 2012, 2013, and 2014. Each of the three medical service category indices was composed of the set of the most common services observed in the HCCI claims within the respective category.

In general, we found that prices in all three service categories increased over the study period, 2012 through 2014. Overall, the largest change was observed in outpatient facility prices, while physician prices increased the least. The most consistent growth was seen in inpatient prices; approximately 5% each year overall. There was substantial variability in the changes in price levels over time and across geographic areas in all service categories.

Analysis population

All of the HMI metrics were calculated with HCCI's research data set, which is one of the largest and most comprehensive sources of ESI data in the US. HCCI's data are composed of statistically de-identified administrative claims, compliant with the Health Insurance Portability and Accountability Act (HIPAA) of 1996. The data account for approximately 27% of the national ESI population younger than age 65 (approximately 40 million individuals) and include claims from all 50 states and the District of Columbia.

Additional details about the HMI analysis population are included in Appendix A.

All of the HMI metrics, including the medical service category price indices reported in this issue brief, were calculated for 61 Core-Based Statistical Areas (CBSAs). CBSAs are defined by the Office of Management and Budget (OMB) and commonly used by the U.S. Census Bureau for reporting. Every CBSA includes a core urban area consisting of one or more counties, and may include adjacent counties with a "high degree of social and economic integration (as measured by commuting to work) with the urban core."[1]

CBSAs were chosen as the geographic unit of analysis due to feasibility and policy relevance. CBSAs have well-defined, mutually exclusive geographic boundaries allowing for the construction of distinct areas for analysis and comparison. They are also large enough to provide sufficient sample sizes. Calculating the HMI metrics at the CBSA level assumes that the relevant economic environment (e.g., the demand and supply of health care services) is related to the social

MEDICAL SERVICE CATEGORY DEFINITIONS

Inpatient Facility – Services provided to patients admitted to a general acute care hospital with at least a one night stay.

Outpatient Facility – Services provided to patients visiting a hospital or other health care facilities such as ambulatory surgical centers, imaging centers, emergency departments, which do not included an overnight stay.

Physician Services – Services provided by any medical professional such as nurse practitioner or physician assistant, as well as all physician services.

and economic integration inherent in the CBSA geography definitions.

All of the HMI measures were calculated based on the members' CBSAs, as opposed to the facility or physician location. Members were assigned to CBSAs based on the ZIP code included in their membership records. Some medical services may have been provided outside of the members' CBSAs and those costs and services were included in the calculations. Conversely, facilities and physicians in each CBSA likely treated individuals who did not reside in the CBSA, but these claims were not included in the HMI analyses.

The methodology is important to consider when interpreting the results. In a CBSA where prices are relatively high, further investigation into where medical services are received may be warranted because policy options will differ. For example, if everyone leaves a CBSA to see specialists in a neighboring CBSA, policies aimed at increasing access to specialists may be more productive than policies targeting the specialists' prices in neighboring CBSAs.

Index calculation

All three price indices were constructed using a set of the most common procedures performed for a given category in 2013. The frequency count of each set of procedures was based on the "total population" (i.e. the total analysis population from all 61 CBSAs) used for the HMI analyses. The inpatient index uses the 100 most frequent Diagnostic Related Group (DRG) codes and the outpatient and physician indices use the 500 most frequent Current Procedural Terminology (CPT) codes.[2] The most frequent CPT codes were identified separately for outpatient facilities and physician services. Of the 500 CPT codes included in the outpatient price index, 25.8% were also in the physician price index top 500.

Although the price indices are composed of only a fraction of the codes that occur in the claims data, the sets of most frequent codes made up the majority of spending of in each service category. In 2013, the top 100 DRGs accounted for 65% of inpatient spending. For the outpatient and physician indices, the top 500 CPT codes made up 60% and 64% of spending, respectively.

The price indices are ratios of the CBSA weighted average prices relative to the total population weighted average price in a given service category. Within each category, a weight was calculated from the positive, nonzero dollar, 2013 claims by dividing the frequency of a given procedure code by the total number of codes observed. Then for each analysis year, 2012 through 2014, the 61 CBSA-level and total population average prices of each code were multiplied by the respective code weights. For each year, the weighted average prices were summed to produce a single weighted average price for each CBSA as well as the total population. Finally, each of the 61 CBSA-level annual weighted average prices were divided by the 2013 total population weighted average price; resulting in annual CBSA-level price indices. Thus, the indices can be interpreted as the CBSA-level price relative to a national average. (A more detailed description of the price index calculation is provided in Appendix B.)

Additionally, in each category, the total population weighted average price for a given year was divided by the 2013 total population weighted average price to calculate an annual price index for each category. By holding the weights and the denominator constant throughout the comparisons, the differences between years were limited to changes in prices. The annual indices can be used to identify overall service category price changes.

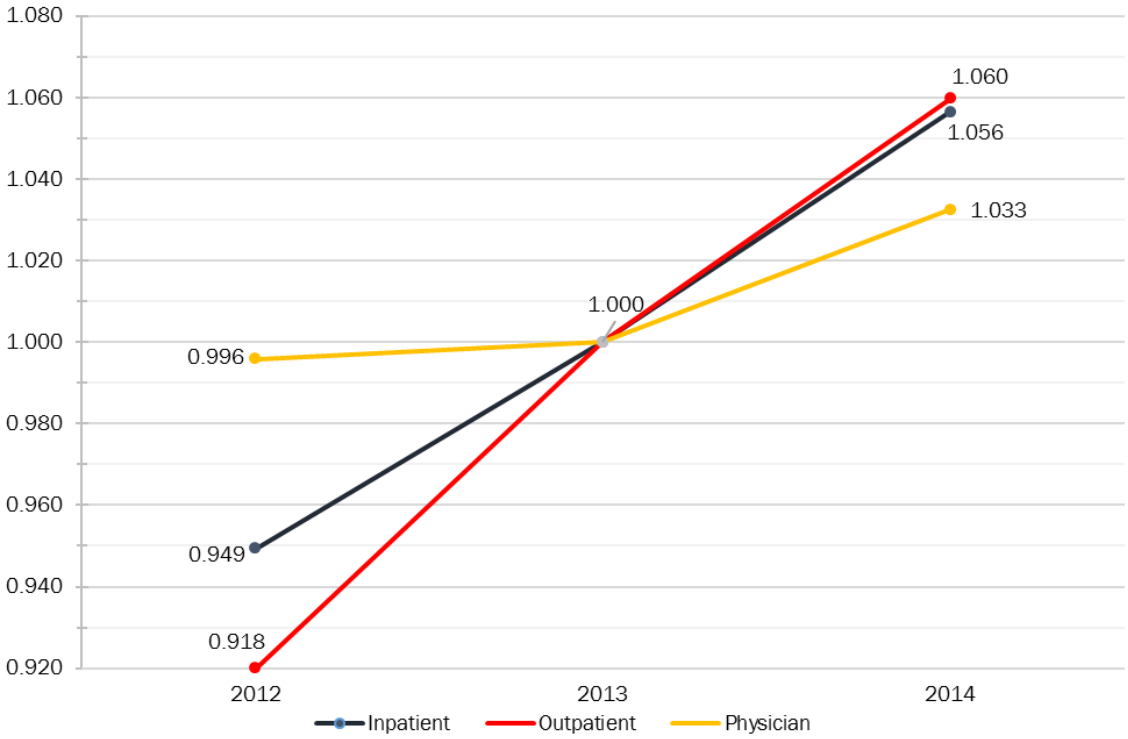
The annual indices can also be used to facilitate CBSA-level comparisons in years 2012 and 2014. With the base year held constant at 2013, comparing price indices across CBSAs in other years is easier if they are normalized by the respective annual price index. For example, a CBSA with an index value of 1.10 in 2013 has a price level that is 10% higher than the national average in 2013. However, an index value of 1.10 in 2014 is calculated relative to a 2013 baseline. Therefore, the CBSA's 2014 index value needs to be compared to the 2014 annual price index to determine how much a CBSAs price levels differ from the national average in 2014.[3] A 2014 CBSA-level index, however, can be compared directly to its 2013 counterpart to determine how much prices within a CBSA changed from 2013 to 2014.[4]

Results

From the annual price indices, we found that prices in all three medical service categories increased from 2012 through 2014, but at differing rates. Figure 1 shows the annual price index for all three service categories; prices were normalized to 2013 in order to allow for comparisons over time. Growth in the annual inpatient price index was most consistent during the study period. An inpatient service that cost $100 in 2013 would have cost $94.90 in 2012 (a difference of 5.4%) and $105.60 in 2014 (a difference of 5.6%). There was, however, more variability in the outpatient and physician price level increases. Outpatient services had the largest growth of the three categories over both periods; increasing by 8.9% from 2012 to 2013 ($91.80 dollars in 2012 for the same $100 service in 2013) and increasing an additional 6.0% in 2014 ($106.00 in 2014 dollars compared to $100 in 2013). The smallest increases in price levels were among physician services. There was virtually no change from 2012 to 2013, and only a 3.3% increase in 2014 prices. A $100-dollar physician service in 2013 would have only increased to $103.30 in 2014.

At the CBSA-level, we generally also found increases in the inpatient, outpatient, and physician price indices. Summary statistics of the CBSA-level price

Figure 1. Yearly National Average Price Ratio



Source: HCCI, 2017
Note: The reference year is 2013.

indices are presented for each year of the study in Table 1 (page 4). Consistent with the annual price indices, there was constant growth in the inpatient price index average, relatively small growth in the physician price index average, and the largest growth in the outpatient index average. A similar pattern is found among 50th percentile price index values in each category. Additionally, the summary statistics show that there was a wide distribution of index values in all three categories across CBSAs. The widest distribution was in the outpatient price index. The minimum index levels for inpatient and outpatient services were roughly congruent. Conversely, the outpatient and physician maximum index levels were similar.

INPATIENT

At the CBSA-level, on average, approximately 60.6% of the CBSA's included in the study had inpatient price levels less than the national average of 1.00. Table 2 shows the annual CBSA-level inpatient price indices. The CBSA with the highest inpatient price index in each year of the study was El Paso, Texas. El Paso's price index increased over time, reaching its peak in 2014 with an index of 1.36, 29% higher than the 2014 national average.[5]

The CBSA with the lowest inpatient price index in all three years was Knoxville, Tennessee. In 2013, the Knoxville inpatient index was 0.61, which corresponds to a price level 39% less than the national average inpatient price in that year. However, prices in Knoxville also increased over the study period. In 2014, the Knoxville inpatient index was at the highest of the study period at 0.66 – a price level 37.5% less than the 2014 national average.

Over half of the CBSA's studied (32 CBSA's) had increases in the inpatient price index of over 10% from 2012 to 2014, with the largest change occurring in Dayton, Ohio – an increase of 23.2%. Only 8 CBSA's experienced a net change in the index of less than 5% over the study period.

Although there was wide geographic variation, there was some consistency in price levels among CBSAs within the same state. Some states, like Kentucky, Arizona, and Louisiana had consistently low inpatient price-levels. In Kentucky, for example, both Lexington and Louisville had 3-year average inpatient prices at least 20% lower than the 2013 national average, 24% and 27%, respectively. Conversely, CBSAs in Connecticut had consistently high price levels. In Connecticut, all 4 CBSA's included in the study had average indices between 7% and 19% greater than the national average. However, in some states there was a wide range of index values across CBSAs. For instance, the inpatient price index 3-year averages for the 7 Texas CBSAs studied ranged from 0.82 in Corpus Christi to 1.31 in El Paso.

OUTPATIENT

Table 3 shows the annual CBSA-level

Table 1. CBSA-level Price Index Summary Statistics

	Inpatient			Outpatient			Physician		
	2012	2013	2014	2012	2013	2014	2012	2013	2014
Average (Standard Deviation)	0.92 (0.14)	0.96 (0.15)	1.01 (0.17)	0.89 (0.14)	0.98 (0.15)	1.03 (0.16)	1.02 (0.17)	1.02 (0.17)	1.05 (0.18)
Minimum	0.62	0.61	0.66	0.61	0.64	0.66	0.82	0.83	0.85
25th Percentile	0.83	0.87	0.9	0.82	0.88	0.94	0.91	0.91	0.93
50th Percentile	0.93	0.97	1.00	0.89	0.99	1.04	0.96	0.95	0.99
75th Percentile	1.01	1.07	1.13	0.96	1.05	1.10	1.06	1.06	1.10
Maximum	1.23	1.34	1.36	1.45	1.55	1.64	1.59	1.63	1.69

Source: HCCI 2017

Notes: All indices were calculated using a 2013 baseline. The average reported in the table was calculated using CBSA-level price indices and may not equal 1.00. To account for the distribution of members, the index baseline was calculated from full analysis sample rather than with CBSA.-level measures.

outpatient price indices. Every CBSA studied experienced increases in the outpatient price index between 2012 and 2014. The smallest CBSA-level increase in an outpatient price index was found in Peoria, Illinois, where the 2014 outpatient index was 4.6% greater than it was in 2012. This, however, was the only CBSA with an increase in the outpatient index of less than 5%. In fact, there were only 9 CBSAs with an increase in price-levels of less than 10% between 2012 and 2014. Of the other 52 CBSAs, the largest increase occurred in Green Bay, Wisconsin. In 2012, the outpatient index was 0.87, but had risen to 1.09 by 2014 (an increase of 24.3%).

The CBSA with the lowest outpatient price index in each year studied was Baltimore-Columbia-Towson, Maryland. On average, the CBSA had outpatient prices 36% lower than the 2013 baseline average (a 3-year average index value of 0.64). In contrast, the CBSA with the highest outpatient index each year was Trenton, New Jersey. Trenton's 2014 outpatient price index, 1.64, implies prices were 55% higher than the 2014 national average.

As seen in the inpatient price index, there were patterns of consistent relative CBSA-level prices within states in the outpatient service category as well. Both of Louisiana's CBSAs (Baton Rouge and New Orleans-Metairie) had 3-year average indices at least 10% below the 2013 baseline national average (0.87 and 0.75, respectively, Table 3). In contrast, each of the 7 CBSAs in Texas had 3 -year index value averages greater than 1.00. The largest difference between CBSAs within the same state was in Florida. In Jacksonville, outpatient prices were, on average, 17% lower than the national average. In Miami, however, outpatient prices were 12% more expensive on average.

PHYSICIAN

Table 4 shows the annual CBSA-level physician price indices. Generally, the changes in physician price index values within CBSAs were minimal, which is consistent with the overall trend in physician prices (Figure 1). Fifty of the CBSAs did not experience a net change in their index value of more than 5% between 2012 and 2014. Additionally, no CBSA-level physician price index changed more than 10% over the study period. The largest net change was in New Haven-Milford, Connecticut where the 2014 physician price index was 8.5% greater than in 2012. The physician price index also declined in 6 of the 61 studied CBSAs, however, only one CBSA had a decline of greater than 1% (Oklahoma City, Oklahoma).

Of the 36 CBSAs with an average physician price index less than 1.00, Louisville-Jefferson County, Kentucky had the lowest index value in each year studied. Across the study period, Louisville's average physician prices were 17% less than the national average – 0.83. Among the other 25 CBSAs, with average index values above 1.00, Sheboygan, Wisconsin had the highest physician index every year. In 2014, the physician index was 1.69 in Sheboygan, this equates to average physician prices that were nearly 64% higher than national average prices.

In the CBSAs studied, there were also some states with consistent relative physician price levels across CBSAs in a state. For example, Missouri had two CBSAs with average price indices 10% less than the national average. Other states where all CBSAs in the study had prices below the national average included Arizona, Florida, Kentucky, Ohio, and Oklahoma. Alternatively, some states had only relatively high priced CBSAs, like Connecticut and Wisconsin. For instance, of the 5 CBSAs in Wisconsin, each of them had average price indices between 42% - 64% more than national average. Moreover, Wisconsin had the largest range in average physician price index levels amongst the CBSAs within a state, even though all 5 CBSAs within Wisconsin were the highest among all CBSAs studied.

Table 2. Inpatient Facility Price Index

CBSA Name	2012	2013	2014	CBSA Name	2012	2013	2014
Appleton, WI	0.72	0.77	0.72	Lexington-Fayette, KY	0.72	0.75	0.81
Atlanta-Sandy Springs-Roswell, GA	0.83	0.89	0.92	Louisville/Jefferson County, KY-IN	0.69	0.73	0.76
Augusta-Richmond County, GA-SC	0.83	0.87	0.93	Memphis, TN-MS-AR	0.75	0.78	0.75
Austin-Round Rock, TX	0.96	1.01	1.04	Miami-Fort Lauderdale-West Palm Beach, FL	0.99	1.02	1.03
Baltimore-Columbia-Towson, MD	0.78	0.78	0.80	Milwaukee-Waukesha-West Allis, WI	0.98	1.03	1.08
Baton Rouge, LA	0.83	0.89	0.95	Minneapolis-St. Paul-Bloomington, MN-WI	0.95	0.99	1.05
Beaumont-Port Arthur, TX	0.90	0.92	0.90	Nashville-Davidson--Murfreesboro--Franklin, TN	0.97	1.00	1.02
Boulder, CO	1.16	1.16	1.16	New Haven-Milford, CT	1.02	1.11	1.17
Bridgeport-Stamford-Norwalk, CT	1.11	1.19	1.27	New Orleans-Metairie, LA	0.79	0.79	0.84
Cape Coral-Fort Myers, FL	0.93	0.97	1.08	New York-Newark-Jersey City, NY-NJ-PA	1.13	1.21	1.31
Charlotte-Concord-Gastonia, NC-SC	1.08	1.12	1.16	North Port-Sarasota-Bradenton, FL	0.85	0.89	0.98
Charlottesville, VA	1.06	1.12	1.24	Norwich-New London, CT	1.09	1.10	1.18
Chicago-Naperville-Elgin, IL-IN-WI	1.00	1.04	1.09	Oklahoma City, OK	0.86	0.87	0.95
Cincinnati, OH-KY-IN	0.89	0.93	0.99	Omaha-Council Bluffs, NE-IA	0.89	0.97	0.97
Colorado Springs, CO	0.95	0.98	1.06	Orlando-Kissimmee-Sanford, FL	1.12	1.20	1.31
Columbus, OH	0.89	0.92	0.98	Palm Bay-Melbourne-Titusville, FL	1.13	1.15	1.26
Corpus Christi, TX	0.80	0.80	0.85	Peoria, IL	0.77	0.81	0.85
Dallas-Fort Worth-Arlington, TX	1.07	1.13	1.17	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	1.12	1.20	1.24
Dayton, OH	1.02	1.10	1.26	Phoenix-Mesa-Scottsdale, AZ	0.90	0.96	1.00
Deltona-Daytona Beach-Ormond Beach, FL	0.93	1.01	1.04	Portland-South Portland, ME	1.07	1.13	1.19
Denver-Aurora-Lakewood, CO	1.01	1.07	1.13	Providence-Warwick, RI-MA	0.90	0.94	1.04
Des Moines-West Des Moines, IA	0.73	0.75	0.79	Racine, WI	0.95	1.02	1.05
El Paso, TX	1.23	1.34	1.36	San Antonio-New Braunfels, TX	0.81	0.86	0.92
Green Bay, WI	0.86	0.90	0.98	Sheboygan, WI	0.82	0.91	0.89
Greensboro-High Point, NC	0.95	0.98	0.91	St. Louis, MO-IL	0.67	0.72	0.78
Hartford-West Hartford-East Hartford, CT	0.99	1.07	1.15	Tampa-St. Petersburg-Clearwater, FL	0.98	1.06	1.13
Houston-The Woodlands-Sugar Land, TX	0.93	0.94	0.97	Trenton, NJ	1.01	1.05	1.08
Jacksonville, FL	1.01	1.05	1.09	Tucson, AZ	0.67	0.71	0.72
Kansas City, MO-KS	0.84	0.88	0.88	Tulsa, OK	0.73	0.75	0.80
Knoxville, TN	0.62	0.61	0.66	Washington-Arlington-Alexandria, DC-VA-MD-WV	0.86	0.90	0.94
Lakeland-Winter Haven, FL	0.86	0.90	0.97				

Source: HCCI, 2017
Notes: All indices were calculated using a 2013 baseline.

Table 3. Outpatient Facility Price Index

CBSA Name	2012	2013	2014	CBSA Name	2012	2013	2014
Appleton, WI	0.73	0.78	0.81	Lexington-Fayette, KY	0.83	0.92	0.98
Atlanta-Sandy Springs-Roswell, GA	0.87	0.98	1.04	Louisville/Jefferson County, KY-IN	0.81	0.87	0.95
Augusta-Richmond County, GA-SC	0.76	0.85	0.91	Memphis, TN-MS-AR	0.75	0.80	0.87
Austin-Round Rock, TX	0.98	1.09	1.11	Miami-Fort Lauderdale-West Palm Beach, FL	1.04	1.13	1.19
Baltimore-Columbia-Towson, MD	0.61	0.64	0.66	Milwaukee-Waukesha-West Allis, WI	0.94	1.01	1.08
Baton Rouge, LA	0.84	0.89	0.90	Minneapolis-St. Paul-Bloomington, MN-WI	0.78	0.83	0.85
Beaumont-Port Arthur, TX	0.96	1.09	1.18	Nashville-Davidson--Murfreesboro--Franklin, TN	0.91	1.01	1.03
Boulder, CO	0.96	1.08	1.11	New Haven-Milford, CT	0.91	0.99	1.03
Bridgeport-Stamford-Norwalk, CT	1.01	1.07	1.09	New Orleans-Metairie, LA	0.73	0.76	0.77
Cape Coral-Fort Myers, FL	0.93	1.05	1.10	New York-Newark-Jersey City, NY-NJ-PA	1.03	1.11	1.16
Charlotte-Concord-Gastonia, NC-SC	0.89	0.99	1.04	North Port-Sarasota-Bradenton, FL	0.92	1.00	1.07
Charlottesville, VA	0.87	0.97	1.00	Norwich-New London, CT	0.97	1.04	1.08
Chicago-Naperville-Elgin, IL-IN-WI	1.02	1.09	1.14	Oklahoma City, OK	0.81	0.91	0.96
Cincinnati, OH-KY-IN	0.84	0.93	0.98	Omaha-Council Bluffs, NE-IA	0.82	0.93	0.98
Colorado Springs, CO	0.93	1.02	1.05	Orlando-Kissimmee-Sanford, FL	0.76	0.84	0.94
Columbus, OH	0.90	1.00	1.08	Palm Bay-Melbourne-Titusville, FL	0.89	1.01	1.06
Corpus Christi, TX	1.03	1.13	1.25	Peoria, IL	0.82	0.84	0.86
Dallas-Fort Worth-Arlington, TX	1.00	1.12	1.20	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	1.07	1.12	1.16
Dayton, OH	0.84	0.91	0.96	Phoenix-Mesa-Scottsdale, AZ	0.89	0.99	1.07
Deltona-Daytona Beach-Ormond Beach, FL	0.81	0.88	0.95	Portland-South Portland, ME	0.86	0.91	0.94
Denver-Aurora-Lakewood, CO	1.14	1.25	1.37	Providence-Warwick, RI-MA	0.82	0.89	0.94
Des Moines-West Des Moines, IA	0.86	0.88	0.93	Racine, WI	0.95	1.02	1.09
El Paso, TX	1.20	1.27	1.35	San Antonio-New Braunfels, TX	0.93	1.03	1.11
Green Bay, WI	0.87	1.00	1.09	Sheboygan, WI	0.93	1.06	1.08
Greensboro-High Point, NC	0.82	0.92	0.94	St. Louis, MO-IL	0.71	0.82	0.81
Hartford-West Hartford-East Hartford, CT	0.88	0.98	1.02	Tampa-St. Petersburg-Clearwater, FL	0.91	1.02	1.14
Houston-The Woodlands-Sugar Land, TX	1.15	1.25	1.29	Trenton, NJ	1.45	1.55	1.64
Jacksonville, FL	0.78	0.84	0.88	Tucson, AZ	0.68	0.74	0.83
Kansas City, MO-KS	0.90	0.99	1.05	Tulsa, OK	0.82	0.90	0.95
Knoxville, TN	0.71	0.77	0.83	Washington-Arlington-Alexandria, DC-VA-MD-WV	0.82	0.86	0.91
Lakeland-Winter Haven, FL	0.96	1.04	1.09				

Source: HCCI, 2017
Notes: All indices were calculated using a 2013 baseline.

Table 4. Physician Services Price Index

CBSA Name	2012	2013	2014	CBSA Name	2012	2013	2014
Appleton, WI	1.48	1.48	1.51	Lexington-Fayette, KY	0.87	0.87	0.88
Atlanta-Sandy Springs-Roswell, GA	1.00	1.03	1.06	Louisville/Jefferson County, KY-IN	0.82	0.83	0.85
Augusta-Richmond County, GA-SC	1.01	1.00	1.00	Memphis, TN-MS-AR	0.93	0.92	0.95
Austin-Round Rock, TX	0.99	0.98	0.99	Miami-Fort Lauderdale-West Palm Beach, FL	0.95	0.94	0.98
Baltimore-Columbia-Towson, MD	0.88	0.88	0.91	Milwaukee-Waukesha-West Allis, WI	1.43	1.41	1.46
Baton Rouge, LA	0.99	0.98	0.99	Minneapolis-St. Paul-Bloomington, MN-WI	1.33	1.36	1.41
Beaumont-Port Arthur, TX	1.00	0.98	1.02	Nashville-Davidson--Murfreesboro--Franklin, TN	0.98	0.98	1.04
Boulder, CO	1.03	1.03	1.04	New Haven-Milford, CT	1.14	1.18	1.24
Bridgeport-Stamford-Norwalk, CT	1.10	1.12	1.16	New Orleans-Metairie, LA	0.92	0.91	0.94
Cape Coral-Fort Myers, FL	0.92	0.91	0.93	New York-Newark-Jersey City, NY-NJ-PA	1.06	1.06	1.10
Charlotte-Concord-Gastonia, NC-SC	1.16	1.16	1.19	North Port-Sarasota-Bradenton, FL	0.91	0.90	0.91
Charlottesville, VA	1.06	1.06	1.11	Norwich-New London, CT	1.03	1.01	1.04
Chicago-Naperville-Elgin, IL-IN-WI	1.07	1.08	1.11	Oklahoma City, OK	0.95	0.93	0.93
Cincinnati, OH-KY-IN	0.93	0.93	0.95	Omaha-Council Bluffs, NE-IA	1.25	1.27	1.30
Colorado Springs, CO	0.99	0.99	1.00	Orlando-Kissimmee-Sanford, FL	0.90	0.89	0.91
Columbus, OH	0.88	0.88	0.93	Palm Bay-Melbourne-Titusville, FL	0.88	0.86	0.88
Corpus Christi, TX	0.91	0.91	0.93	Peoria, IL	1.03	1.03	1.08
Dallas-Fort Worth-Arlington, TX	1.07	1.06	1.09	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	0.91	0.94	0.97
Dayton, OH	0.86	0.86	0.87	Phoenix-Mesa-Scottsdale, AZ	0.87	0.87	0.88
Deltona-Daytona Beach-Ormond Beach, FL	0.90	0.89	0.90	Portland-South Portland, ME	1.09	1.08	1.10
Denver-Aurora-Lakewood, CO	0.96	0.95	0.98	Providence-Warwick, RI-MA	0.90	0.91	0.94
Des Moines-West Des Moines, IA	1.06	1.05	1.10	Racine, WI	1.41	1.40	1.46
El Paso, TX	0.91	0.90	0.91	San Antonio-New Braunfels, TX	0.87	0.89	0.91
Green Bay, WI	1.47	1.50	1.56	Sheboygan, WI	1.59	1.63	1.69
Greensboro-High Point, NC	1.00	0.99	1.03	St. Louis, MO-IL	0.87	0.88	0.90
Hartford-West Hartford-East Hartford, CT	1.14	1.14	1.18	Tampa-St. Petersburg-Clearwater, FL	0.90	0.91	0.94
Houston-The Woodlands-Sugar Land, TX	0.96	0.96	1.00	Trenton, NJ	1.00	1.03	1.06
Jacksonville, FL	0.93	0.95	1.00	Tucson, AZ	0.91	0.92	0.91
Kansas City, MO-KS	0.90	0.89	0.91	Tulsa, OK	0.94	0.92	0.93
Knoxville, TN	0.94	0.94	0.97	Washington-Arlington-Alexandria, DC-VA-MD-WV	0.96	0.95	0.99
Lakeland-Winter Haven, FL	0.95	0.93	0.96				

Source: HCCI, 2017
Notes: All indices were calculated using a 2013 baseline.

RELATIONSHIPS BETWEEN THE MEDICAL SERVICE CATEGORY PRICES

Table 5 shows that each medical service category index was highly correlated over the study period. The strong positive correlation implies that the relationship of CBSA-level price indices is similar over time within a given medical service category. In other words, within a given category, high price CBSAs are consistently high priced and low price CBSAs are consistently low priced.

Table 5. Cross Year Price Index Correlations

	2012-2013	2013-2014	2012-2014
Inpatient	0.988	0.972	0.960
Outpatient	0.984	0.987	0.967
Physician	0.997	0.997	0.993

Source: HCCI, 2017.

Table 6. Cross Price Index Correlations

	2012	2013	2014
Inpatient with outpatient	0.548	0.539	0.470
Inpatient with physician	0.066	0.107	0.049
Outpatient with physician	0.031	0.053	0.028

Source: HCCI, 2017.

Table 6 shows the correlations between service category indices within each of the years analyzed. The inpatient and outpatient price levels appear to be moderately related. However, there appears to be no systematic relationship between physician prices and either inpatient or outpatient prices. Only one correlation coefficient, for the 2013 inpatient-physician correlation, was greater than 0.10.

The moderate positive correlation between inpatient and outpatient facility prices can be seen in Figure 2. Each point in the figure represents a CBSA's inpatient and outpatient price index. The inpatient index values were measured on the horizontal axis and outpatient index values are plotted on by the vertical axis.

Figure 3 and Figure 4 are similar scatter plots depicting the 2013 CBSA-level physician services price indices in relation to the inpatient and outpatient facility price indices, respectively. In both figures the facility price indices are graphed on the horizontal axis and the physician price index values are graphed on the vertical axis. As the cross category correlations in Table 6 revealed, there was no consistent relationship between facility price levels (inpatient or outpatient) and physician price levels across CBSAs. This is apparent in the figures as well. The CBSA-level observations fall largely to the left and right of a 45-degree line rather than being clustered along the line.

There were examples of CBSAs that had relatively large differences in inpatient and outpatient price levels but had similar inpatient and physician price levels, which are shown in Figure 3. For example, Trenton, New Jersey (1.05, 1.03), Houston-The Woodlands-Sugar Land, Texas (0.94, 0.96), and Portland-South Portland, Maine (1.13, 1.08) had relatively similar inpatient and physician indices.

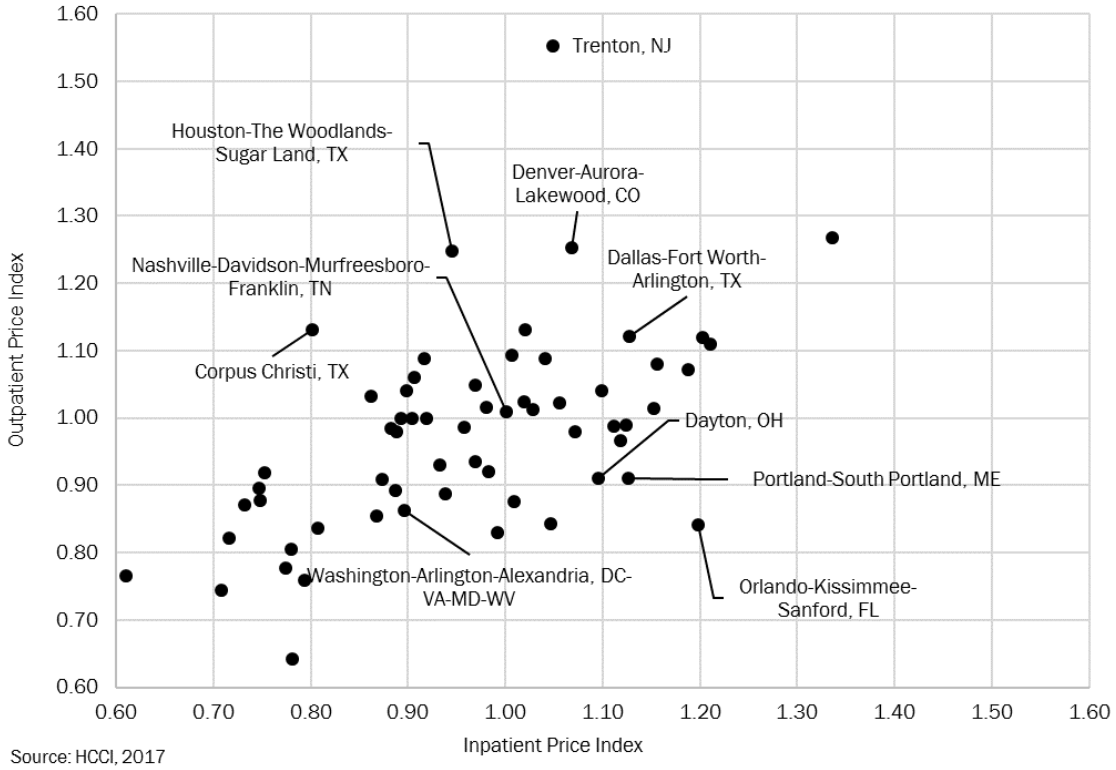
There are also CBSAs noted in Figure 3 that had similar relative inpatient and physician prices and also had similar relative inpatient and outpatient prices. These CBSAs include Washington-Arlington-Alexandria, District of Columbia (0.90, 0.95), Nashville-Davidson-Murfreesboro, Tennessee (1.00, 0.98), and Dallas-Fort Worth, Texas (1.13, 1.06).

There are notable outliers in both directions in Figure 3 as well. Dayton, Ohio (1.10, 0.86) was one example with high inpatient prices and low physician prices, El Paso, Texas (1.34, 0.90) was another example. In the opposite direction Appleton, Wisconsin (0.77, 1.48) and Sheboygan, Wisconsin (0.91, 1.63) both had relatively high physician prices and low inpatient prices.

The lack of a relationship between outpatient and physician price indices can be seen in Figure 4. As with the comparisons of other indices, there were instances of CBSAs that had closely related index values such as Nashville-Davidson-Murfreesboro, Tennessee (1.01, 0.98), and Dallas-Fort Worth, Texas (1.12, 1.06) and to some extent Washington-Arlington-Alexandria, District of Columbia (0.86, 0.95) and Dayton, Ohio (0.91, 0.86).

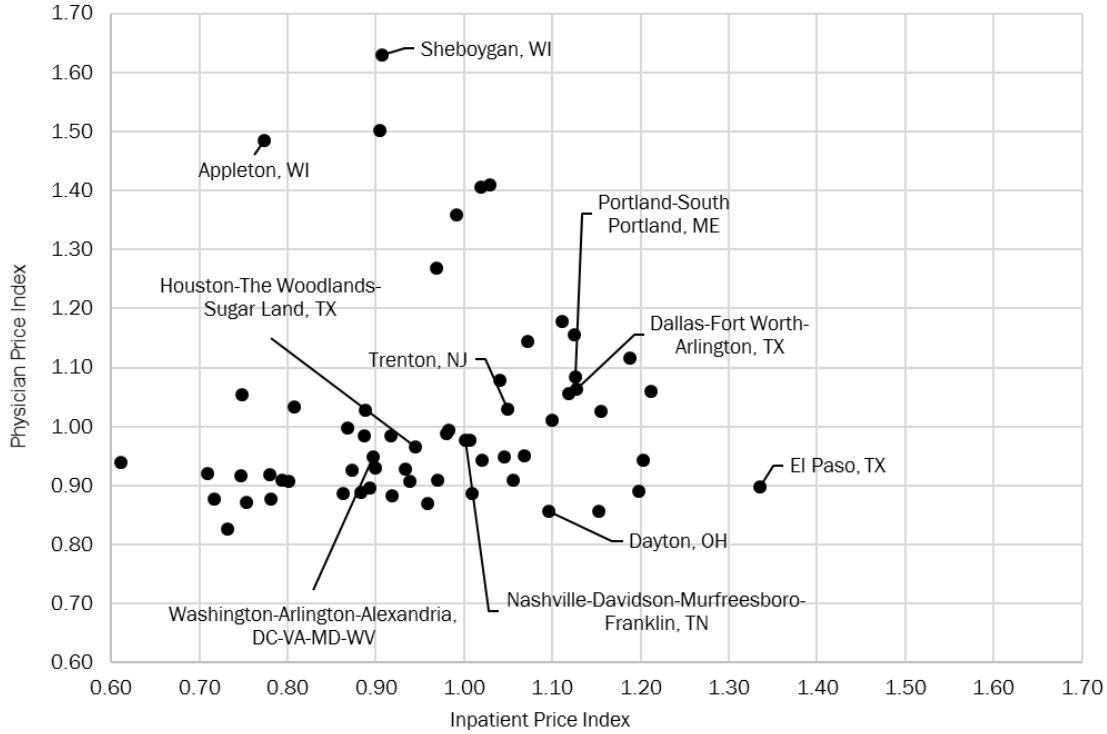
There were a large number of CBSAs where either the outpatient or physician price index was substantially higher than the national average while the other index was not. For example, Houston-The Woodlands-Sugar Land, Texas (1.25, 0.96) and Trenton, New Jersey (1.55, 1.03) as well as El Paso, Texas (1.27, 0.90) had high inpatient price indices and relatively average physician price indices. Alternatively, Portland-South Portland, Maine (0.91, 1.08), Appleton, Wisconsin (0.78, 1.48), and Sheboygan, Wisconsin (1.06, 1.63) had high physician prices and relatively low or average outpatient prices.

Figure 2. Inpatient vs Outpatient Price Indices (2013)



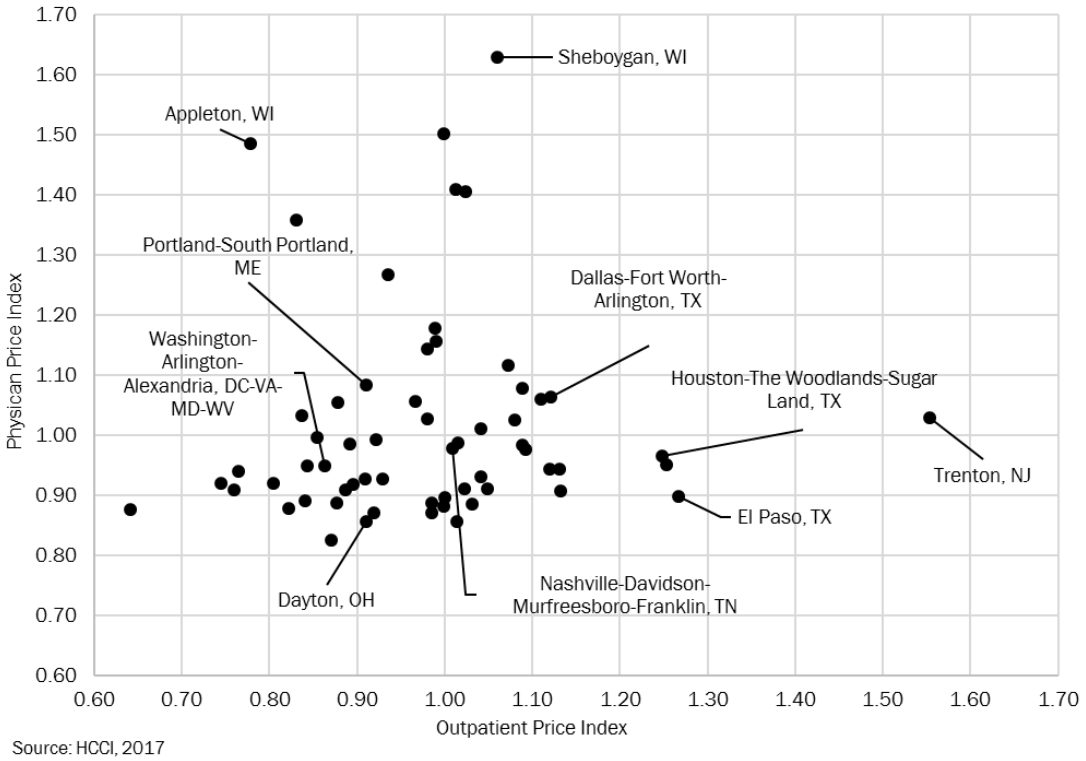
Source: HCCI, 2017

Figure 3. Inpatient vs Physician Price Indices (2013)



Source: HCCI, 2017

Figure 4. Outpatient vs Physician Price Indices (2013)



Source: HCCI, 2017

Limitations

The medical service category price indices are intended to provide insight into the overall price levels in order to facilitate comparisons by geography and over time. Aggregation and standardization of prices and services in the calculations were needed to make prices from a broad range of services easily comparable. The methodology, however, prohibits the metrics from being used to draw conclusions about specific medical service prices. Additionally, the indices do not assess or account for the necessity, appropriateness, or value of health care services.

There are also a number of limitations to the generalizability of all of the HMI metrics. First, all the analyses were conducted with the HCCI data set, which is a convenience sample of the US ESI population. Although it comprised more than 25 percent of the total US ESI population, it may not be representative of the prices among the ESI population not included in the HCCI data set. Second, the choice of CBSA as the geographic unit of interest is not necessarily a relevant market boundary for all health care analyses. "Markets," in an economic sense, likely differ in size and scope by geography and type of service. Third, the results may not generalize to CBSAs not included in the study or to non-CBSA areas, such as rural areas, in the US. Finally, the analyses focused on only one population within health care markets. Other populations (e.g., individual coverage, Medicare, Medicaid) potentially influence both prices and utilization.

Conclusion

Even though some distinctive findings are highlighted in this report, the results discussed should be considered examples of how the indices can be used. The results presented are intended to motivate additional investigation within and across CBSAs into both the patterns of health care pricing and the underlying causes. The medical service category price indices reported in this brief show that inpatient and outpatient facility prices rose from 2012 through 2014, while physician service prices remained relatively constant during the same period. At the CBSA level, we found inpatient and outpatient prices are moderately related, such that areas with higher inpatient prices also often have higher outpatient prices and vice versa. However, we found almost no relationship between physician price levels and either inpatient or outpatient price levels.

The medical service category indices are intended as a reference for health care leaders, policy makers, and researchers to identify potential research topics. The indices do not identify the factors that directly contribute to higher or lower prices. However, by separating all medical services into these three distinct categories, specific policy and research questions can be prioritized. For example, investigations into the drivers of outpatient prices may be warranted in a CBSA where outpatient prices are substantially above the national average.

Knowing how inpatient and physician price levels in the same CBSA compare to the respective national averages would help focus the investigation on outpatient prices as well as help direct resources toward specific policy interventions within the CBSA.

Endnotes

1. All CBSAs included in this HMI report are metropolitan statistical areas with a population of at least 50,000. United States Census Bureau. "Metropolitan and Micropolitan," Available at: http://www.census.gov/population/metro/.

2. Frequency counts are based on the CPT code and CPT modifier because the modifiers are often related to the payment.

3. In 2014 the annual average inpatient price index is 1.056. Thus, a CBSA-level inpatient price index of 1.10 implies the CBSA price level is 4.2% more than the national average price level in 2014 (1.10/1.056 = 1.042).

4. For example, if a CBSA-level inpatient price index is 1.10 in 2014 and 1.05 in 2013, inpatient prices in that CBSA increased 4.76% from 2013 to 2014 (1.10/1.05 = 1.0476).

5. Note, the 29% difference is an example of a comparison by re-normalized the reference year to the 2014 national average.

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Appendix A: Analysis Population

Population Selection

The analysis population included individuals in the HCCI database younger than age 65 who were enrolled in an employer-sponsored insurance (ESI) plan during the years 2012, 2013, and 2014. Core-Based Statistical Areas (CBSAs) were used as the geographic unit of analysis and were selected for inclusion in the HMI based on average annual membership. The HMI analysis sample included 61 CBSAs. The aggregate population from these 61 CBSAs comprised the study's total population.

Average annual CBSA-level membership was calculated by summing monthly CBSA membership and dividing by 12 for each study year. Monthly membership was assigned to a CBSA based on the ZIP code listed in a membership record. If a ZIP code crossed a CBSA boundary, the ZIP code was assigned to a single CBSA (or non-CBSA area) based on where the largest percentage of a ZIP codes residences were located. In the event of a tie in residences, the percentage of business locations were used.[1] The proportion of HCCI membership in a CBSA was calculated by dividing the HCCI CBSA-level average annual membership by the under age 65 ESI population estimates from the U.S. Census Buearu.[2]

CBSAs were included in the HMI analysis sample if either of two criteria were met: 1) average annual HCCI membership was greater than or equal to 25% of a CBSA's ESI population and there were at least 25,000 average HCCI members or, 2) HCCI membership was less than 25% but greater than or equal to 20%, and HCCI average annual membership was greater than or equal to 50,000. One outlier CBSA that met the inclusion criteria, Bismarck, North Dakota, was excluded from the analysis because over 95% of the members in the CBSA were male.

Analysis population

The sample population contains over 24 million individuals in each of the study years - 2012 through 2014. Forty of 41 CBSA's included in the 2015 HMI report were also included in this analysis. Fort Collins, Colorado was the only CBSA from the previous report not included. The average HCCI membership in Fort Collins did not meet the 25% criteria in all 3 study years.

Tables A1-A3 present CBSA population, gender, and age summary statistics by year. As shown in Table A1, there was a wide range in the total population sizes amongst the 61 CBSAs. Each year the minimum population size was roughly 35,000 people (Sheboygan, Wisconsin), while the maximum was close to 3 million (New York City-Newark-Jersey City, New York) – roughly 85 times larger. The distribution of population sizes, however, was constant across the three years studied, with little difference observed in the summary statistics.

The CBSAs tended to have similar population characteristics regardless of their population size (Tables A2-A3). The small ranges between the minimum and maximum in each age and gender category suggest only minor variations between the CBSAs. The population characteristics were also constant across the study period.

Endnotes

1. ZIP code residence and business location distributions were based on data from U.S. HUD: https://www.huduser.gov/portal/datasets/usps_crosswalk.html.

2. US employer-based health insurance population estimates were based on data from the U.S. Census' American Community Survey: https://factfinder.census.gov/bkmk/table/1.0/en/ACS/14_5YR/C27004/0100000US

Table A1. CBSA-level Average Annual Membership Summary Statistics by Year

	2012	2013	2014
Average	404,258	405,050	402,619
(Standard Deviation)	(519,816)	(522,214)	(534,078)
Minimum	34,795	35,703	33,299
25th Percentile	93,745	93,683	91,263
50th Percentile	189,425	180,291	185,312
75th Percentile	540,913	547,958	540,137
Maximum	2,890,783	2,942,313	3,080,473

Source: HCCI, 2017.

Note: The CBSAs and populations listed for each percentile are the closest to the actual percentile of the CBSAs included in the HMI sample.

Table A2. CBSA-level Membership Gender Distribution by Year

Gender	2012	2013	2014
Percent male			
Average	49.2	49.2	49.4
(Standard Deviation)	(1.2)	(1.1)	(1.0)
Minimum	46.2	46.4	46.7
Maximum	51.8	51.8	51.9
Percent female			
Average	50.8	50.8	50.6
(Standard Deviation)	(1.2)	(1.1)	(1.0)
Minimum	48.2	48.2	48.1
Maximum	53.8	53.6	53.3

Source: HCCI, 2017.

Table A3. CBSA-level Membership Age Distribution by Year

Age Category	2012	2013	2014
Percent under age 18			
Average	24.7	24.4	24.1
(Standard Deviation)	(1.9)	(2.0)	(2.0)
Minimum	20.3	19.9	19.1
Maximum	29.2	28.7	28.6
Percent ages 18-24			
Average	11.7	11.9	12.1
(Standard Deviation)	(1.9)	(1.8)	(1.8)
Minimum	9.5	9.8	10.2
Maximum	19.6	20.1	20.6
Percent ages 25-34			
Average	15.9	16.2	16.7
(Standard Deviation)	(1.9)	(1.8)	(1.8)
Minimum	12.0	12.3	12.9
Maximum	20.1	20.0	20.5
Percent ages 35-44			
Average	16.3	16.1	16.1
(Standard Deviation)	(1.4)	(1.4)	(1.4)
Minimum	12.8	12.6	12.5
Maximum	19.6	19.5	19.2
Percent ages 45-54			
Average	17.6	17.4	17.2
(Standard Deviation)	(1.6)	(1.5)	(1.4)
Minimum	14.0	14.2	14.3
Maximum	22.8	22.2	21.2
Percent ages 55-64			
Average	13.7	14.0	13.9
(Standard Deviation)	(2.0)	(2.1)	(2.1)
Minimum	10.0	10.2	10.3
Maximum	19.1	19.2	19.1

Source: HCCI, 2017.

Note: Age categories many not sum to 100% due to rounding. The CBSAs and percentages listed for each percentile are the closest to the actual percentile of the CBSAs included in the HMI sample.

Appendix B: Price Index Methodology

The medical service category price indices are collections of the most common health care services provided to patients for three broad types of services: inpatient facility, outpatient facility, and professional ("physician") services. Codes listed in claims data are used to identify the health care services provided to an individual and billed by the health care provider to insurance. The inpatient facility price index was constructed with Diagnosis-Related Group (DRG) codes. The outpatient and physician price indices were constructed using Current Procedural Terminology (CPT) codes.

To construct the indices, the most common services were identified in each category by the frequency of codes occurring in the non-negative, nonzero dollar 2013 claims from the under 65 ESI population in the 61 CBSAs included in the HMI (i.e. the full analysis population). The inpatient index used the top 100 DRGs and the outpatient and physician indices used the top 500 CPTs, calculated separately.

For each set of codes in the respective service category, a weight for each code was calculated by dividing the number of occurrences of a given code by the total occurrences of all codes included in the service category. An average price was also calculated for each code within a service category at the CBSA level and for the full analysis population in a given year. The mean price of each code was multiplied by its respective weight, and the weighted prices were summed within a service category and year to produce a single weighted average service category price for each CBSA and for the full analysis population. If there were not enough claims for a specific code within a CBSA to calculate a mean price in the given year, the full analysis population average price for that code was substituted.

The CBSA-level price indices were calculated by dividing each CBSA-level average annual price in a study year by the full analysis population 2013 average price. Thus, an index value equal to 1.00 indicates that, on average, the price level in the CBSA was equal to the price level of the full analysis cohort for the same service mix. CBSAs with higher than average prices will have index values larger than 1.00, and CBSAs with lower than average prices will have index values less than 1.00.

The denominator of the index was held constant at the full analysis population 2013 weighted average price in every year of the study to allow for evaluating changes in prices over time. A constant reference point allows for direct comparison of a CBSA-level index values from different years. For example, a CBSA-level index of 0.98 in 2012 that increased to 1.05 in 2014 experienced an increase in the price level of 7% over the study period. Additionally, for each service category, the full analysis population weighted average price from each year was divided by the respective full analysis population 2013 weighted average price. The resulting ratio provided a means of measuring the overall price change over time and for adjusting the reference year for CBSA-level indices.

One concern with choosing a reference year for measuring changes over time is that the service mix changes overtime influencing prices. For example, new expensive technologies may become more popular in a year. In order to test if there were substantial changes in the mix of services used over time, the 2013 weights were compared to weights calculated from 2012 and 2014 claims in each service category. The correlation between the set of annual code weights was 0.99 in each category. This suggests that even if there were changes in utilization, the frequency of the most common services is consistent across the study period.

Finally, the reference year for the indices in this report is 2013 and the reference year for the indices in the 2015 HMI report was 2012. Moreover, the calculation of the total population weighted average market basket price differed slightly between the two reports. In order to ensure that these changes did not overly influence the results, we also compared the 2013 CBSA-level inpatient and outpatient price indices from this report to the corresponding 2013 inpatient and outpatient price indices from the 2015 HMI report. For the 40 CBSAs in both reports, the inpatient indices had a correlation value of 0.92, while the outpatient indices had a correlation of 0.90. Although a direct comparison of the 2015 and 2016 results is not recommended, the change in methodology does not appear to have had a large impact on the overall results relative to the previous HMI report.