

Introducing the New BEA Health Care Satellite Account

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TOTAL HEALTH CARE spending reached 17.4 percent of gross domestic product (GDP) in 2013, and that share is expected to continue to grow significantly, according to the Centers for Medicare and Medicaid Services. Given this trend, it is critical to develop an understanding of what those increased expenditures represent. Are the increases attributable to rising costs of treatment or more individuals receiving medical care? What medical conditions account for the majority of spending? Which medical conditions see the cost of treatment rising most rapidly? Do these spending increases coincide with improvements in treatment? Answers to these questions are necessary in order to formulate policies that allow for society's efficient consumption of health care as well as for the improvement of the nation's overall health status.

The Bureau of Economic Analysis (BEA) has been conducting research to develop a health care satellite account (HCSA)—engaging in methodological research, evaluating new data sources, collaborating with academic researchers, and working jointly across mul-

tipale federal agencies (see the SURVEY OF CURRENT BUSINESS articles (2007), (2008), (2009), (2012), (2013)). The account builds on research by prominent health economists, recommendations from two reports of the National Academy of Sciences' Committee on National Statistics, and years of research both at BEA and the Bureau of Labor Statistics (BLS).

This first release of the HCSA presents preliminary estimates that may be used to improve our understanding of health care spending trends and its effects on the U.S. economy.

The principal contribution of the HCSA is that it redefines the commodity provided to patients by the health sector as the treatment of disease (for example, cancer or diabetes) rather than the specific types of medical care that individuals purchase (such as visits to a doctor's office or the purchase of a drug), as is currently published. Economists generally agree that doing this will allow for a greater understanding of the health sector and will help researchers better assess the returns to medical care spending (Berndt and others

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(2000)). Indeed, a recent panel of the National Academies urged statistical agencies to produce expenditure accounts (National Research Council 2010). In response, the first HCSA, which is presented in this article, modifies the published approach to health care in the national income and product accounts (NIPAs) by explicitly accounting for spending on the treatments of diseases and constructing new disease-based price indexes. The redefinition of the output of the health sector as the treatment of disease implies a different allocation of consumer spending for health care services (across diseases rather than goods and services) and also different price indexes than those published in the NIPAs.

This first release of the HCSA presents two versions for the 2000 to 2010 period. One version uses data from the Medical Expenditure Panel Survey (MEPS). The MEPS is the only nationally representative survey that contains detailed expenditure information by disease category. The MEPS has been used extensively for studying disease expenditures in the academic literature and in a previous, related SURVEY article by Aizcorbe, Liebman, Cutler, and Rosen (2012). For these reasons, the MEPS is a natural starting point for producing our national-level health care satellite account.

While the “MEPS Account” has several attractive properties, a major limitation is its relatively small sample size, which produces less stable estimates across years. To address this issue, we present a second version of the satellite account, which blends together data from multiple sources, including large claims databases that cover millions of enrollees and billions of claims. In order to maintain representativeness in the “Blended Account,” the MEPS serves as the foundation, and the large claims databases are folded into the estimates. This is done by carving out the associated MEPS population (that is, Medicare or commercially insured enrollees) and substituting those patients with the associated population from the large claims data, using population weights to ensure that the weighted share of individuals in each insurance category does not change. In this way, the Blended Account incorporates the large claims data, while covering populations where associated claims data are unavailable (for example, the uninsured and Medicaid enrollees) and maintaining the representative property of the MEPS. The “big data” prove to be essential for accurately and reliably capturing the cost of treatment because medical care spending is highly variable. In addition, as discussed below, studies have shown that measuring medical care spending through traditional surveys tends to understate actual expenditures by over 10 per-

cent, particularly at the high end of the spending distribution.

Under both approaches, prices for the treatment of diseases show faster price growth over 2000–2010 than the published BEA prices that are based on individual services. One method shows an annual price increase of 4.4 percent for health care spending over 2000–2010, and the other method shows 4.0 percent.¹ By comparison, the published BEA prices show a 3.1 percent annual increase. The faster measured growth in health care prices implies slower measured annual growth for real health care spending of 2.0 percent and 2.4 percent respectively, compared with the published 3.3 percent. Finally, these new prices imply faster measured price change in the broader aggregate for personal consumption expenditures (PCE), and slower measured growth in real GDP by about 0.1 percentage point per year.

The HCSA does not capture all the information that we would ideally include in a complete health account (for example, quality of treatment and nonmarket activity). However, the HCSA offers a new lens through which health professionals and policymakers may view and improve our understanding of the health care sector. For instance, several health policy papers have debated whether spending growth is due to the rising cost of treatment or more individuals being treated (Starr, Dominiak, and Aizcorbe 2014; Roehrig and Rousseau 2011; and Thorpe, Florence, and Joski 2004). The answer has implications for how health policies are shaped to combat rising health care costs. Both accounts suggest that the rising costs are driven primarily by increases in the cost per case. Specifically, the Blended Account shows that cost per case contributed 73 percent to per capita spending growth, while the number of treated cases contributed only 27 percent.²

The Blended Account also has the potential to offer more meaningful estimates, allowing policymakers to take recent trends in the account as informative rather than wait years to determine whether trends are real or a result of statistical imprecision. As an example, one of the condition categories with a large share of spending, musculoskeletal conditions, showed a sharp increase in its MEPS Account disease-based price index in 2006 followed by price declines in the 2 subsequent years. In contrast, the Blended Account smoothed out these jumps that could otherwise create unnecessary

1. Growth rates are computed as compound annual growth rates throughout the text.

2. This is similar to the findings in Roehrig and Rousseau (2011) and Starr, Dominiak, and Aizcorbe (2014). The MEPS Account shows 59 percent of the spending is attributable to cost per case over the 2000–2010 period.

alarm and confusion for users of the data. Indeed, we present evidence that the error bands on important components of the MEPS Account are large, and, at the same time, we find evidence that the corresponding Blended Account estimates tend to fall within these error bands. This does not mean that we believe that the Blended Account is “ideal.” In fact, we see many areas for potential improvement. However, these results suggest that the Blended Account likely offers more meaningful information for more recent trends (especially for more disaggregated estimates) and that incorporating “big data” into the HCSA will be important going forward.

Providing statistics for health care spending by disease is the first step in developing an account that would allow one to better assess the value in health care spending. To better assess the value of spending, it will be necessary to incorporate changes in the quality of treatment into the account, an issue where no clear consensus exists among experts. However, one motivation for the production of the HCSA is to complement research on quality adjustment for the disease-based price index going forward. The focus on the treatment of disease is clearly necessary for quality adjustment because the extent to which a particular health care expenditure is beneficial greatly depends upon the condition being treated. Research continues at BEA to account for potential changes in the quality of treatments.

The new HCSA marks another step in BEA’s efforts to adapt its measure of economic activity to reflect changes in the U.S. economy by providing improved measures of health care spending and prices. BEA recognizes that much more research is needed, especially in measures of quality changes in health care. As with BEA’s other satellite accounts, this will be a complementary product and will not replace the current methodology for health care in the NIPAs. Only after more research will we consider this for inclusion in the official accounts.

The remainder of this article discusses the following:

- Differences between disease-based and official price indexes
- Allocation of spending by disease
- Source data used to construct the HCSA
- The methodology used to construct the HCSA
- Results for spending and prices and a summary of the impact on PCE for health, overall PCE, and GDP
- A look at areas of possible future research and some conclusions

Differences Between Disease-Based Price Indexes and Official Price Indexes

An important feature of national accounting is the use of price deflators to decompose changes in spending into changes in prices (inflation) and changes in the quantity of services. In the NIPAs, this is done using producer price indexes (PPIs) from BLS.

The organization of the PPIs is by industry (for example, hospital, physician, or prescription drugs), which makes it challenging to connect the quality improvement for a specific treatment with the corresponding price index. Therefore, scope for improving these indexes is limited. In contrast, the HCSA presented here uses disease-based price indexes to deflate changes in spending, which are more amenable to quality adjustment going forward.

The official PPIs differ in several ways from the disease-based price indexes presented in this article:

- The PPIs do not account for changes in the cost of treatment when treatment shifts across industries—for example, a shift from inpatient hospital services to outpatient.
- The PPIs do not account for changes in utilization during a medical care visit.
- The PPIs hold the insurance plan of the individual constant, while the disease-based price indexes allow individuals to switch plans.

These shifts across industries, changes in utilization or plan switching can theoretically lead to disease-based prices that show faster or slower growth than the BLS price indexes currently used in the NIPAs. These issues are discussed in greater detail in Aizcorbe (2013).

Within the academic literature examining disease-based prices, the disease-based price index is often referred to as a medical-care expenditure (MCE) index, which is built up from prices for the treatment of individual diseases, defined at a very granular level. For each disease, the index is constructed based on the ratios of the estimates of the cost of disease treatment at time, t , relative to a base period. Let $c_{d,t}$ be the average expenditure per patient for condition, d , at time, t , or the “price” of treating condition, d , at time, t .³ Also let $c_{d,0}$ denote the average expenditure per patient for condition, d , in the base period, $t=0$. The change in the price of treating disease, d , from the base period

3. Repeat collection of patients receiving the same medical care condition is not practical, so it is necessary for this index to be a unit value. For instance, it would be difficult for an index to rely on the same person receiving a heart attack treatment over multiple periods. This issue was anticipated in National Research Council (2010, 114). To limit unit value bias we try to limit the heterogeneity of disease episodes by defining diseases at a fairly disaggregated level.

to time, t , is the ratio of the two and is called a price relative:

$$MCE_{d,t} = \left(\frac{c_{d,t}}{c_{d,0}} \right) .$$

An $MCE_{d,t}$ price relative that is greater than one means that the price for treating disease, d , is larger than it was in the base period; a value less than one means that the price is lower than it was in the base period. A change in prices may occur because the prices of the underlying services change (for example, the price of a magnetic resonance imaging (MRI) scan increases) or because the utilization per patient changes (for example, more individuals receive an MRI for the treatment of their condition). One can then construct an MCE index that averages these price changes over some (or all) conditions using price index formulas.

Several studies have attempted to quantify differences in disease-based price indexes and more traditional indexes. This literature is summarized in Aizcorbe (2013). In general, the important lesson from this research is that the MCE index can grow faster or slower than the PPI-type index.

Some potential examples in table 1 help to demonstrate these possibilities and their effect on price. For example, the potential for shifts from costly inpatient surgery to outpatient hospital visits may lower the overall cost of care and lower the MCE relative to a PPI. A similar decline in the MCE relative to the PPI may be observed in the case where a high-cost technology is replaced by a low-cost technology (for example, the introduction of depression drugs). However, shifts do not necessarily flow to less costly treatments. For

instance, physicians may use more intensive procedures (for example, 30 minute visits instead of 15 minute visits) or conduct more procedures (for example, more visits to the office), which would increase utilization per patient and push the MCE index higher relative to the PPI. Of course, higher underlying prices of the services will have a similar effect on both indexes.

Finally, it is important to mention that shifts across insurance plans can also affect a disease-based price index. In particular, one feature of the BLS PPIs that distinguish them from the disease-based price indexes is that they hold the type of insurance constant when tracking procedure prices.⁴ Increases in utilization from individuals moving to more generous plans would be reflected as an increase in an MCE index but would have no effect in the PPI.

Whether the MCE index grows faster or slower than the corresponding service prices will depend on the specific factors affecting treatment for the population. For instance, growth of the MCE index relative to the PPI will depend on the specific health condition (for example, heart disease or depression), the shifts in medical treatment practices and technologies, the time period, and the population (for example, Medicare or commercially insured).

One way to compare the official price indexes with disease-based price indexes is to create a disease-based estimate for the entire economy that may be directly compared with the official BLS PPI and BEA PCE indexes. We conducted this comparison using the estimates from this article. Consistent with the prior discussion, we find that the growth in the MCE index relative to the published indexes depends on the period studied. We find that the MCE index grows faster than BEA’s PCE deflator for health care over the 2000 to 2005 period, but grows at about the same rate between 2005 and 2010. We discuss some of the industry shifts and utilization changes that may have contributed to this faster growth from 2000 to 2005 later in the article.

Table 1. Examples of the Impact of Utilization Changes on MCE and PPI

Examples: (<i>Ceteris Paribus</i>)	MCE	PPI
Shift from high cost inpatient hospital services to lower cost outpatient hospital services	↓	—
Higher intensity procedures used in physician offices.....	↑	—
Higher prices for physician office procedures.....	↑	↑
Switch from high cost talk therapy to lower cost drug therapy to treat depression.....	↓	—
Change from restrictive insurance plan to generous plan.....	↑	—

MCE Medical care expenditure index
PPI Producer price index

4. BLS aims to track prices for precisely defined goods and services, so they control for all aspects of the price characteristics, including the precise payer of the service (for example, United Health Care). In contrast, this disease-based index recognizes the savings that may accrue from people switching to a plan that might control the utilization of services more carefully or bargain more forcefully with providers (see Cutler, McClellan, and Newhouse (2000)).

Historical MCEs compared with BLS price indexes

The lesson that MCE indexes may grow faster or slower than PPIs may be gleaned from looking at earlier periods. A study by Aizcorbe and Highfill (2014) provides some historical perspective on MCE trends relative to PPI trends. Their study uses survey data from the MEPS and its predecessors from 1980, 1987, 1997, and 2006 to directly calculate and compare MCE indexes with PCE price deflators for comparable health services that rely on the BLS price indexes. The authors find differences in the MCE and PCE price indexes that coincide with developments in insurance markets over these periods. For example, there was a well-known shift from relatively generous fee-for-service plans to more restrictive managed care plans in the late 1980s and early 1990s. The managed care plans imposed restrictions on services and also limited provider networks to control costs (see Glied 2000). As insurance coverage shifted to managed care plans, providers received lower revenues for the same service and conducted fewer services, thus lowering the “price” of care. Consistent with this pattern, Aizcorbe and Highfill find that in 1987–1997 the disease-based indexes grew 3.6 percent, substantially slower than the 5.9 percent growth rate in the PCE health care index.

While the managed care plans succeeded in restraining expenditure growth for many years, the popularity of the more tightly controlled plans declined over time as public dissatisfaction with insurer restrictions grew. In the late 1990s and early 2000s, there was a backlash against tightly controlled managed care plans. Again, Aizcorbe and Highfill find estimates consistent with this pattern. For 1997–2006, MCEs show faster growth than the published PCE statistics (4.7 percent versus 2.6 percent).⁵

Allocation of Spending by Disease

One of the biggest challenges in measuring health care spending by disease is the fact that patients often suffer from more than one illness—the presence of coexisting illnesses are referred to as comorbidities. This makes it difficult to disaggregate and allocate spending to diseases. For example, for a patient obtaining treatment for both hypertension (high blood pressure) and heart disease, how should the expenditures be allocated across these two related diseases? This problem is substantial in health care markets in general. Dunn and

5. Consistent with this last finding, work by Pinkovskiy (2014) provides evidence that the managed care backlash had a substantial impact on expenditures, utilization, and salaries, consistent with the idea that shifts in the insurance market may impact MCE indexes.

others (2014) examine commercial claims data and find that most expenditures are for patients that have many conditions, with 53 percent of expenditures allocated to those with seven or more conditions.

Three general approaches to allocate disease expenditures to mutually exclusive disease categories have been studied (see Rosen and Cutler 2007), with no consensus on which method is best. The three approaches are as follows:

- An encounter-based approach, which assigns expenditures to diseases based on the diagnosis reported on each observation. Often the expenditures are allocated to the primary diagnosis listed on a claim, where the typical categorization is based on 263 Clinical Classification Software (CCS) disease categories.⁶ The cost of treatment is typically counted as all expenditures for the treatment of a disease over a fixed period, typically a year.
- An episode-grouper approach, which uses software algorithms to review a patient’s medical history and assign claim lines to distinct episodes.⁷
- A person-based approach, which uses regressions and the characteristics of the patient in an attempt to statistically divide expenditures across disease categories (see Trogon, Finkelstein, and Hoerger 2008).

Because there is no consensus on which of these methods is preferable, staff at BEA have conducted research to explore how sensitive the allocations and the price indexes that use them are to the choice of method using different data sources.⁸ On balance, these studies show that price indexes can be sensitive to the method used to allocate spending by disease, particularly for individual disease categories. But growth rates for the overall aggregate indexes are similar, particularly when calculated using large claims databases.

For purposes of this first version of the HCSA, we applied the primary diagnosis method (an encounter-based approach) using the CCS classification system because of its simplicity and widespread use in the literature. Unfortunately, this approach cannot be applied to all of the data sources used in the construction of the Blended Account. For instance, in medical claims data, prescription drug claims do not contain

6. Previous research has also used a “proportional” method of assigning spending to events with two or more diagnoses (Roehrig and others 2009).

7. Episodes include all services involved in diagnosing, treating and managing medical conditions and potentially vary in duration, ending when treatment has completed. Work by Dunn and others (2014) find that looking at these indexes based on episodes or patient expenditures over a fixed period, produce very similar indexes.

8. Aizcorbe and others (2011), Rosen and others (2012), Hall and Highfill (2013), and Dunn and others (2014).

diagnostic information, making it challenging to map their expenditures to a unique CCS disease category. When this data limitation arises, the person-based approach is applied, which is able to consistently allocate expenditures for prescription drugs using other diagnostic information for each individual.

While we selected this particular methodology for this first version of the account, it is important to highlight that, at this point, BEA has not determined which methodology is best. After presenting the main results of the paper, we will discuss the implications of the selected disease allocation method on the estimates and avenues for future research in this area.

Data Sources

BEA devoted substantial resources to studying alternative data sources that might be used in the HCSA. This section describes the three data sources used in this version of the HCSA and briefly discusses two additional sources that may be used in the future.

Medical Expenditure Panel Survey (MEPS)

The Medical Expenditure Panel Survey, which is conducted by the Department of Health and Human Services' Agency for Healthcare Research and Quality (AHRQ), is a nationally representative survey of the health care utilization and expenditures of the civilian noninstitutionalized U.S. population. The sample includes approximately 15,000 families and 35,000 individuals each year. For each year of the survey, respondents report detailed information on all medical care encounters (for example, inpatient hospital visits, physician office visits, and prescription drug purchases) in that year for each member of the household. This includes medical conditions for which treatment was sought and the associated total expenditures paid, including out-of-pocket payments and all third-party payers. The medical conditions reported by individuals are mapped into *International Classification of Diseases* 9th revision (ICD-9) categories by trained staff. Population weights are included that allow researchers to construct estimates that are representative of national totals.

The MEPS is unique in that it is the only nationally representative survey in the United States that contains detailed medical care expenditure information. Moreover, it is the only data source available that contains medical expenditure information for the uninsured population. To enhance coverage of patients and diseases with small sample sizes, we follow AHRQ's recommendation of pooling 2 years of data when ana-

lyzing trends in the MEPS.⁹

There are various limitations of the MEPS. Most importantly, MEPS assigns diseases based on respondent self-reports, which are subject to various biases and reporting errors. Aizcorbe, Liebman, Pack, Cutler, Chernew, and Rosen (2012) find that the MEPS may underreport expenditures for the commercially enrolled population by as much as 10 percent. These differences are due to both underrepresentation of high expenditure cases and underreporting across the remaining distribution. Selden and Sing (2008) also find MEPS to under count high-cost cases. In addition, the bias may be skewed toward certain medical care services. When comparing MEPS respondents covered by Medicare with actual Medicare enrollees' claims data, households accurately reported inpatient stays and number of nights but underreported emergency department visits by roughly 30 percent and office visits by as much as 20 percent (see Zuvekas and Olin 2009).

MarketScan® Data

The Truven Health MarketScan® Commercial Claims and Encounters Database contains patient-level health care claims information from employers and health plans. The analysis uses a sample of enrollees who are not in capitated plans and are enrolled for 360 days or more each year.¹⁰ The sample is also limited to enrollees with drug benefits. The final sample includes about 3.5 million commercially insured enrollees each year and offers detailed information about all aspects of medical care expenditures (for example, inpatient hospital, outpatient hospital, physician offices, and prescription drugs). Each observation in the claims data represents a procedure or service that is billed on a medical care claim. This claim information generally includes the ICD-9 diagnosis of the patient and detailed information on the precise procedure or service performed. One important exception is prescription drug claims, which contain no diagnostic information. Therefore, a distinct methodology must be applied to allocate these expenditures across disease categories.

9. For example, for the year 2000, we pool data from the 1999 and 2000 sample years.

10. Plans with some capitation represent approximately 20 percent of the MarketScan sample. These are typically health maintenance organization insurance plans that do not contain expenditure information on capitated services. BEA has conducted some preliminary work that attempts to impute expenditures on capitated claims over the period 2003 to 2010 (a period when a "capitation" flag is available in the data). The imputation uses pricing information on similar services for similar plans in the area. We find that incorporating these additional plan types has little impact on the overall MCE price index for the commercially insured population. This is a topic where continued work is necessary.

We follow the work of Dunn and others (2014) and apply a person-based approach to allocate expenditures across CCS disease categories.

A distinguishing feature of the MarketScan data is that it is a convenience sample that may not be representative of national totals. When working with the MarketScan data, it is important to apply population weights so that the weighted population reflects the demographics and national population totals for the commercially insured population.¹¹

Medicare claims

The Medicare claims data come from a 5 percent random sample of Medicare beneficiaries. The data contain detailed demographic and medical care information for approximately 2 million enrollees per year. Similar to the MarketScan data, detailed medical service information is available by service category (for example, inpatient hospital, outpatient hospital, and physician offices) at the claim line level. Again, this includes information on the total amount paid, ICD-9 diagnosis information, and detailed information regarding the procedures performed. For this analysis, the sample of enrollees includes only beneficiaries enrolled in a fee-for-service plan because expenditure information is not available for those enrolled in the private Medicare Advantage program.¹² Patients dually enrolled in both Medicare and Medicaid are included.¹³ Medicare claims data do not report drug spending prior to the implementation of Part D in 2006, whereas these expenditures can be found in the MEPS. Therefore, because of these limitations on the availability of drug information, drug spending is imputed for the Medicare population. Although the

11. Once population weights are applied, Dunn, Liebman, and Shapiro (2014) find that the MarketScan data follow growth trends that are similar to national totals. Since the MarketScan data are a convenience sample, the number of data contributors (that is, employers and insurers) changes over the sample period of study, growing considerably from 2000 to 2010. Following the work of Dunn, Liebman, and Shapiro (2014) we try to keep the data contributors constant through much of the sample period. However, there are many more contributors in the end of the period relative to the beginning, and we do not want to remove this additional information. To allow the sample to grow, we divide the data into two periods. First, we hold the contributors constant over the 2000 to 2004 period and then produce a second set of estimates where we hold contributors constant over the 2003 to 2010 period. We use the overlapping period of the two samples to investigate the effects of the sample change on the price index. We determined that these effects were minimal. In addition, we also explored estimates where we held data contributors constant over the entire period (that is, 2000–2010) and found similar results.

12. The Medicare Advantage program is a private alternative to traditional Medicare. The medical care claims for the Medicare Advantage population are processed and retained by the private insurers.

13. Since Medicare is the primary payer, the dual-eligible population enrolled in fee-for-service Medicare is observed and is included in this sample population.

Medicare 5 percent sample is random, the exclusion of the Medicare Advantage enrollees leads to a non-random sample. Similar to the MarketScan data, population weights are applied to ensure that the demographics and the population totals reflect the national totals for all Medicare beneficiaries.

Other data sources

The Medicare Current Beneficiary Survey (MCBS) is an annual survey that constitutes an alternative data source for Medicare beneficiaries. For Medicare beneficiaries who are enrolled in a Medicare Advantage program, the in-person survey portion of the MCBS is currently the only source of data available on their spending. At this time, we use the Medicare 5 percent claims data instead of the MCBS data for the entire Medicare population because of the larger sample size and because detailed ICD-9 diagnostic information is not available for the Medicare Advantage enrollees in the MCBS data (see Hall and Highfill 2014).¹⁴

A potential data source for the Medicaid population is the Medicaid Analytic Extract (MAX) claims data. These Medicaid patient-level claims data are collected by state on a yearly basis. However, because of the state-by-state variation of reporting, the task of analyzing the Medicaid data must be handled one state at a time. Preliminary estimates for a small sample of states suggest that Medicaid is not guaranteed to trend the same way across states or to trend similarly to Medicare and the commercially insured. More work will be necessary to incorporate this complex data source into our analysis.

Methodology for Construction of the HCSA

The new HCSA requires restructuring the published NIPA breakout of health care consumption. In addition, the MEPS Account and Blended Account use different methodologies and data sources to allocate medical spending by disease into disease groups. This section describes these differences in structures and methodologies.

Differences in NIPA health by function and the HCSA

Both the MEPS Account and Blended Account will restate health expenditures as published in the health

14. Hall and Highfill (2013, 2014) have conducted a substantial amount of work examining disease-based estimates with the MCBS data. Future versions of the account may try to explore how these data may be incorporated to improve the accounts.

by function tables in the NIPAs into new aggregates.¹⁵ As shown in table 2, the three health categories of hospitals, physician services, and paramedical services will be allocated to “medical services by disease.” In addition, the category of prescription drugs, counted as a good in the health by function account, will also be allocated to medical services by disease. The new medical products category will include all of the items published in medical products, appliances, and equipment, except for prescription drugs, which are recorded in medical services by disease under the diseases that the drugs were used to treat. The remaining items published under “health” are reported in the same way in the new account: dental services, nursing homes, nonprescription drugs, other medical products as well as therapeutic appliances and equipment.¹⁶

The structure and aggregate goods and services numbers presented in table 2 are identical for both the MEPS Account and Blended Account. The key difference is that the MEPS Account and Blended Account use different methodologies and data sources to allocate expenditures across different diseases within the medical services by disease category.

The MEPS Account

The MEPS Account is constructed using data from the MEPS. Each encounter in the data includes expenditure information and a primary ICD–9 diagnosis code.¹⁷ Each diagnosis code is mapped into one of 263 possible CCS categories.¹⁸ Next, expenditures for each service are multiplied by the associated population weights and summed across the entire population. Similarly, for each condition category, we apply MEPS population weights to compute an estimate of the total number of patients that are treated for that condition within a year. The annual expenditure totals and patient counts are then used to produce the different components of the account.

One component of the account is current-dollar spending by disease. While MCEs are computed at the CCS level, spending is reported at a more aggregated

15. This total amount excludes output produced by health-related industries that are not directly paid for by households, such as spending by state and local governments and nonprofit institutions providing health care services; goods produced by these industries that are exported abroad and not consumed by U.S. households; and goods consumed by U.S. households that are not produced domestically. These factors account for around 7 percent of health spending. This is discussed in further detail in Aizcorbe, Liebman, Cutler, and Rosen (2012) and is referred to as household consumption expenditures in that article.

16. Due to data limitations, nursing homes, dental services and nonprescription drugs are left as published in the NIPAs and not broken down further.

17. If multiple diagnoses are listed, we use the first listed diagnosis.

18. Dental services are removed from the MEPS and other data sources, and left unchanged in the NIPAs. To avoid logical inconsistencies in the accounts, the CCS category 136 that is related to dental care (for example, cleanings and fillings) is removed from our analysis.

Table 2. Health Care Expenditures Comparison, 2010

[Billions of dollars]

	Current NIPA presentation health by function	Health care satellite account
Health	2,080.4	2,080.4
Services		
Medical services by disease		1,722.4
Physician services.....	402.8	
Paramedical services	260.6	
Hospitals	770.5	
Nursing homes	152.3	152.3
Dental services.....	104.5	104.5
Goods		
Medical products, appliances, and equipment	389.7	101.3
Pharmaceutical and other medical products	334.1	49.6
Pharmaceutical products.....	330.1	45.6
Prescription drugs.....	288.5	
Nonprescription drugs	41.7	41.7
Other medical products	4.0	4.0
Therapeutic appliances and equipment.....	55.6	55.6

NIPA National income and product accounts

level than the underlying CCS categories. Specifically, the CCS categories are aggregated into 18 ICD–9 chapters. Because certain disease chapters are relatively small, we further collapse four of them (diseases of the blood and blood-forming organs, congenital anomalies, certain conditions originating in the perinatal period, and residual codes: unclassified) into an “other” category. In total, we report total expenditures for 15 disease chapters.

The spending total in the HCSA must match the relevant NIPA health care spending total. A couple of steps are taken to construct spending by disease categories that add up to the NIPA total. We first calculate the expenditure shares for each disease category in each year. We then multiply the NIPA control total by the expenditure share for each disease category to construct spending for that category.

To calculate the MCE price indexes, we first estimate annual spending per patient for each CCS disease category. That is, we define the price of a condition as the annual cost per patient used to treat that condition. Next, we construct MCE price relatives using 2009 as the base year. A Laspeyres MCE index is then calculated for each of the ICD–9 chapters. To derive an overall inflation figure for the health care sector, the disease chapter indexes are combined using the Fisher price index formula.

The Blended Account

Additional steps are necessary to construct the Blended Account. As stated previously, the basic idea behind the Blended Account is to substitute pieces of the MEPS for certain populations with corresponding big

data. The two data sets that we incorporate into the Blended Account are the MarketScan claims data and the Medicare 5 percent claims data sample.

To incorporate the MarketScan data, we first identify the corresponding population in the MEPS. Specifically, we identify those individuals in the MEPS with private insurance that are not also enrolled in either Medicare or Medicaid. Next, we use the MEPS population weights to identify the number of privately insured individuals in the categories of age, sex, region, and year.¹⁹ We then construct new weights so that the weighted MarketScan population has demographic shares for each category equal to the weighted MEPS population. For example, the weighted MEPS population of privately insured individuals represents 176 million in 2007. Of these, 3 million are males between the ages of 25 and 35 and are located in the West. After the new population weights are applied to the MarketScan data, the weighted estimates reflect a share for males between 25 and 35 located in the West equivalent to 3 million. Once these weights are constructed, privately insured individuals in the MEPS are replaced with the corresponding MarketScan data in the Blended Account.

Parallel steps are taken to incorporate the Medicare 5 percent claims data. We identify those individuals in the MEPS with Medicare insurance (including enrollees who are simultaneously enrolled in Medicaid identified as Medicare dual-eligibles). Next, we construct population weights for the Medicare 5 percent sample using the associated MEPS population weights for all Medicare beneficiaries. Because the sample sizes of the Medicare and MarketScan data are considerably larger than the MEPS sample, each enrollee in the data will represent fewer individuals in the population relative to those observations in the MEPS.²⁰

An additional step is taken to impute prescription drug spending for the Medicare 5 percent sample because it does not contain prescription drug claims for a majority of the years in the data.²¹ To do this, we calculate, for each CCS category, prescription drug spending per patient in the MEPS for Medicare beneficiaries. We then multiply the estimate of drug spending per

patient in the MEPS by the number of patients in the claims data to obtain spending totals by CCS category.²²

Using weights from the MEPS and the newly constructed individual weights for MarketScan and Medicare, we estimate national current expenditures and patient counts for each CCS category from estimates of annual spending per patient for each condition and use the resulting estimates to construct MCE price relatives for each CCS category.²³

After the Medicare 5 percent sample and MarketScan data are blended with the remaining MEPS, the method for constructing spending and the disease-based price indexes is identical to that described for the MEPS Account.

Results for Spending and Prices

The following three subsections summarize the main results from this release of the HCSCA: measures of spending, price indexes, and real expenditures growth for the aggregate published in the NIPAs as health by function.

Expenditures

Table 3 compares current-dollar expenditures on medical care in the MEPS Account with expenditures in the Blended Account for 2000 and 2010. As discussed

22. The imputation is given by

$$\begin{aligned} & \left(\frac{\text{Prescription Spending}_{\text{MEPS}}}{\text{Patients}_{\text{MEPS}}} \right)_{\text{CCS}} \cdot \text{Patients}_{\text{Medicare}_{\text{CCS}}} \\ & + \text{Other Medical Spending Total}_{\text{Medicare}_{\text{CCS}}} \\ & = \text{Total Medicare Spending}_{\text{CCS}} \cdot \end{aligned}$$

23. Specifically, the spending totals are calculated as

$$\begin{aligned} & \text{National Expenditures}_{\text{CCS}} = \\ & \sum_i w_{i, \text{Other MEPS}} \cdot \text{Expend}_{i, \text{Other MEPS}, \text{CCS}} \\ & + \sum_i w_{i, \text{MarketScan}} \cdot \text{Expend}_{i, \text{MarketScan}, \text{CCS}} \\ & + \sum_i w_{i, \text{Medicare}} \cdot \text{Expend}_{i, \text{Medicare}, \text{CCS}} \cdot \end{aligned}$$

Then the number of episodes is calculated as

$$\begin{aligned} & \text{National Patients}_{\text{CCS}} = \\ & \sum_i w_{i, \text{Other MEPS}} \cdot \text{Patient}_{i, \text{Other MEPS}, \text{CCS}} \\ & + \sum_i w_{i, \text{MarketScan}} \cdot \text{Patient}_{i, \text{MarketScan}, \text{CCS}} \\ & + \sum_i w_{i, \text{Medicare}} \cdot \text{Patient}_{i, \text{Medicare}, \text{CCS}} \cdot \end{aligned}$$

Then the price relative is calculated as

$$\text{MCE}_{\text{CCS}} = \frac{\text{National Expenditures}_{\text{CCS}}}{\text{National Patients}_{\text{CCS}}} \cdot$$

19. We use 10-year age categories up to the age of 64 as well as Census Bureau regions. The MarketScan data do not contain individuals 65 and older that are typically enrolled in Medicare.

20. Ultimately, about 90 percent of expenditures come from these two data sets (50 percent from commercially insured and 40 percent for Medicare and dual Medicare-Medicaid enrollees (including the imputed prescription drug expenditures)). The remaining 10 percent of expenditures come from the MEPS remaining population (for example, nondual Medicaid and uninsured).

21. Although drug expenditure information is available post-2006 with the introduction of Medicare Part D, at this time, we chose to impute drug spending based on MEPS, which is consistently reported throughout the sample period.

previously, the only differences in spending arise within the category medical services by disease, where the two accounts use different data and methods to break out that spending into disease categories. The complete name of each chapter and a brief description of some medical conditions in each chapter are in the appendix.

Growth in spending is one of the fundamental measures for purposes of measuring real GDP. The growth rates for spending by disease in the MEPS Account are within 2 percentage points of the growth rates in the Blended Account for nearly all categories. This is surprisingly similar given the vast differences in these data, especially the known issue of underreporting in the MEPS that are likely to impact particular diseases and services in distinct ways. The one condition category that stands out as different is the symptoms, signs, and ill-defined conditions chapter, where the growth in the MEPS Account is over 4.5 percentage points lower than in the Blended Account (6.2 percent growth and 11.0 percent growth, respectively). A potential reason for this difference is that expenditures are allocated differently for this category in the MEPS, compared with the large claims data.²⁴

There are many distinctions in the data and methodology that could contribute to the observed differences in spending, including underreporting in the MEPS, survey data versus administrative records, random sample of the MEPS versus convenience sample of the claims data, pooled 2 year MEPS versus annual blended data, and different methods of expenditure allocation. However, another very plausible explanation for these differences is the imprecision in the MEPS due to the high variability of medical spending and the relatively small sample sizes in that survey. Circulatory, which is the largest disease chapter based on expenditures, shows spending growth rates in the two accounts that diverge by about 2 percentage points, with the MEPS Account showing faster growth. However, the MEPS estimates have a high standard error (around 6–13 percent of spending) with large confidence bands around the MEPS estimate, as displayed in chart 1. In fact, for circulatory, the confidence

24. For both the MEPS and claims data, expenditures are allocated to this category based on diagnosis. However, additional claims are allocated to this category for the MEPS. Specifically, for some events in the MEPS that do not have diagnosis codes, we follow the work of Roehrig and others (2009) and allocate several services to a preventative category. For example, we were able to identify general check-ups, follow-up or post-op visits, and well child exams and allocate these services to a disease in chapter 17, symptoms, signs, and ill-defined conditions. Roughly, 6 percent of this undiagnosed spending we were able to reallocate to chapter 17. While we were able to identify and allocate some of the unallocated spending, much of it remains unallocated. After these adjustments, both the claims and the MEPS have roughly 13 percent of expenditures unallocated. These unallocated expenditures are dropped.

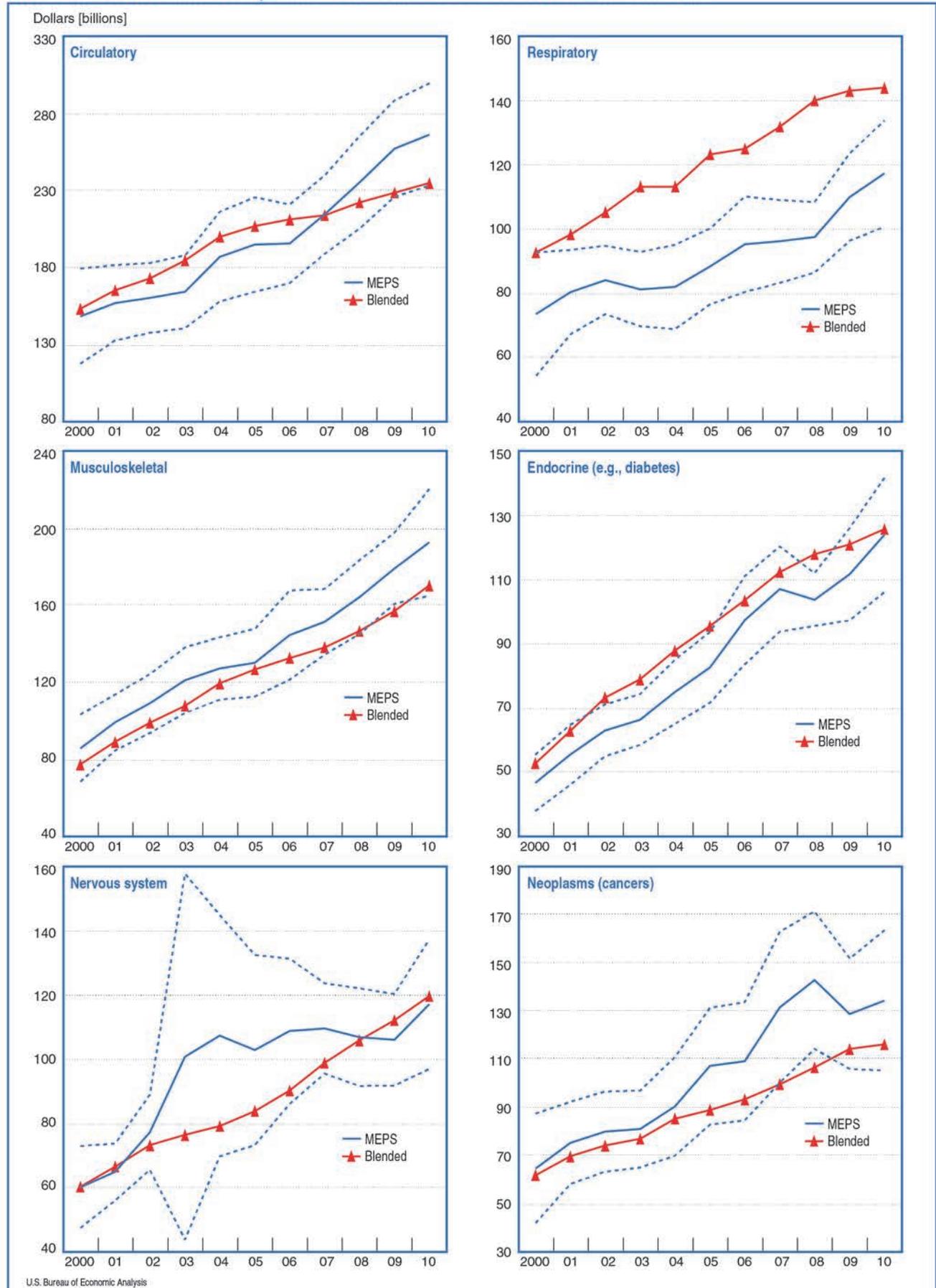
Table 3. Expenditures, Health Care Satellite Account

[Billions of dollars]

	MEPS account			Blended account		
	2000	2010	Annual growth rate (percent)	2000	2010	Annual growth rate (percent)
Health	1,109.6	2,080.4	6.5	1,109.6	2,080.4	6.5
Health services.....	1,052.2	1,979.2	6.5	1,052.2	1,979.2	6.5
Medical services by disease	900.7	1,722.4	6.7	900.7	1,722.4	6.7
Infectious and parasitic diseases	18.9	35.9	6.6	23.2	58.1	9.6
Neoplasms	64.5	134.3	7.6	61.8	116.1	6.5
Endocrine; nutritional; and metabolic diseases and immunity disorders.....	46.5	123.8	10.3	52.5	125.6	9.1
Mental illness	66.1	111.1	5.3	43.3	79.1	6.2
Diseases of the nervous system and sense organs	60.1	117.0	6.9	60.3	119.6	7.1
Diseases of the circulatory system	148.0	266.0	6.0	152.8	234.5	4.4
Diseases of the respiratory system	73.4	117.1	4.8	92.6	143.9	4.5
Diseases of the digestive system	49.6	108.0	8.1	55.8	101.6	6.2
Diseases of the genitourinary system	38.0	79.4	7.6	64.6	111.0	5.6
Complications of pregnancy; childbirth; and the puerperium	38.1	59.3	4.5	25.5	38.2	4.1
Diseases of the skin and subcutaneous tissue.....	16.7	27.3	5.0	21.3	38.3	6.1
Diseases of the musculoskeletal system and connective tissue	85.3	192.5	8.5	76.9	169.9	8.3
Injury and poisoning.....	85.6	135.2	4.7	65.4	109.8	5.3
Symptoms; signs; and ill-defined conditions.....	85.7	157.0	6.2	72.7	206.9	11.0
Other	24.0	58.5	9.3	32.3	69.8	8.0
Diseases of the blood and blood-forming organs	3.2	11.9	13.9	8.6	20.9	9.3
Congenital anomalies	6.6	13.2	7.1	5.3	7.6	3.6
Certain conditions originating in the perinatal period	3.5	6.9	6.9	4.7	6.7	3.6
Residual codes; unclassified; all E codes.....	10.6	26.5	9.6	13.6	34.6	9.7
Medical services by provider	151.5	256.8	5.4	151.5	256.8	5.4
Dental services.....	63.6	104.5	5.1	63.6	104.5	5.1
Nursing homes	87.9	152.3	5.6	87.9	152.3	5.6
Proprietary and government nursing homes.....	56.8	100.2	5.8	56.8	100.2	5.8
Nonprofit nursing homes services to households.....	31.1	52.1	5.3	31.1	52.1	5.3
Medical products, appliances and equipment	57.4	101.3	5.8	57.4	101.3	5.8
Pharmaceutical and other medical products	25.2	45.6	6.1	25.2	45.6	6.1
Pharmaceutical products (without prescription drugs).....	23.2	41.7	6.0	23.2	41.7	6.0
Nonprescription drugs	23.2	41.7	6.0	23.2	41.7	6.0
Other medical products	1.9	4.0	7.4	1.9	4.0	7.4
Therapeutic appliances and equipment	32.2	55.6	5.6	32.2	55.6	5.6
Corrective eyeglasses and contact lenses.....	19.9	29.7	4.1	19.9	29.7	4.1
Therapeutic medical equipment	12.3	25.9	7.8	12.3	25.9	7.8

E Supplementary Classification of External Causes of Injury and Poisoning E codes
MEPS Medical Expenditure Panel Survey

Chart 1. MEPS and Blended Expenditures with MEPS 95 Percent Confidence Intervals



interval is sufficiently large that the levels reported in the Blended Account for this disease category in 2000–2010 fall entirely within the confidence interval.²⁵ Given the large differences in sample size and confidence bands, it is not surprising that spending patterns appear different across the two accounts. To put the magnitude of these sample size differences in perspective, note that the MEPS Medicare population averages just 125 heart attacks per year, while the corresponding population in the Medicare claims data averages more than 30,000.

Three other examples in chart 1 include the respiratory, musculoskeletal, and endocrine chapters. For all three chapters, there are also differences between the levels of spending. The respiratory chapter shows spending for the Blended Account that exceeds spending in the MEPS Account and lies well above the confidence interval. The musculoskeletal chapter shows spending for the Blended Account that is less than that in the MEPS Account, but falls within the confidence interval. The MEPS Account falls below the Blended Account for endocrine (for example, diabetes) but mostly lies within the confidence interval. Again, given the difference in data and methodology, these level differences are not surprising. For many purposes, users of the data may be more interested in growth rates than in differences in the levels. For the respiratory, musculoskeletal, and endocrine chapters, the growth trends follow quite similar patterns.

Finally, the chapters on nervous system (for example, epilepsy) and neoplasms (that is, cancers) are shown. The Blended Account spending generally falls within the error band of the MEPS Account estimates, but the two accounts show very different trends over time.

For many practical purposes, the greater precision offered by the Blended Account is a clear advantage. The choppy, year-to-year jumps in the MEPS spending levels displayed in chart 1 are the most striking feature of the MEPS Account's current-dollar spending. This is especially noticeable for nervous system and neoplasm spending, but respiratory and circulatory conditions also show some unusual changes over the sample. For instance, the nervous system shows a sharp rise and some unusual declines over the 2002 to 2006 sample period. While it is possible that these year-to-year

shifts in spending are real, the more plausible explanation is the greater variability in the MEPS. For policy-makers and health experts attempting to understand recent trends in the health sector, it may be challenging to interpret these random bumps observed in the MEPS Account.

Although we cannot determine which account is best for all purposes, it is clear that the Blended Account is likely to produce more stable and precise estimates over a short horizon. This attribute of the Blended Account is even more noticeable for the measurement of prices.

Price indexes

The second contribution from the new HCSA is the new price indexes that result from redefining the commodity provided to consumers by the health sector. Indexes for all the categories listed under health are shown in table 4 for 2000 and 2010 (page 14). Any differences in the price indexes for the medical services by disease category will be reflected in the aggregates that this category feeds into; price indexes for medical services by provider and all the pieces of medical products, appliances, and equipment are not affected and therefore remain identical across the two accounts.

For medical services by disease, the annual price changes are 4.2 percent and 4.7 percent in the MEPS and Blended Accounts, respectively. When comparing the growth in the price indexes across the different disease categories, growth rates for the price indexes from the two methods are within 1.5 percentage points of each other, except for neoplasms (2.9 percent, compared with 5.1 percent), mental illness (1.5 percent, compared with 3.4 percent), and circulatory system (0.3 percent, compared with 3.0 percent). Neither these differences in disease-level prices nor the differences in spending levels reported above have driven a large wedge between the aggregate price indexes of the two accounts.

The divergences in the disease-level indexes are, at least in part, explained by the volatility in the MEPS indexes. For example, chart 2 shows the price indexes for six of the disease chapters—circulatory, respiratory, musculoskeletal, endocrine, nervous system, and neoplasms. For circulatory, musculoskeletal, and neoplasms, the MEPS Account indexes show relatively slower growth rates over time than the Blended Account indexes. However, price change for the treatment of diseases in the respiratory system shows a faster annual growth rate in the MEPS Account index (5.1 percent) than the Blended Account index

25. The [standard error bands](#) are calculated based on a Taylor series approach that uses information provided in the MEPS. Using spending estimates and standard errors computed directly from the MEPS, we assume that the standard error bands surrounding current spending in the MEPS Account are proportional (for example, 10 percent of spending).

Chart 2. Volatility of MEPS Versus Blended Price Indexes



Table 4. Price Indexes, Health Care Satellite Account

[Index numbers, 2009=100]

	MEPS account			Blended account		
	2000	2010	Annual growth rate (percent)	2000	2010	Annual growth rate (percent)
Health.....	70.2	103.8	4.0	66.8	103.2	4.4
Health services.....	69.3	104.0	4.1	65.8	103.4	4.6
Medical services by disease.....	69.4	104.3	4.2	65.3	103.6	4.7
Infectious and parasitic diseases.....	61.9	113.0	6.2	55.0	107.3	6.9
Neoplasms.....	82.8	109.8	2.9	61.0	100.4	5.1
Endocrine; nutritional; and metabolic diseases and immunity disorders.....	68.1	107.7	4.7	67.5	100.7	4.1
Mental illness.....	81.1	94.1	1.5	72.1	100.9	3.4
Diseases of the nervous system and sense organs.....	60.5	113.1	6.4	61.7	106.5	5.6
Diseases of the circulatory system.....	100.2	103.1	0.3	77.1	103.2	3.0
Diseases of the respiratory system.....	65.3	107.6	5.1	69.6	105.6	4.3
Diseases of the digestive system.....	56.9	100.6	5.9	64.0	106.3	5.2
Diseases of the genitourinary system.....	62.3	99.2	4.8	60.6	99.9	5.1
Complications of pregnancy; childbirth; and the puerperium.....	58.8	103.1	5.8	68.7	107.6	4.6
Diseases of the skin and subcutaneous tissue.....	48.2	86.1	6.0	62.4	100.6	4.9
Diseases of the musculoskeletal system and connective tissue.....	69.8	104.9	4.2	63.5	106.8	5.3
Injury and poisoning.....	60.8	104.1	5.5	62.1	105.4	5.4
Symptoms; signs; and ill-defined conditions.....	58.5	104.8	6.0	60.9	104.5	5.6
Other.....	53.2	107.0	7.2	55.1	96.2	5.7
Diseases of the blood and blood-forming organs.....	34.0	121.8	13.6	48.8	93.9	6.8
Congenital anomalies.....	86.6	131.9	4.3	54.8	85.9	4.6
Certain conditions originating in the perinatal period.....	70.6	94.3	2.9	59.9	88.0	3.9
Residual codes; unclassified; all E codes.....	46.6	95.5	7.4	57.9	102.6	5.9
Medical services by provider.....	68.6	102.3	4.1	68.6	102.3	4.1
Dental services.....	66.6	102.7	4.4	66.6	102.7	4.4
Nursing homes.....	70.1	102.0	3.8	70.1	102.0	3.8
Proprietary and government nursing homes.....	70.1	102.0	3.8	70.1	102.0	3.8
Nonprofit nursing homes services to households.....	70.1	102.0	3.8	70.1	102.0	3.8
Medical products, appliances and equipment.....	90.4	99.4	1.0	90.4	99.4	1.0
Pharmaceutical and other medical products.....	92.0	99.5	0.8	92.0	99.5	0.8
Pharmaceutical products (without prescription drugs).....	91.7	99.7	0.8	91.7	99.7	0.8
Nonprescription drugs.....	91.7	99.7	0.8	91.7	99.7	0.8
Other medical products.....	94.7	97.9	0.3	94.7	97.9	0.3
Therapeutic appliances and equipment.....	89.2	99.4	1.1	89.2	99.4	1.1
Corrective eyeglasses and contact lenses.....	85.3	100.7	1.7	85.3	100.7	1.7
Therapeutic medical equipment.....	94.7	97.9	0.3	94.7	97.9	0.3

E Supplementary Classification of External Causes of Injury and Poisoning E codes
MEPS Medical Expenditure Panel Survey

(4.3 percent).

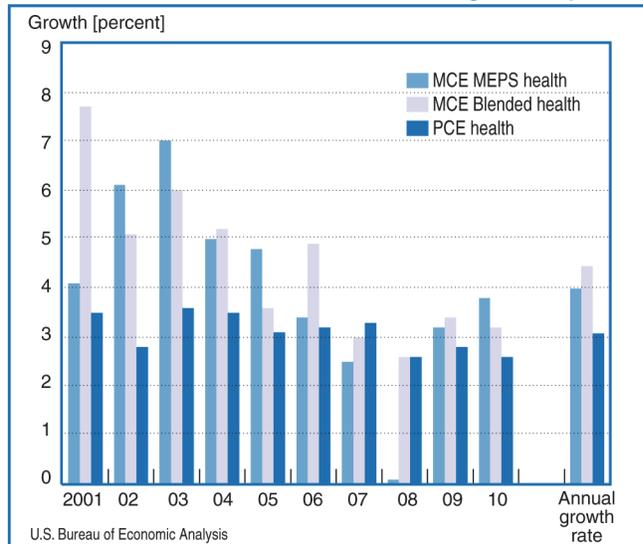
Even more than the current-dollar spending estimates by chapter, the volatility in the price indexes using the MEPS Account offers an important reason for many users of the data to prefer the Blended Account estimates. Several of the MEPS indexes show sharp jumps that are even more pronounced than the current-dollar spending changes. For example, price indexes for the chapters of musculoskeletal, endocrine, nervous system, and neoplasms show rapid declines followed by a sharp rebound.²⁶

Comparing price indexes

As shown in chart 3, the price indexes for the health aggregate show an annual increase of 4.0 percent in the MEPS Account and 4.4 percent in the

26. Using MarketScan data, we investigate the importance of sample size for measuring disease prices by repeatedly drawing samples of patients from the MarketScan data and constructing MCE indexes at the aggregate level and at the disease category level. For an enrollee sample size of 30,000, equivalent to the MEPS annual sample, we found a wide spread in the growth rates for the aggregate MCE: The 95th percentile aggregate MCE grew 2.8 percentage points faster per year than the 5th percentile MCE. This difference was just 1.2 percentage points per year when the sample was 120,000. The differences at the disease category level are even more dramatic. For a sample size of 30,000, we found that the 95th percentile MCE for cardiology grew 7.9 percentage points faster per year than the 5th percentile MCE. This difference for cardiology was just 3.5 percentage points for a sample of 120,000. As one might expect, the high variability in the MCE estimates at the disease category level when sample sizes are small, suggests a large benefit to using the Blended Account index that draws upon a sample size of around 4 million enrollees. One advantage of resampling from MarketScan is that it draws upon data with a very large sample of enrollees. Bootstrapping standard errors using a smaller sample is potentially biased if the sample that one draws from is not representative of the entire population. This analysis was conducted for the period 2003–2007, where the disease categories were based on the Symmetry ETG grouper, as in Dunn and others (2013). We would anticipate qualitatively very similar results if we had used CCS categories.

Chart 3. Annual Health Price Index Changes Compared



U.S. Bureau of Economic Analysis

Blended Account as compared with an increase of 3.1 percent for the official PCE index for health. It is notable that the disease-based indexes rise more rapidly than the PCE index in the first half of the decade (2000–2005) but move at about the same rate as the PCE measure for the second half of the decade (2005–2010). The negligible increase in the MEPS Account in 2008 is mainly due to changes in the MEPS sample during this period.²⁷

The implication of these differences is that output growth measured using the MCE indexes will show considerably slower growth in 2000–2005 relative to the growth measured using the official price indexes. Our analysis of the claims data suggest that the underlying difference in these measures is driven by a higher growth in utilization per patient over 2000–2005.

There are several different factors that may contribute to the relatively rapid MCE growth in 2000–2005. As mentioned previously, during the managed care backlash of the late 1990s and early 2000s, many individuals switched to less restrictive insurance plans, which tended to have both higher costs per service and fewer restrictions on utilization.²⁸ This switching to less restrictive plans is thought to have had effects on the entire market by affecting the general practice patterns of physicians and hospitals.²⁹

While the backlash may explain some of the overall increase in the cost of treatment, it does not pinpoint exactly where utilization per patient increased. A deeper look at the claims data uncovers some specific factors that impact the growth rate of the MCE over this period.

- **Imaging.** The growth in imaging services through the first half of the decade is well documented in the literature and we observe these same patterns in the claims data (see Iglehart 2009, GAO 2008, and Levin, Rao, and Parker 2010). Levin, Rao, and Parker (2010) report outpatient utilization of advanced diagnostic imaging rising by 72.7 percent for outpatient Medicare services between 2000 and

2005 and the use of imaging services stabilized post 2005.³⁰

- **Anticholesterol drugs.** The use of anticholesterol drugs increased rapidly throughout the 1990s and 2000s because of the introduction of the statin class of drug therapies, which were proven to lower cardiovascular-related mortality. We find that the increased use of more expensive statin drugs in 2000–2005, such as Lipitor and Zocor, led the MCE index for the treatment of high cholesterol to grow rapidly. The MCE index slows in 2005–2010 as generics were introduced in the second half of the decade.
- **Other generic drug introductions.** Such introductions reduce the growth in the MCE index in the second half of the decade relative to the first half. These include several different generic drugs used for the treatment of diabetes, high blood pressure (hypertension), and osteoarthritis.
- **Increase in utilization per physician office visit.** Over the entire period we found that patients received more services per physician office visit (that is, more procedures or more intensive procedures). This would lead the MCE index to grow more rapidly than the PCE index, which prices specific procedures.

Real spending on medical services

The growth of current-dollar spending and price indexes determines the growth in real spending on medical services. Table 5 shows the growth rates in real spending from 2000 to 2010. Overall, the expenditures, price indexes and real expenditure estimates presented here may be used to improve our understanding of the health care sector. We anticipate that the estimates presented in the account may be used for a variety of purposes. To briefly demonstrate one practical application, we use these estimates to investigate a key question in the health policy literature (see the box “Using the Numbers: What Drives Spending Growth?”).

Impact on PCE health, overall PCE, and GDP

Summarizing the impacts to PCE health, overall PCE and GDP, table 6 details how the estimates from the HCSA differ from what is published in the NIPAs. At this aggregate level, the growth in real spending is similar across the two accounts and a bit lower than the NIPA estimates. Real health care spending shows slower growth in the Blended Account (2.0 percent

27. In regards to the index in 2007 and 2008, there is a combination of 4 panels for each 2 year pool. The change began in the second panel of 2007 in which individuals would have been surveyed from 2007 to 2008. The change in the survey was to initiate more accurate responses regarding individual conditions, which led to an increase in treated prevalence. Because of the panel structure of the survey, the index for 2007 would contain about 25 percent of data that is structurally different and have a higher prevalence (combining 2006 and 2007) and 2008 would contain about 75 percent of data that is structurally different and having a higher prevalence (combining 2007 and 2008).

28. According to the Kaiser Family Foundation Benefit Survey, 50 percent of individuals were enrolled in the more restrictive managed care plans in 2000, but only 36 percent were enrolled in these plan categories by 2005.

29. Indeed, Pinkovsky (2011) finds that the managed care backlash increased U.S. health care spending share of GDP by 2 percent.

30. We find within the MarketScan data that increases in utilization from imaging are not offset by other factors, which is consistent with Baker and others (2003).

Table 5. Real Expenditures, Health Care Satellite Account

[Billions of chained (2009) dollars]

	MEPS account			Blended account		
	2000	2010	Annual growth rate (percent)	2000	2010	Annual growth rate (percent)
Health	1,580.5	2,004.2	2.4	1,661.5	2,015.6	2.0
Health services	1,518.1	1,902.5	2.3	1,600.2	1,913.9	1.8
Medical services by disease	1,297.9	1,651.5	2.4	1,379.6	1,662.9	1.9
Infectious and parasitic diseases ...	30.5	31.8	0.4	42.1	54.2	2.6
Neoplasms	78.0	122.3	4.6	101.4	115.6	1.3
Endocrine; nutritional; and metabolic diseases and immunity disorders	68.3	115.0	5.3	77.8	124.8	4.8
Mental illness	81.5	118.0	3.8	60.1	78.4	2.7
Diseases of the nervous system and sense organs	99.4	103.5	0.4	97.7	112.3	1.4
Diseases of the circulatory system	147.7	258.0	5.7	198.1	227.3	1.4
Diseases of the respiratory system	112.5	108.9	-0.3	133.0	136.3	0.2
Diseases of the digestive system	87.1	107.4	2.1	87.1	95.6	0.9
Diseases of the genitourinary system	61.1	80.0	2.7	106.6	111.1	0.4
Complications of pregnancy; childbirth; and the puerperium ...	64.9	57.5	-1.2	37.1	35.5	-0.4
Diseases of the skin and subcutaneous tissue	34.7	31.7	-0.9	34.1	38.1	1.1
Diseases of the musculoskeletal system and connective tissue	122.2	183.5	4.1	121.0	159.2	2.8
Injury and poisoning	140.7	129.8	-0.8	105.3	104.2	-0.1
Symptoms; signs; and ill-defined conditions	146.4	149.7	0.2	119.3	198.0	5.2
Other	45.1	54.6	1.9	58.6	72.6	2.2
Diseases of the blood and blood-forming organs	9.5	9.7	0.2	17.6	22.3	2.4
Congenital anomalies	7.6	10.0	2.7	9.8	8.9	-0.9
Certain conditions originating in the perinatal period	5.0	7.3	3.9	7.9	7.6	-0.3
Residual codes; unclassified; all E codes	22.8	27.8	2.0	23.5	33.7	3.6
Medical services by provider	220.8	251.0	1.3	220.8	251.0	1.3
Dental services	95.4	101.7	0.6	95.4	101.7	0.6
Nursing homes	125.3	149.4	1.8	125.3	149.4	1.8
Proprietary and government nursing homes	81.1	98.3	1.9	81.1	98.3	1.9
Nonprofit nursing homes services to households	44.3	51.1	1.4	44.3	51.1	1.4
Medical products, appliances and equipment	63.4	101.8	4.8	63.4	101.8	4.8
Pharmaceutical and other medical products	27.4	45.9	5.3	27.4	45.9	5.3
Pharmaceutical products (without prescription drugs)	25.3	41.8	5.1	25.3	41.8	5.1
Nonprescription drugs	25.3	41.8	5.1	25.3	41.8	5.1
Other medical products	2.1	4.1	7.1	2.1	4.1	7.1
Therapeutic appliances and equipment	36.1	56.0	4.5	36.1	56.0	4.5
Corrective eyeglasses and contact lenses	23.3	29.5	2.4	23.3	29.5	2.4
Therapeutic medical equipment	13.0	26.5	7.4	13.0	26.5	7.4

E Supplementary Classification of External Causes of Injury and Poisoning E codes
MEPS Medical Expenditure Panel Survey**Table 6. Annual Real Expenditure Growth Rate, Health Care Satellite Account**

[Percent]

	Personal consumption expenditures		GDP
	Health	Overall	
Published	3.3	2.1	1.6
MEPS	2.4	1.9	1.5
Blended	2.0	1.8	1.5

GDP Gross domestic product
MEPS Medical Expenditure Panel Survey**Using the Numbers:****What Drives Spending Growth?**

Several health policy papers have debated whether spending growth is due to the rising cost of treatment or due to more individuals being treated (Starr, Dominiak, and Aizcorbe 2014; Roehrig and Rousseau 2011; and Thorpe, Florence, and Joski 2004). The answer has implications for how health policies are shaped to combat rising health care costs. For example, policies aimed at cutting the contribution of disease prevalence will have a more limited impact on overall spending if cost per case is the primary driver of spending growth. These papers first look at real per capita spending for the entire economy; that is, they deflate current per capita health spending and prices by an economy-wide deflator, such as the overall PCE deflator. Next, they look at how much of that growth may be attributable to cost per patient, compared with other factors.

Following the work in the literature, we divide the ratio of spending for medical services in 2010 to spending in 2000 (\$1,722 billion/\$900 billion = 1.9) by the population growth rate over the period (1.1). This is further divided by the overall PCE deflator (1.2) to obtain a measure of the deflated growth in per capita spending of 1.4. Next, we also deflate the disease-based price indexes to remove the portion of price growth in the health sector that is due to economy-wide inflation. The resulting growth rates are 1.2 (MEPS Account) and 1.3 (Blended Account).

Based on these figures, both accounts suggest that the rising costs are driven primarily by increases in the cost per patient in 2000–2010. Specifically, the Blended Account shows that cost per case contributed 73 percent to per capita spending growth (calculated by dividing the 30 percent growth rate of the Blended Account, with the overall 41 percent growth in PCE spending), while the number of treated cases contributed only 27 percent.¹ The MEPS Account attributes 59 percent to cost per case and 41 percent to the number of treated cases, but the amount the MEPS Account attributes to cost per patient changes more dramatically from year-to-year.

1. More precisely, 27 percent may be attributed to nonprice factors, which are primarily the number of treated cases.

compared with 3.3 percent) and in the MEPS Account (2.4 percent compared with 3.3 percent). This translates into differences in the growth of real PCE spending of less than three-tenths of a percentage point (1.8 percent and 1.9 percent respectively, compared with 2.1 percent). The implication for real GDP

growth is that measured real GDP growth is about one-tenth of a percentage point slower than what is published in the NIPAs.

The new estimates also have implications for the industry accounts (see the box “Disease-Based Health Measures and the Industry Accounts”).

Disease-Based Health Measures and the Industry Accounts

The industry economic accounts (IEAs) provide a framework for measuring and analyzing the production of goods and services by industry. They show the flows of goods and services purchased by each industry, the incomes earned in each industry, and the distribution of sales for each commodity to industries and final users. The IEAs also present statistics for value added—a measure of an industry’s contribution to gross domestic product. The health care satellite account (HCSA) has implications for the IEAs because the new disease-based price indexes slow the growth rates of both real gross output and real value added.

There are a number of ways in which the IEAs may be adjusted to reflect the new disease-based index. A more detailed discussion of potential alternatives is in Moulton, Moyer and Aizcorbe (2009). Our goal here is not to provide an indepth discussion of this topic but only to provide a rough example for how the IEAs may be impacted in the HCSA.

In this example, we choose a method that proportionately adjusts price indexes for select industries using a computed “adjustment factor.”¹ Specifically, the industry-specific price indexes are adjusted to reflect the more rapid growth in the HCSA. The adjustment takes place in two steps and is conducted separately for the Blended Account and MEPS Account. First, we compute an adjustment factor, which is based on the ratio of the overall MCE index and the aggregate official price index for all impacted health care industries. Given that the overall disease-based measure grows faster than the official index, the adjustment factor is greater than one for the 10 year

1. Another possibility would be to distribute this adjustment solely to the physician service industry. Moulton, Moyer, and Aizcorbe (2009) propose this since physicians tend to carry more weight and influence medical care decisions for the consumer.

period. Next, this adjustment factor is then multiplied by the associated official price indexes for each of the industries. For example, the price index for offices of physicians would be multiplied by the adjustment factor to derive the adjusted offices of physicians price index. After the new indexes are created, gross output for these health care commodities are then deflated with the adjusted price indexes.

The health care industry groups that are included in this analysis are ambulatory health care services (NAICS 621)² and hospitals (NAICS 622). Together, these groups account for 80 percent of gross output in the overall health care sector.³

For this example, using the alternative disease-based price indexes, one can see that the adjusted price indexes for the selected industries increased relative to published IEA statistics (see table A).⁴ Corresponding to these price adjustments, real gross output and real value added for selected industries increased at a slower pace, compared with the published statistics. For instance, the growth in real gross output for NAICS 62 decreased from 3.4 percent to 1.9 percent in the Blended Account and to 2.3 percent in the MEPS Account.

It is important to highlight that these numbers reflect just one stylized example of how the IEAs may change. A more formal examination of alternative adjustments to IEAs is a topic for future work.

2. This North American Industry Classification System (NAICS) category includes offices of physicians, offices of other health practitioners, outpatient care centers, medical and diagnostic laboratories, home health care services, and other ambulatory health care services.

3. A notable industry excluded from this example is prescription drugs.

4. Real value added equals gross output minus intermediate inputs. The alternative price indexes have a minimal impact on intermediate goods and are not displayed. Unless otherwise specified, the results described are all presented as compound annual growth rates for the period 2000 to 2010.

Table A. Annual Quantity and Price Growth Rates, Gross Output, and Value Added, 2000–2010

[Percent]

Industry description (Industry code)	Gross output			Value added		
	Published	Alternate		Published	Alternate	
		MEPS	Blended		MEPS	Blended
Annual quantity growth rate, 2000–2010						
Health care and social assistance (62).....	3.4	2.3	1.9	2.8	1.1	0.5
Ambulatory health care services (621).....	3.4	2.2	1.8	3.4	1.5	0.8
Hospitals (622).....	3.6	2.1	1.6	2.6	0.1	-0.9
Annual price growth rate, 2000–2010						
Health care and social assistance (62).....	2.8	3.9	4.3	3.2	4.9	5.6
Ambulatory health care services (621).....	2.4	3.6	4.1	2.5	4.5	5.2
Hospitals (622).....	3.2	4.7	5.2	3.9	6.6	7.6

MEPS Medical Expenditure Panel Survey

Future Work

The current data release schedule will provide BEA with sufficient data to estimate the 2011 and 2012 spending and prices, which we plan to release in 2015. After that period, releases will occur on a regular basis, likely on an annual schedule with a 3-year lag (for example, a 2013 release in the spring of 2016). In addition to updating the HCSA going forward, it is also important to improve the data and content of the account.

The following are areas for future research.

Data—timeliness, representativeness, and coverage

BEA must conduct research to provide a more complete historical time series as well as to provide more timely estimates. Bradley (2013) suggests an alternative index that approximates the MCE disease-based index which may be used to produce more timely results. His approach combines MEPS with current official price indexes, which are published monthly.³¹

There are several gaps in the coverage of our data, and BEA must work to improve in these areas. As the Blended Account index excludes patients on capitated plans, Medicare Advantage plans, and nondual Medicaid enrollees, further research involves working to incorporate these insurance plan categories. The representativeness of the MarketScan data is another area for future research. Additionally, further work is necessary to incorporate nursing homes and other services into the medical spending by disease category.

The distribution of spending across disease categories is currently determined by the microdata sets (MEPS, MarketScan, and Medicare 5 percent sample). Estimates of this distribution could potentially be improved or refined using recent data from the Census Bureau. In the 2012 Economic Census, the Census Bureau released data on spending by disease from providers, such as hospitals and physicians offices. BEA is working with the Census Bureau to understand the data that were collected and how they may be used to improve the HCSA.

Severity

BEA's HCSA applies the CCS categories to define disease expenditures. One potential drawback with the use of CCS categories is that they do not account for

factors impacting severity, such as comorbidities. Future work should examine how to incorporate a severity adjustment into the national account estimates. Based on preliminary estimates, we believe that a portion of the difference between the MCE and PCE indexes may be related to unaccounted changes in severity.³²

Quality changes

Without methods to adjust for quality and to attribute these changes in quality to specific medical interventions, we cannot measure the value of the spending on medical care. Indeed, quality adjustment is of great importance, as demonstrated in Murphy and Topel (2006) and in numerous case studies (see Cutler and others 1998; Shapiro, Shapiro, and Wilcox 2001; and Frank, Berndt, and Busch 1999). As a next step, it will be important to move forward with research that will allow us to connect changes in the cost of disease treatment to improvements in health outcomes. The National Academies Panel suggested that measures such as QALYs (quality-adjusted life years), DALYs (disability-adjusted life years) and QALEs (quality-adjusted life expectancy) be explored as potentially useful indicators for quality change.

This line of research has begun at BEA. The BEA research builds off the recently released Global Burden of Disease 2010 Study, which provides the first consistent time series of DALYs in 1990–2010.³³ Research conducted at BEA by Highfill and Bernstein (2014) explores the potential usefulness of these DALYs for 30 chronic conditions for 1987–2010. This work connects the cost of treatment to outcomes across these condition categories to better understand the value of spending growth for the treatment of these diseases. While this paper demonstrates that it is possible to connect changes in quality and changes in spending, challenges remain in determining how to attribute DALY changes to medical care spending and nonmarket factors. Many other academic papers and researchers are looking at trends in quality in the United States (for example, Stewart, Cutler, and Rosen 2013). Research along these lines will continue, with the end goal to include quality measures in future versions of the HCSA.

32. In preliminary estimates, we find that the growth in the MCE index is closer in value to the PCE deflator when adjusting for severity, explaining around one-quarter of the difference.

33. This was an extensive project led by The Institute for Health Metrics and Evaluation in conjunction with the World Health Organization, among others.

31. In the article, Bradley uses utilization information from the MEPS, which may be volatile and is limited to encounter-level utilization information rather than procedure-level claims. However, this method could be adapted to incorporate large claims data and procedure-level information.

Conclusion

There is much more research that needs to occur before these new indexes can be incorporated into the published national account measures. In the meantime, we believe that the HCSA can provide a complementary picture of the spending and price changes for health care at the disease level. We hope that the reporting of these estimates will improve our understanding of the health care sector and also foster research on related topics. In addition, we anticipate that feedback from users of the data will help improve the quality of the HCSA going forward.

While this article highlights BEA's new satellite account, several other government agencies, organizations, and academic groups are also working on related topics. The Bureau of Labor Statistics is also conducting research on disease-based price indexes. The Cen-

sus Bureau is now gathering disease-based expenditure information through its surveys. The Agency for Health Research and Quality and Centers for Medicare and Medicaid Services have been providing reports and data on disease expenditures for many years. Numerous nongovernment organizations—such as the Kaiser Family Foundation, Altarum, Health Care Cost Institute, and Truven Health Analytics—are also involved in related projects and research. Academic groups such as the Institute of Health Metrics and Evaluation at the University of Washington and David Cutler's national health account group at Harvard University are also conducting research in this area. An important avenue for improving the HCSA in the future will be through working with these groups and agencies.

Appendix: Description of International Classification of Diseases 9th Revision (ICD-9) Chapters

Chapter 1: Infectious and parasitic diseases—HIV infection, septicemia, and hepatitis

Chapter 2: Neoplasms—cancer (malignant and non-malignant)

Chapter 3: Endocrine; nutritional; and metabolic diseases and immunity disorders—hyperlipidemia and diabetes

Chapter 4: Diseases of the blood and blood-forming organs—anemia, sickle cell disease

Chapter 5: Mental Illness—dementia, depression, and alcohol and substance Abuse

Chapter 6: Diseases of the nervous system and sense organs—cataract, epilepsy, multiple sclerosis, Parkinson's disease, and meningitis

Chapter 7: Diseases of the circulatory system—hypertension, heart attack, chronic heart failure

Chapter 8: Diseases of the respiratory system—pneumonia, COPD, asthma

Chapter 9: Diseases of the digestive system—diverticulosis, gastrointestinal disease, and appendicitis

Chapter 10: Diseases of the genitourinary—renal failure, kidney disease, and diseases of the male and female

reproductive system

Chapter 11: Complications of pregnancy; childbirth; and the puerperium—including contraceptives, deliveries, and abortions

Chapter 12: Diseases of the skin and subcutaneous tissue—infections and inflammatory conditions of skin

Chapter 13: Diseases of the musculoskeletal system and connective tissue—back problem, arthritis, osteoporosis,

Chapter 14: Congenital anomalies—cardiac, digestive, genitourinary, and nervous system conditions present from birth

Chapter 15: Certain conditions originating in the perinatal period—birth trauma, infections, hemorrhaging, and other issues that occur during the perinatal period

Chapter 16: Injury and poisoning—sprain, fractures, burns, poisoning (various agents)

Chapter 17: Symptoms; signs; and ill-defined conditions and factors influencing health status—preventive care, rehab, colds and flus, and allergies

Chapter 18: Residual codes; unclassified; all E codes—external causes of needing medical care, accidents

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