PRCR
7/14/08
1:00 pm

Draft Concept Paper for NBER/CRIW Summer Institute
July 14-16, 2008

Proposal to Create Alternative Multi-industry Medical Care Prices Indexes Structured by Disease

Bonnie H. Murphy*
Roslyn B. Swick*

U.S. Bureau of Labor Statistics

2 Massachusetts Avenue NE

Washington, DC 20212

*** The views expressed are those of the authors and do not reflect the policies of the U.S. Bureau of Labor Statistics or the views of other BLS staff members**

Introduction

In response to a long-standing recommendation that Bureau of Labor Statistics (BLS) explore the feasibility of publishing episode or disease based price indexes[1], the Producer Price Index (PPI) is proposing to use currently collected medical care item data to create alternative medical care price indexes that are organized by broad disease category. Broad disease categories are defined by the chapter titles from the International Classification of Diseases, 9th Revision Clinical Modification (ICD-9-CM). The PPI realized long ago the importance of this type of price index as evidenced by the publication of indexes by Major Diagnostic Category (MDC) for all payers except Medicare and Medicaid in the General Medical and Surgical Hospitals index since its inception in January 1993. The PPI Pharmaceutical Preparation Manufacturing industry began publication by disease category in July of 2001 as well. Unfortunately, these are the only two industries (of the thirteen industry level medical care price indexes published in the PPI) where weight data are published based on a disease structure currently. The additional sample size required to support this publication detail for other industries has also contributed to the lack of this level of detail in other medical care PPIs.

Because these alternative indexes would be organized by disease category and not by industry, this proposal would create a completely new product for the PPI. All current medical price indexes by industry will continue to be published. The price data used to create these alternative indexes will continue to be subject to the standard PPI definitions and methodologies used to create timely (monthly) indexes consisting of transaction prices realized at the point of service delivery (the provider). This, coupled with the fact that revenue data from the Economic Census that is needed to weight the disease based structure will not be available until at least 2010, introduces certain limitations in the creation of these alternative indexes that will be discussed further.

Purpose of Disease Based Price Indexes

The Committee on National Statistics (CNSTAT), in a report titled "Beyond the Market, Designing Nonmarket Accounts for the United States", specifically recommends that the Bureau of Economic Analysis (BEA) in cooperation with the Centers for Medicare and Medicaid Services (CMS) develop a health satellite account to "uncover approaches and encourage the development of data that improve the way medical care is measured in the conventional (National Income and Product) accounts". BEA's satellite health account will be a measure of national nominal output, ideally by disease, and a price index structured by disease would provide the necessary and appropriate deflator so that real output by treatment of disease can be obtained. The CNSTAT report provides a recommended framework for the ideal measure of health which includes not only the dollars spent but also the improvements in the nation's health. Some of the most important "ideal" characteristics of price indexes created to measure the change in the

[1] Berndt, E.R., D.M. Cutler, R.G. Frank. Z. Griliches, J.P. Newhouse and J.E. Triplett. "Price Indexes for Medical Care Goods and Services: An Overview of Measurement Issues." NBER Working Paper 6817. November 1998.

dollars spent on health care serve as a guide in the development of the PPI alternative index structure and are explained in the methodology section below.

Methodology

Ideally, a disease based price index must first measure a treatment path (or course of treatment) for any given diagnosis across all providers. For example, a patient being treated for lung cancer might have an episode of care that contains many office visits to a physician, a diagnostic imaging center visit, drug therapy, a hospital stay and then home health care. As in this example, a number of providers are often employed in the treatment of a disease and the accurate measurement of the total price of the entire episode must include all providers. There are a number of conceptual inconsistencies that arise when attempting to construct a monthly price index using episodes of care. Assuming an episode of care is defined as including all treatments for the entire length of a patient's illness, the sometimes extended length of an episode of care would not lend itself well to monthly pricing. Additionally, a single price typically cannot be obtained for an episode of care (the exception is global fees) that occurs over a long period of time or involves multiple providers.

Secondly and more importantly, an index based on disease should capture substitutions of treatment protocols both within and across treatment providers. In the previous example, if the protocol for treating lung cancer became solely pharmaceutical in nature, or the hospital stay was reduced from an inpatient stay to an outpatient stay, these changes would be able to be captured if the price were measured for the entire episode. It is important to note here that the term "substitution" is typically used in a price index context to describe when a different service must be obtained because a service in the sample leaves the market and is no longer available to be priced (service replacement might be a more accurate term). Often in health care, two (or more) different methods of treatment occur over a period of time for a given diagnosis. It is not clear in these situations if and when a treatment actually leaves the market. Substitutions in this field often involve different combinations of existent services as well. This is somewhat different from the product replacements that are typically seen in most industries in the PPI where a product becomes obsolete or is discontinued at a point in time and a "substitute" product takes its place. In this situation, virtually all market transactions occurring after that point in time are for the new product. Conversely, in health care, the characteristics of the patient, the preferences of the provider, and countless other factors (not to mention actual treatment protocols) all contribute to numerous treatment paths for the same diagnosis continuing for long periods of time.

Another very important distinction concerning substitute treatments is that replacement treatments are not always less costly to administer. The term "substitution", in economics literature, often refers to the phenomenon of consumers shifting to goods and services (or producers shifting to inputs) whose relative prices *fall*. The "substitution effect" would be toward the cheaper product. In the case of replacement health care treatments, a shift to more expensive treatments is also possible and would cause upward adjustments to be made to the price index. There is a potential change in the quality of a replacement treatment that must not be ignored. The amount of the adjustment to the

price of the treatment for the change in quality has to do with valuing the ultimate outcome of the patient which will be discussed later in this paper.

The PPI has two specific strategies in place to attempt to capture the substitution of a treatment protocol within an industry. First, the PPI has had success with treatment substitution through frequent contact directly with the providers. Respondents are asked if the treatment that the PPI is pricing is representative of the treatments that are actually being performed. However, this process has not resulted in a large number of treatment substitutions. This may be because treatment protocols tend to change slowly over a long period of time. Changes in treatments and changes in the mix of treatments between providers that have evolved slowly will be captured during sample rotations. Providers and treatments for medical care price indexes in the PPI are typically resampled every seven years to ensure that newer treatments are captured. The second strategy employed by PPI is a process called directed substitution which is a procedure designed to capture evolutionary changes in services provided that have occurred since the current sample was selected. The use of this process minimizes new item bias.

One distinct advantage of the alternative structure is that substitution both within and across providers can be accommodated, while the currently published industry based structure can only capture substitutes within provider.

Micro Data

Before revealing the publication structure that is being proposed here, an examination of the micro data that will be used to reflect price change within the structure is necessary. For medical care indexes that involve patient care, the PPI surveys the providers directly. At initiation, the price that providers are asked to provide is the total reimbursement (not the total charges on the patient bill) they receive for a specified treatment and payer. In subsequent months, the provider is asked to provide their expected reimbursement if they were to treat a patient with the same characteristics receiving the same set of services (typically as specified on the original patient bill) and having the same diagnosis and payer. The treatment is typically a single visit to the provider. For example, if a patient visits a physician and receives a diagnosis of appendicitis, then the total reimbursement for that visit would be included in the index for Offices of Physicians. If that same patient then had a hospital stay and the procedure performed was an appendectomy, the reimbursement that the hospital receives for that patient from admission to discharge for the appendectomy would be included in the PPI index for Hospitals. It is important to note here that the published PPI Hospital indexes do not distinguish between inpatient and outpatient treatments. This is by design so that as patient treatments shift from inpatient to outpatient, they can be directly compared and price changes that occur when the length of stay decreases can be shown in the index. The direct price comparison in this case assumes that the "quality" of the patient care remains constant. The PPI will use the resource cost methodology when changes in the quality of treatment occurs and the marginal costs of inputs are available.

Reimbursements to providers are measured for eleven of the thirteen published medical care related industries listed below. The remaining two industries are priced according to the accepted and appropriate pricing mechanisms for their respective sectors of the

economy. In the Pharmaceutical Preparation manufacturing industry, prices received by the manufacturer are captured and in the Retail Pharmacies industry, average gross margin prices are collected.

Industry	Publication date
Pharmaceutical Preparation Manufacturing*	July 1981
General Hospitals*	Jan 1993
Psychiatric and Substance Abuse Hospitals*	Jan 1993
Other Specialty Hospitals*	Jan 1993
Offices of Physicians*	Jan 1994
Diagnostic Imaging Centers*	July 1994
Medical Laboratories*	July 1994
Nursing Care Facilities	Jan 1995
Home Health Care	Jan 1997
Retail Pharmacies and Drug Stores	July 2000
Health and Medical Insurance Carriers	Jan 2003
Residential Mental Retardation Facilities	Jan 2004
Blood and Organ Banks	Jan 2007

At this time, the PPI plan is to use only the seven indexes (indicated with an *) in the proposed multi industry indexes due to the limited scope of the relevant Census weighting data (described below). Should PPI create these indexes with only the seven industries included or should we impute weights for some or all of the other six industries? What data is available for allocating weights appropriately by disease for these remaining industries?

With respect to sampling, is the ideal for the proposed alternative structure to sample by disease instead of the normal PPI sampling by provider in the first stage of sampling so that each disease category is given the appropriate weight and representation in the index? We are not aware of any comprehensive national data by disease across all providers that could be used for this sampling purpose. The PPI may be doing the next best thing by first stage sampling by provider and then second stage sampling by treatment (Diagnosis Related Group for hospital inpatients).

The Bureau of Labor Statistics, the Bureau of Economic Analysis and the Census Bureau worked together to negotiate the level of service line detail that would be captured for the major medical care industries as part of the North American Product Classification System (NAPCS). For the seven largest industries (indicated above), Census has agreed to attempt to capture revenue data directly from providers by major disease category as defined by the chapter titles of the ICD-9-CM beginning with the 2007 Economic Census. Final data from the Census Bureau for these NAPCS categories will be available in 2010. Given that the same broad disease categories will be captured across all of these industries, the PPI is proposing to use the Census data to aggregate the weights for the broad disease categories to properly weight price indexes that cross multiple industries.

The scope of this proposed structure is also limited somewhat by the current coverage of medical care industries in the PPI and also by the fact that not all health care related

treatments can necessarily or appropriately be aligned with a given disease (nursing home care is a good example).

Proposed Alternative Structure

The price indexes that are being proposed are output indexes represented conceptually by the Fixed-Input Output Price Index (FIOPI) model and , similar to the typical PPI industry based price indexes, will be approximated with a fixed reference period (Laspeyres) formula.

The proposed alternative index structure will not be restricted by an industry or provider classification. The structure will be composed of the following disease categories:

1 - Infectious and parasitic diseases
2 - Neoplasms
3 - Endocrine, nutritional, and metabolic diseases and immunity disorders
4 - Diseases of the blood and blood-forming organs
5 - Mental disorders
6 - Diseases of the nervous system and sense organs
7 - Diseases of the circulatory system
8 - Diseases of the respiratory system
9 - Diseases of the digestive system
10 - Diseases of the genitourinary system
11 - Complications of pregnancy, childbirth
12 - Diseases of the skin and subcutaneous tissue
13 - Diseases of the musculoskeletal system and connective tissue
14 - Congenital anomalies
15 - Certain conditions originating in the perinatal period
16 - Injury and poisoning
17 - Other conditions (signs and symptoms)
18 – Supplementary classifications

The following is an example of the components that will be included in each of these eighteen broad disease categories.

8 - Diseases of the Respiratory system (RS)

- Pharmaceutical preparations, acting on the RS
- Physician services, relating to RS disorders
- Medical lab services, relating to RS disorders
- Diagnostic imaging services, relating to RS disorders
- Hospital services, relating to RS disorders

Since price data from all seven industries could potentially be included in any one of the disease categories, this structure, theoretically, allows the flexibility to substitute similar treatments for diagnoses that fall within the broader disease category. For the lung cancer treatment example mentioned previously, price change could be shown across providers when the treatment protocol changed from an inpatient hospital stay to a drug

treatment. The comparability issues involved with this type of substitution will be discussed later.

Comparison Between Industry (or treatment) Based Price Indexes and the Proposed Alternative Multi-industry Price Indexes

As explained previously, the current publication structures and the pricing strategies for medical care PPIs are meant to accommodate within industry substitutions. The reflection of price change that occurs from this type of substitution would be reflected in exactly the same manner in the proposed multi-industry structure. However, there are important differences in the way price changes for across industry substitutions would (or would not) be reflected in the current PPI industry based structure and the proposed multi- industry structure. The best way to begin to illustrate the differences is by examining a very straightforward (albeit unrealistic) example.

Suppose a treatment protocol for a respiratory system disease changes from a two day hospital inpatient treatment (Treatment A) to a treatment using a newly introduced drug for 10 days (Treatment B) at a single point in time. This would be similar to the substitutions that are discussed in the price theory literature. For ease of illustration, Treatment A (assuming this treatment is not used for any other diagnosis) is completely discontinued with no similar hospital treatment replacement. This treatment would be dropped out of the currently published industry based hospital index and no price change would be reflected in that index. Treatment B would be added to the pharmaceutical PPI index as a new drug and would be priced thereafter with no price change shown at its introduction. In the proposed alternative structure in the index for Respiratory system diseases, Treatment B would be treated as a direct substitute for Treatment A. Treatment A would replace Treatment B in the index and the price difference between the two treatments would be reflected in the index. For the sake of this example only, in order for the entire price difference to be shown in the alternative index, we must assume that the "quality" of the treatments and the outcome of the patient is the same. These assumptions are the subject of much debate and will be discussed in some detail later in this paper.

The example above is meant to illustrate the theoretical flexibility of the proposed alternative index structure but the reality is that treatments are not discontinued or replaced at a point in time. One last example is necessary to illustrate the further challenges substitutions within medical care treatments present. In this example, a treatment (Treatment C) for a particular eye disease involves surgery performed as a hospital inpatient. A treatment for the same eye disease (Treatment D) is discovered that can be performed in a physician's office. Treatment D requires the physician to purchase a large piece of capital equipment in order to perform the treatment. Treatment D requires only a single office visit. Over the next few years, as physicians begin to acquire the necessary capital equipment, patients with this eye disease are gradually switching from the hospital inpatient treatment to the physician office visit treatment. What this scenario means for our currently published industry based indexes is that, for some period of time, depending on whether the hospitals that continue to perform Treatment C are in our sample and depending on whether the physicians in our sample have begun to perform Treatment D on a regular basis, Treatment C will continue to be priced in our

hospital industry index and Treatment D will begin to be priced in our physician industry index, showing no price change as a direct result of Treatment D being "substituted" for Treatment C. The reason is that these are concurrent treatments for the same eye disease (from here forward, I will refer to these as concurrent substitutes). Note here that normal reimbursement changes that occur for each of these treatments separately will be shown in the appropriate index.

If the concurrent substitutes described above are included in the alternative index for diseases of the nervous system and sense organs, both Treatment C and Treatment D will be priced for some overlapping period of time. Once the PPI determines that the revenue generated by Treatment C has sufficiently declined and the revenue for Treatment D has sufficiently penetrated the medical care market, Treatment D will replace Treatment C in this index and any price change at the point it is decided to substitute will be reflected in the alternative index. Treatment D would continue to be priced in the physician industry based index and would have a price adjustment in order to reflect the price change at the time of the substitution in the alternative index only. Outside source data used by the PPI give objective measures of when treatment revenues are either declining or increasing and will be used to make decisions concerning the appropriate timing of substitutions in our alternative index. The PPI purchases national hospital inpatient data each year so that we can monitor any increase or decrease in revenue generated for these treatments over time. The PPI also has very comprehensive data concerning pharmaceutical preparations. For this industry, actual products (as opposed to establishments) are sampled and the sample is continuously updated with new drugs and weight information.

The challenge, and frankly one of the limitations of the alternative index, is that comprehensive data sources with revenue (or any other measure of size) by treatment and/or disease for industries outside of hospitals and pharmaceuticals may not exist and, if they do exist, may be prohibitively expensive. Perhaps a greater limitation is that the data sources that we currently have access to reflect patient treatments from previous years (most sources contain data at least two years old). This limitation is not new and it is not one that is specific to the PPI because practically all medical related sources of data take months if not years to compile.

How will the PPI be alerted to what procedures or protocols are in development and are entering the market? First, new codes (ICD, CPT, etc.) that are added by Medicare are examined every year as an indication of a new procedure entering the market. The medical care industry analysts also, following the normal practices used for other industries in the PPI, continually search medical journals and medical related papers to keep abreast of industry trends toward new processes and procedures. Because of the multitudes of patient treatments that exist in the medical field and the volume of literature on any given treatment and the fact that the PPI analysts are not clinicians, this strategy will by no means be comprehensive. It will, however, serve as a supplement to the statistical data. It is worth noting here that since PPI is not attempting to measure entire episodes of care and the incidence of shifts in specific treatments at an individual provider level are likely less frequent than shifts that occur in episodes, there is somewhat less opportunity for PPI to substitute than if episodes were measured. With regard to medical related data sources, the PPI is keenly aware of the research that is being conducted in the CPI program using the Medical Expenditure Panel Survey (MEPS)

dataset and the hope is that this research will provide valuable information that the PPI will also be able to use to enhance the proposed alternative index.

The proposed structure also adds an important set of requirements to the way that the PPI is calculated. Continuing to publish industry based medical care indexes while also calculating indexes in the proposed alternative structure requires that any single reimbursement collected for a treatment appear in more than one index structure. The PPI has only very recently (February 2008), with the deployment of a new index estimation system, been able to meet this requirement. An additional requirement is that a single collected treatment must be allowed to show different levels of price change depending on whether it is being used in the industry based index or the proposed alternative index. Unfortunately, the part of the new system that has this capability will not be deployed until 2010 at the earliest due to recent budget cuts that the PPI has sustained. This restriction is the main reason why this proposed structure remains in the "conceptual" phase.

Outcomes

The issues of the comparability of substitute treatments and treatment outcomes have been assumed away earlier in this paper but they are important issues to be considered. One of the greatest challenges for the price index practitioner in developing medical price indexes is dealing with outcomes in the medical care services. In medical services, outcome measures would include both improvements and declines in the treatment for patients. Changes in outcomes could reflect increased or decreased benefits to the patient from the change in treatment.

Since the producer price index (PPI) program uses the Laspeyres formulation to approximate the fixed input-output price indices (FIOPI), quality adjustments are used to maintain constant quality price indices where the services provided have changed. In traditional PPI industry or commodity indexes, when inputs that are price-determining change (change in output), the FIOPI concept is violated. The marginal cost of input changes are utilized to disentangle price changes from changes in the production function. The nursing home care industry provides an example of the application of quality adjustment for a service industry. A methodology for quality adjusting nursing home care has been developed by PPI to utilize government inspection data on nursing staff hours in conjunction with wage data on nursing care jobs. This methodology provides a means for quality adjustment that is consistent with both the producer cost approach to quality adjustment and the outcome approach to quality adjustment. In this example, research data from a Centers for Medicare and Medicaid Services (CMS) report titled, "Appropriateness of Minimum Nurse Staffing Ratios in Nursing Homes", provided empirical evidence supporting minimum nurse staffing ratios, below which critical quality of care problems occur and above which there is no incremental quality improvement. This report established the positive correlation between the number of nurse staffing hours and the outcome of the patient care.

PPI has used alternative methods of quality adjustment in sectors other than medical care services when research has proved that the alternative methods provided superior quality adjustment. An example of an alternative method is the hedonic models that are used to

determine values of quality adjustment for industries such as desk top and laptop computers, servers, and retail trade. In these cases, hedonic models enabled the PPI to provide improved measures of constant quality output price indexes relative to the standard resource cost methodology.

To some degree, quality adjustment based solely on outcomes may be considered a user value approach to quality adjustment and therefore, not appropriate for industry output price indexes. However, "price index theory suggests that, in competitive equilibrium, user value and resource cost may converge".[2] If there is competitive equilibrium when a patient switches from one treatment to another across providers, then the value of the outcome would be equal to differences in the costs of two treatments. If there is not competitive equilibrium, then how is the value of the outcome determined?

For most medical care service industries, determining the changes in outcomes for the changes in treatments is a monumental task. Research has been conducted for many years, by outstanding scholars, without developing a methodology that is universally accepted as the means for valuing the effectiveness of treatments. Research on Quality Adjusted Life Years (QALY) produced very interesting results but did not yield a method for determining values that could be used in quality adjustment of price indexes.

The new hospital quality adjustment method described in a recent PPI paper ("Proposal for Adjusting the General Hospital PPI for Quality Change") is loosely associated with outcomes. The treatment factors used to determine the quality adjustment value does relate to outcomes but by no means does it account fully for the change in outcome experienced by the patient for the change in treatment. However, this proposal is considered a first step in the development of a quality adjustment methodology for the hospital industry that is consistent with the PPI producer cost principles and also attempts to at least partially address outcomes.

There are additional challenges even beyond the issue of measuring medical outcomes. In some industries, such as medical laboratories and imaging centers, there does not appear to be a defined outcome from the services provided to the patients. The only possible changes in outcomes from these industries would be if a particular test provided different diagnostic abilities. Outcomes from different diagnostic abilities would be even more difficult to quantify or measure and may, in fact, be deemed non-comparable substitutes. So when an alternative index is produced that is aggregated or structured by disease category, the affect of adjustments for changes in outcomes would be reduced since not all the data aggregated together for a disease category would be subject to outcome analysis.

In both the examples shown in previous sections about substitution across provider types using different treatments in alternative indexes structured by disease category, the outcomes for the different treatment were determined to be comparable. So to have meaningful indexes aggregated by disease category, in addition to having the ability to

[2] From Holdway, "Should User-Value Trump Resource Cost as a Quality Valuation Method in PPIs and If so Under What Conditions? (2007)

substitute to different treatments provided by different providers for the same disease, does a comparison of the different treatments need to be made to determine if there are different outcomes and if so, what is the value of those outcome differences? Are these alternative indexes meaningful even without or with limited quality adjustment for outcomes?

Conclusion

In response to a research need for price indexes organized by disease, the PPI is presenting this concept paper to lay the foundation for an alternative product for medical care indexes. The proposed structure would provide what we think is a valuable product not currently available, current month price change by broad disease category for all providers. This index allows for substitution of treatments both within and across providers. Another advantage of this proposed alternative index is that it is extremely budget friendly. The index is made up of item data that is already collected (i.e. it will not require additional sample units and therefore additional resources to create) and the analysis of substitutions utilizes data that is already "in house". At this time, the PPI plan is to reweight all categories included in the proposed alternative structure every five years concurrent with the Economic Census unless annual data can be extrapolated from other sources. As new processes and procedures are adopted, the relative importance of each broad disease category will shift and the alternative index will reflect those shifts. Reflecting these weight shifts may prove to have a greater affect than overall price change on the index.