

Plans for developing disease based price indexes in the U.S.

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Introduction

The U.S. Bureau of Labor Statistics' Office of Prices and Living Conditions has been conducting research in recent years on the development of medical care price indexes that reflect the out-of-pocket costs to the consumer (CPI) and the total reimbursement received by providers (PPI) for the treatment of diseases. This stands in contrast to current approaches in the U.S. CPI and PPI programs that measure the out-of-pocket cost of consuming individual medical goods and services (CPI) from or the total reimbursement received by individual provider types (PPI) such as hospitals, physician specialty, and pharmacies. A disease based approach emphasizes the entire path of treating an episode of disease that tracks the consumption of goods and services across all provider types in the course of treatment.

This paper summarizes work that has been accomplished to date on using such an approach in the U.S. CPI and plans for adopting a disease based price index approach in the U.S. PPI program. This paper is based largely on published and unpublished work by BLS staff, copies of which are provided as room documents for this session.ⁱ The approach in this paper is to provide background for this effort, summarize the approaches at a fairly high conceptual level, present findings to date and a description of the anticipated future products that will be forthcoming by both the CPI and PPI programs.

Background

The U.S. National Academy of Sciences' Committee on National Statistics has recommended that the U.S. Bureau of Labor Statistics develop 'disease-based medical-care' price indexes in the U.S. CPI program.ⁱⁱ Recent meetings held by the National Research Council with Statistical Agencies on the development of a Satellite Health Care Account at the Bureau of Economic Analysis also advocate the idea of developing disease based price indexes in the U.S. PPI program.ⁱⁱⁱ There is also a significant body of academic literature that advocates such an approach (although the focus in the latter is more consumer than producer oriented).^{iv}

In general, one of the (many) conceptual issues that disease based price indexes seek to address is that the treatment for an episode of disease will often, if not nearly always, cross provider type, and in general, current medical price indexes fail to capture the path of treatment. For a given treatment episode, the scope for determining the total out of pocket costs to the consumer or the total reimbursements received by providers of medical services could include services and treatments provided by ambulance services, hospital emergency rooms, physicians' offices, MRI scanning centers, hospital in-patient or out-patient services, and

pharmacies, to name a few. Rather, what the CPI and PPI medical care price indexes do capture are separate and distinct price indexes for physician services, hospital and related services, prescription drugs, and nonprescription drugs and medical supplies.

Specifically, the CPI publication structure for medical care is as follows:

- Medical care
 - Medical care commodities
 - Medicinal drugs
 - Prescription drugs
 - Non prescription drugs
 - Medical equipment and supplies
 - Medical care services
 - Professional services
 - Physicians' services
 - Dental services
 - Eyeglasses and eye care
 - Services by other medical professionals
 - Hospital and related services
 - Hospital services
 - Inpatient hospital services
 - Outpatient hospital services
 - Nursing homes and adult day services
 - Health insurance

The PPI industry publication structure is listed below, annotated by the original publication date of the series:

General Hospitals	Jan 1993
Psychiatric Hospitals	Jan 1993
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
Residential Mental Retardation Facilities	Jan 2004
Blood and Organ Banks	Jan 2007

Other related industries:

Pharmaceutical Preparation Manufacturing	Jul 1981
Retail Pharmacies and Drug Stores	Jul 2000
Health and Medical Insurance Carriers	Jan 2003

Another aspect of the treatment of disease is the failure of traditional medical care price indexes to capture substitution of different treatment protocols for treating a disease – protocols that may change the mix and cost of goods and services consumed and which type of medical provider (or providers) administers the treatment. For example, in the treatment of cataracts there has been a shift away from in-patient hospital treatment to the use of out-patient facilities that has lowered the cost of treatment. To the extent that the substitution of one treatment protocol for another represents a change in the cost of treating a disease, then the failure to capture these substitutions could result in an over or under estimation of medical care inflation. The substitution of protocols also may be accompanied by observed price increases which may be coincident with improved quality of the services provided and a change in the mix of capital and labor inputs that are used to provide the service.

To illustrate these issues, consider the following example. Suppose that in the treatment of a mental illness disease diagnosis we observe a treatment protocol for a patient in period 1 as 4 visits of talk therapy at an office of mental health specialist at the cost of \$200 per visit. Assume that in period 2 the treatment protocol has shifted so that the patient makes 1 office visit at a cost of \$220 and receives 4 drug therapy treatments at the cost of \$33 each. Also assume that the cost of the same Rx drug was \$30 per unit in the initial period. Between period 1 and 2, both the cost of the drug therapy and the cost of office visits increased by 10% and, under current BLS price index methods that hold quantity shares fixed, medical inflation over the period is also 10%. However, taking into account the changing mix of office visits and drug therapy utilized in the treatment of disease in periods 1 and 2, a disease based price index for the treatment of the mental illness diagnosis falls by 56%.^v

As another example, suppose a particular respiratory ailment is originally treated predominantly through an extended in-patient hospital stay followed by appropriate drug therapy following release from the hospital (Treatment A). Over time, assume that advances in the science of treating the particular disease shift the predominant course of treatment to a 2-day in-patient hospital stay followed by an extended course of outpatient hospital treatments along with appropriate drug therapy (Treatment B). Suppose that further advances in treatment replace hospital stays and out-patient treatments entirely with treatment using a pharmaceutical agent (Treatment C).

As the most prevalent course of treatment shifts from Treatments A to B to C, the actual path of treatment of an episode of a disease experienced by an individual consumer of medical care can vary widely. For some, the original diagnosis may be in a physician's specialty office followed by the predominant treatment protocol at the time (A, B or C). For others the episode may originate in a visit to the emergency room. A further complicating factor may arise from the fact that the diagnosis of the particular respiratory ailment may be a secondary diagnosis that represents a comorbidity in the treatment of a different condition.

The transition in the treatment of the respiratory condition from A to B to C may result in a reduction in both out-of-pocket costs of consumers and payments received by producers (hospitals and then pharmacies). However, the current design of medical care price indexes does not capture the substitution of treatment protocols. One exception to this observation is that the published CPI and PPI Hospital indexes allow the selection of both inpatient and outpatient hospital based treatments. As a result, as the protocols for hospital 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 previous examples can help provide insight into some of the practical challenges in measuring medical care inflation from a disease treatment basis. One immediate challenge is to develop a methodology for assigning the goods and services obtained from various providers to the disease being treated. In the U.S. there exists distinct classification systems that are used by General, Psychiatric and Specialty Hospitals (Diagnostic Regulatory Groups or DRGs), by Offices of Physicians (International Classification of Disease, 9th Revision categories or ICD-9 codes and Current Procedure Terminology or CPT codes), by Outpatient Facilities such as Diagnostic Imaging Centers and Medical Laboratories (ICD-9) and codes for pharmaceutical agents and their primary use in treating disease, pharmaceutical therapeutic equivalent, used by Pharmaceutical Preparation Manufacturing and Retail Pharmacies and Drug Stores.

These classification systems can be mapped consistently into the following (chapter titles) higher level aggregates of the ICD-9 manual. Specifically,

- 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

CPI Disease Based Price Indexes

As mentioned above, recent research published by BLS staff constructs medical care consumer price indexes by disease category. The disease categories used are the chapter titles from the ICD-9 manual as described above. In particular, data from the Medical Expenditure Panel Survey (MEPS) of households are used to estimate the annual expenditures and utilizations by type of provider and by the ICD-9 chapter title disease categories. The MEPS data provides yearly prices for specific medical care goods and services paid by the respondent. Given that one of the analytical objectives of this research was to compare the results derived from using a disease based approach from those based on the current CPI approach, the MEPS price data were converted to monthly estimates using the associated CPI index for the good or service utilized by the consumer.

To account for substitutions in the utilization of medical care goods and services across provider types, the MEPS expenditure shares for each disease / provider combination were updated annually. Hence shifts away from expensive in-patient treatments and toward less expensive out-patient or pharmaceutical treatments would result in a lowering of the price index for that particular disease.

In constructing the disease based price indexes, the authors had to account for several data quality issues. One already mentioned is the existence of comorbidities. Table 1, based on MEPS data presented in the paper, shows the percentage of total visits to Physician Offices for one, two and three diseases.

Year	Mean number of diseases per visit	Number of visits for:		
		one disease	two diseases	three diseases
1996	1.532	89.1%	8.6%	2.3%
1997	1.802	86.6%	10.6%	2.8%
1998	1.78	86.1%	10.9%	3.0%
1999	1.8	85.5%	11.8%	2.7%
2000	1.939	86.3%	10.5%	3.2%
2001	1.9	86.4%	10.2%	3.3%
2002	2.085	85.5%	11.1%	3.4%
2003	2.216	84.6%	12.0%	3.4%
2004	2.033	83.8%	12.8%	3.3%

As the table indicates, between 1996 and 2004, the mean number of diseases treated per office visit grew sharply, primarily driven by an increase in the share of total visits for 2 diseases.

One possible source for the growth in comorbidities is the rise in the occurrence of Type II Adult onset diabetes in the U.S. Data from the MEPS also shows that between 1998 and 2004, the estimated number of diagnoses for endocrine, nutritional and related diseases grew from 47.1 million to 75.6 million, an increase of nearly 61 percent. During this period, the number of diagnoses for diseases of the circulatory system, which is a common comorbidity of diabetes, grew from 65.7 million to 87.5 million, an increase of 33.2 percent.

To address this issue, two assignment methods were used, and while each method has known problems, they provide bounds on the impact of comorbidities. In the first method, a patient visiting a physician's office with two diseases will have two office visits recorded – one for each disease. In the second method, only ½ of the office visit is recorded for each disease. The first method leads to an overcount of office visits. The second method will overstate the productivity of an office visit as comorbidities per office visit increase.

A second issue, one that could be uniquely examined by the use of MEPS data, owes to the fact that the CPI does not include a price for a service for which the provider receives no payment for the services they render. The average CPI price, based on the sample of those who pay, will be higher than the average price paid among all individuals receiving medical care goods and services. The MEPS data does include services received even in the case where the provider is not reimbursed.

Finally, the CPI research examines three separate scope of payment approaches. The first is the total expenditure scope, which captures all total expenditures, regardless of how they are financed (out-of-pocket consumer payments, Medicare payments, Medicaid payments, and private insurance payments).

This concept is consistent with the scope used in the U.S. Bureau of Economic Analysis’s Personal Consumption Expenditures series. It is also consistent with the concept of price as measured in the U.S. PPI program. The second is the out-of-pocket payments for the services received. The third is the CPI scope, which combines the out-of-pocket payments for services received with out-of-pocket premium contributions made to public and private health insurance plans.

The results from the paper are shown next in table 2. This table constructs aggregate medical care price indexes based on the assignment of expenditures to disease ICD-9 chapter title disease category for the three expenditure scopes described above and for alternative assumptions regarding changes in the utilization rates of different medical providers and the treatment of comorbidities. The first column shows the estimated aggregate medical care price index using a traditional goods and service approach in which the relative expenditure shares for the utilization of provider care is held constant over the analysis period. The second column provides the estimates based on yearly updates in utilization rates across provider category, designed to reflect the changed consumption of medical care services as extant protocols for the treatment of diseases change. In constructing the estimates for this column, comorbidities were treated as separate visits to the relevant provider. The third column also provides yearly updates in utilization rates and adjusts for comorbidities using the pro-rated assignment methodology. The final two columns show the differential impacts in the aggregate medical care indexes with and without utilization adjustment and with and without the pro-rated comorbidity adjustment.

Table 2. Aggregate medical price indexes based on traditional and alternative disease based approaches by expenditure scope, using Medical Expenditure Panel Survey and U.S. CPI price index data, 1999-2004.					
Scope	(1) Traditional U.S. CPI for goods and services	Disease based approach with annual updating of utilization rates and:		(2)-(1)	(3)-(2)
		(2) each comorbidity treated as a unique visit	(3) comorbidities pro-rated		
Total expenditures	1.3585	1.3342	1.3091	-0.0243	-0.0251
Out of pocket only	1.2831	1.3163	1.3057	0.0332	-0.0106
U.S. CPI scope	1.3032	1.3055	1.2881	0.0024	-0.0175

Under the total expenditure scope, the adjustment for changing utilization of provider types for the treatment of disease results in a 2.43 percent drop in the aggregate medical care index over the 1999-2004 time period. Adjusting for comorbidities results in a further decline in the aggregate index of 2.51 percent. When the out-of-pocket scope for the payment of services rendered is used, the utilization

adjustment increases the aggregate medical care index by 3.32 percent. The predominant change in utilization expenditures over this period was the shift from in-patient to out-patient services, for which the latter category has a higher out-of-pocket expenditure share. Another factor affecting this result is the coincident shift in utilization of pharmaceutical preparations with its substantially higher out-of-pocket costs in the treatment of disease over the 1999-2004 period.

Using the U.S. CPI scope, including out-of-pocket payments made for medical care services and consumer premium payments to health insurance plans, the aggregate medical care index based on annual adjustment of utilization rates is not statistically different from the index based on an unchanged utilization pattern. Accounting for comorbidities does result in a 1.75 percent reduction in the aggregate medical care price index.

Tables for each price index method and each scope for the eighteen broad disease categories of the ICD-9 manual are provided in an appendix to this paper.

PPI disease based price indexes

This section describes how the U.S. PPI Program is proposing to meet these challenges and produce medical care price indexes by disease category.

An immediate challenge of this effort is to find a data source for the revenue received by all providers of medical services by disease category to determine both the sampling frame for data collection and the weighting structure for estimation. While this ideal does not exist, a second best alternative that is being pursued is to develop revenue data by consistent disease based categories for selected medical care industries. Working with the U.S. Bureau of Labor Statistics and the U.S. Bureau of Economic Analysis, the U.S. Census Bureau attempted 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. The providers are in the following industries:

- Pharmaceutical Preparation Manufacturing;
- Hospitals;
 - General Hospitals;
 - Psychiatric and Substance Abuse Hospitals;
 - Other Specialty Hospitals;
- Offices of Physicians;
- Diagnostic Imaging Centers;
- Medical Laboratories.

Final data from the Census Bureau for these disease categories will be available in 2010. Using the revenue from the common structure of (broad) disease categories in each of these industries, the PPI is planning to use the Census data to aggregate the weights for the broad disease categories to properly weight price indexes that cross multiple industries.

The following is an example of the components that will be included in one of the eighteen broad ICD-9 chapter title disease categories:

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

One obvious limitation of this mapping of various code structures to the chapter titles of the ICD-9 manual is that it does not include all medical care provider types. There are a number of medical care industries not included that may be relevant in the treatment of diseases such as Office of Dentists, Chiropractor Offices, Occupational and Speech Therapy facilities, ambulance services, and Nursing Homes. In some cases, such as Nursing Homes, it is unclear whether such a mapping is even feasible. In other cases, such as in ambulance services, it is unclear whether or not the coding structure for reimbursable payments allows such assignments.

A second challenge is to follow episodes of care for the treatment of diseases. The PPI is not able to construct indexes that specifically use an episode of treatment as the unit of observation for estimating the total revenues received by all the providers of medical care services for that episode. The alternative is basically the one just described – produce price indexes for each ICD-9 chapter title that uses each observed price tied to that disease category no matter the provider class (where the provider classes are the 6 industries listed above).

A third challenge is to capture substitutions of treatment protocols both within and across treatment providers. One of the difficulties in capturing substitutions is the need to have a classification system that allows combining different treatment providers. While this issue has been addressed by associating the coding structures of different providers to the use of ICD-9 chapter titles, there are other more pragmatic data collection issues that remain.

One such data collection issue is how to decide when a substitution has occurred. Preferred treatment protocols can vary widely across and within providers. Some changes in treatment protocols may in fact represent more of a quality improvement in the mix of inputs used to treat a disease such as the adding the use of ace inhibitors to standard protocol for treating the onset of a heart attack. More wholesale shifts in replacing one protocol for another – such as the transition from treatments B to C in the respiratory example given above – are more consonant with the concept of what is needed in terms of making a substitution in the service that is being priced. It is expected that such shifts happen gradually and that it may be necessary to continue pricing treatment B, the in-patient/out-patient hospital and drug therapy mix, and to begin pricing treatment C, the drug only option. Some independent criteria, such as comparative effectiveness research, would possibly be used to identify a point at which one

practice has replaced another as the treatment standard. To measure the impact of the shift, the price change from treatment B to C that accompanies the point-in-time decision to make the substitution will be reflected in the index for treatment C.

Another challenge that affects both current PPIs and the proposed disease based indexes is how to identify and adjust price changes for quality change. In separate work, the PPI program has used hospital level data from the Center for Medicare and Medicare Studies on adherence to heart attack protocol procedures to develop quality adjustments to their hospital index. Finding independent source data on quality measures for treatment options for the variety of providers and disease based treatments is an important and a significant ongoing challenge.

Finally, no mention has been made in terms of what many view the ultimate goal of disease based treatment information systems – which is to measure the impact of treatment interventions on patient quality of life outcomes. In one sense, the impact of interventions on the quality of life outcomes for those receiving medical care is out of scope for the monthly measurement of price change of medical services. Other methodological and survey based approaches – such as longitudinal household survey panels --are probably needed to inform the policy world of the latent impact of an intervention on subsequent outcomes. However, to the extent that the change in an intervention or treatment protocol is assumed to be known or is in fact ultimately known to have a beneficial impact on the quality of life of a patient, then the issue for price theory is to correctly incorporate the change in protocol as either a quality improvement or a directed substitution as described above.

Future U.S. plans for producing PPI and CPI based diseased based price indexes

As mentioned above, the revenue weights by ICD-9 chapter title category will be available for use from the U.S. Census Bureau in 2010. The U.S. PPI program plans to begin calculating unpublished research disease based price indexes starting in 2011. Whether these indexes are published as experimental series will depend on the efficacy of the results. Based on the results of the CPI approach, the PPI program is also considering using MEPS data as a possible source of revenue weights for the creation of experimental indexes with annual updates in utilization. The plans for the CPI are to update and publish annually the disease based research indexes using both MEPS and CPI source data. The final format of the publication tables still needs to be developed but the expectation is that medical care indexes by disease category using the U.S. CPI scope will be published on the BLS web site starting in 2011.

As health care reform is implemented in the U.S., current CPI and PPI medical care price indexes will be important in evaluating the real costs of health care. The goal of lowering consumer out-of-pocket costs for health care makes the scope of CPI indexes increasingly relevant to understanding the impact of health care reform. At the same time, the measurement concept of PPIs, the measurement of the average change in the total reimbursements received by producers for the provision of medical care, will be increasingly relevant to evaluating the total real cost of health care in the U.S. as health care reforms are implemented.

Another critical aspect of health care reform is how access and utilization of health care will change across the population. For the variety of reasons described in this paper, the development of price indexes from both the consumer and producer perspective that accounts for changing patterns of utilizations across medical care provider types for the treatment of disease is a critically important step in the evaluation of the impact and real costs of health care reform.

APPENDIX TABLES

Table 3. Price indexes by disease for the total expenditure scope, 1999-2004.							
Disease	(1) Lowes Approach	(2) Updated Utilization	(3) Adjusted for Co- morbidity	(2)-(1)	Significant at 5%	(2)-(3)	Significant at 5%
Infectious and parasitic diseases	1.3715	1.6888	1.7842	0.3172	*	-0.0954	
Neoplasms	1.3935	1.2919	1.3117	-0.1015	*	-0.0198	
Endocrine, nutritional, and metabolic diseases and immunity disorders	1.3332	1.4301	1.3953	0.097	*	0.0348	*
Diseases of the blood and blood-forming organs	1.3984	1.2082	1.0957	-0.1902		0.1124	
Mental disorders	1.3554	1.0716	1.0202	-0.2838	*	0.0514	
Diseases of the nervous system and sense organs	1.3467	1.4635	1.4738	0.1168	*	-0.0103	
Diseases of the circulatory system	1.398	1.3758	1.3207	-0.0222		0.055	*
Diseases of the respiratory system	1.374	1.3383	1.2477	-0.0357	*	0.0906	*
Diseases of the digestive system	1.3882	1.2307	1.2619	-0.1575	*	-0.0312	
Diseases of the genitourinary system	1.3736	1.3243	1.3215	-0.0493		0.0029	
Complications of pregnancy, childbirth, and the puerperium	1.3804	1.1397	1.1403	-0.2407	*	-0.0006	
Diseases of the skin and subcutaneous tissue	1.3282	1.6834	1.58	0.3553	*	0.1035	*
Diseases of the musculoskeletal system and connective tissue	1.3478	1.2111	1.2171	-0.1367	*	-0.006	
Congenital anomalies	1.3983	1.6399	1.8169	0.2416	*	-0.177	
Injury and poisoning	1.3812	1.6016	1.5547	0.2204	*	0.047	
Other conditions	1.335	1.3488	1.2694	0.0137		0.0793	*
NO DIAGNOSIS	1.3267	1.2304	1.2407	-0.0963		-0.0103	
Dental maintenance	1.2225	1.1954	1.1954	-0.0271	*	0	
Dental disease	1.2225	1.2381	1.2381	0.0156		0	

Table 4. Price indexes by disease for the out-of-pocket scope, 1999-2004.

Disease	(1) Lowes Approach	(2) Updated Utilization	(3) Adjusted for Co- morbidities	(2)-(1)	Significant at 5%	(2)-(3)	Significant at 5%
Infectious and parasitic diseases	1.2849	1.5235	1.526	0.2386	*	-0.0025	
Neoplasms	1.3379	1.291	1.29	-0.0468	*	0.001	
Endocrine, nutritional, and metabolic diseases and immunity disorders	1.2887	1.4133	1.4117	0.1246	*	0.0017	
Diseases of the blood and blood-forming organs	1.2929	1.2942	1.2266	0.0013		0.0676	*
Mental disorders	1.3362	1.1403	1.1095	-0.1959	*	0.0308	
Diseases of the nervous system and sense organs	1.2826	1.3839	1.354	0.1013	*	0.0298	
Diseases of the circulatory system	1.3036	1.3678	1.3677	0.0642	*	0.0001	
Diseases of the respiratory system	1.309	1.3361	1.3122	0.0271	*	0.0238	*
Diseases of the digestive system	1.3143	1.3909	1.4042	0.0766	*	-0.0133	
Diseases of the genitourinary system	1.306	1.3742	1.3579	0.0682	*	0.0163	
Complications of pregnancy, childbirth, and the puerperium	1.3	1.2596	1.2608	-0.0405	*	-0.0012	
Diseases of the skin and subcutaneous tissue	1.2833	1.5048	1.4791	0.2215	*	0.0257	
Diseases of the musculoskeletal system and connective tissue	1.283	1.3247	1.2999	0.0416	*	0.0247	*
Congenital anomalies	1.3247	1.7671	1.8168	0.4424	*	-0.0497	
Injury and poisoning	1.3304	1.501	1.4913	0.1706	*	0.0097	
Other conditions	1.2894	1.4494	1.41	0.16	*	0.0393	*
NO DIAGNOSIS	1.2748	1.1539	1.1825	-0.1209	*	-0.0286	
Dental maintenance	1.2225	1.1954	1.1954	-0.0271	*	0	
Dental disease	1.2225	1.2381	1.2381	0.0156		0	

Table 5. Price Indexes by Disease for the BLS Scope, 1999-2004

Disease	(1) Lowes Approach	(2) Updated Utilization	(3) Adjusted for Co- morbidities	(2)-(1)	Significant at 5%	(2)-(3)	Significant at 5%
Infectious and parasitic diseases	1.3038	1.5359	1.5644	0.2321	*	-0.0285	
Neoplasms	1.3752	1.3434	1.3407	-0.0318		0.0028	
Endocrine, nutritional, and metabolic diseases and immunity disorders	1.2965	1.4133	1.4042	0.1168	*	0.0091	
Diseases of the blood and blood-forming organs	1.313	1.2668	1.1844	-0.0462		0.0824	*
Mental disorders	1.3763	1.0627	1.0083	-0.3136	*	0.0544	
Diseases of the nervous system and sense organs	1.3032	1.4059	1.3842	0.1028	*	0.0217	
Diseases of the circulatory system	1.3286	1.3779	1.3612	0.0493	*	0.0167	
Diseases of the respiratory system	1.3401	1.3425	1.2896	0.0024		0.0529	*
Diseases of the digestive system	1.3489	1.3483	1.3626	-0.0006		-0.0143	
Diseases of the genitourinary system	1.3362	1.3907	1.3773	0.0545		0.0134	
Complications of pregnancy, childbirth, and the puerperium	1.3315	1.1929	1.1976	-0.1385	*	-0.0047	
Diseases of the skin and subcutaneous tissue	1.2987	1.5632	1.5231	0.2645	*	0.0401	*
Diseases of the musculoskeletal system and connective tissue	1.3028	1.2854	1.2612	-0.0174	*	0.0242	*
Congenital anomalies	1.3612	1.6978	1.7998	0.3367	*	-0.1019	
Injury and poisoning	1.3674	1.55	1.5417	0.1827	*	0.0084	
Other conditions	1.3027	1.4211	1.3645	0.1184	*	0.0566	*
NO DIAGNOSIS	1.298	1.2068	1.2262	-0.0912	*	-0.0194	
Dental maintenance	1.2225	1.1954	1.1954	-0.0271	*	0	
Dental disease	1.2225	1.2381	1.2381	0.0156		0	

ENDNOTES

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^ Simple Example of Treating Mental Illness

Two time periods 1 and 2

Prices

Price of Office Visit = \$200 in period 1; = \$220 in period 2.

Price of RX = \$30 in period 1; = \$33 in period 2.

The prices of all inputs increase by 10%.

Treatment Protocols

Quantity of Office Visits = 4 in period 1 ; = 1 in period 2.

Quantity of RX = 0 in period 1 ; = 4 in period 2.

There is a shift away from the “expensive” office therapy to “less expensive” medication.

Under current BLS and BEA price index methods, medical inflation is reported at 10%.

The disease based index using Recommendation 6-1 in the CNSTAT publication, *At What Price*, is

$$\frac{P_{doc,2}Q_{doc,2} + P_{RX,2}Q_{RX,2}}{P_{doc,1}Q_{doc,1} + P_{RX,1}Q_{RX,1}} = \frac{P_{doc,1}Q_{doc,2} + P_{RX,1}Q_{RX,2}}{P_{doc,1}Q_{doc,1} + P_{RX,1}Q_{RX,1}} \times \frac{P_{doc,2}Q_{doc,2} + P_{RX,2}Q_{RX,2}}{P_{doc,1}Q_{doc,2} + P_{RX,1}Q_{RX,2}}$$

$$\frac{220*1 + 33*4}{200*4 + 30*0} = \frac{200*1 + 30*4}{200*4 + 30*0} \times \frac{220*1 + 33*4}{200*1 + 30*4}$$

$$.44 = .4 \times 1.10$$

Index = Input Effect × Price Effect

Where $P_{doc,t}$ is the price of an office visit in time t. $P_{RX,t}$ is the price of a prescription in time period t. The notation for quantities (Q) has the same subscripts.

The price index falls by $(1-.44)*100 = 56\%$. Had there been no price changes, the disease based index would have fallen $(1-.40)*100 = 60\%$. Published price indexes currently only capture the “Price Effect” in the above equation.