

## Decomposing Pharmaceutical Cost Growth in Different Types of Health Plans

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This article received the "Best Podium Presentation" award at the  
2001 International Society of Technology Assessment in Health Care,  
June 4-6, Philadelphia, PA.

**Objective:** To decompose pharmaceutical spending growth into price and quantity components and to compare growth across different types of health plans

**Study Design:** Retrospective analysis of pharmaceutical claims for active employees of a large national employer from 1996 to 1998, who were enrolled in traditional fee-for-service plans, health maintenance organizations (HMOs), and preferred provider organizations.

**Outcome Measures:** Outcomes measures included total cost growth, price growth, and quantity growth. Quantity growth was divided into growth in use of existing products and in use of newly introduced products. For existing products, quantity growth was further decomposed into growth in the number of prescriptions and change in the mix of prescriptions.

**Results:** During the study period, HMOs had the greatest cost growth. This differential cost growth was largely attributable to changes in utilization as opposed to changes in prices, which were similar among types of health plans. Introduction of new products contributed 15 to 20 percentage points to cost growth in each setting. Differences in cost growth were largely attributed to differences in the growth rate of spending on existing products. For existing products, the impact of increases in the number of prescriptions was much greater in the HMOs, while the impact of changes in the mix of prescriptions was only mildly greater in the HMOs.

**Conclusions:** Pharmaceutical cost growth was largely attributable to changes in utilization as opposed to changes in prices. Changes in utilization patterns were complex and differed across types of health plans.

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(*Am J Manag Care* 2001;7:667-673)

various sources differ, growth in pharmaceutical spending has frequently exceeded 10% per year in the past few years, a rate substantially more rapid than the rate in previous years and that in other categories of medical expenditure.

Given this cost concern, there has been some work on decomposing pharmaceutical expenditure growth into price and quantity components,<sup>1</sup> and extensive studies have examined ways to contain expenditures.<sup>2-11</sup> Understanding whether cost growth is attributable to changes in price or changes in quantity is essential to target efforts to contain expenditures. The published literature generally concludes that rising expenditures are more reflective of increased utilization (quantity) than increased prices. This study extends that work, comparing the components of pharmaceutical spending growth among different types of health plans, specifically, traditional fee-for-service (FFS) plans, health maintenance organizations (HMOs), and preferred provider organizations (PPOs).

Conventional wisdom, based largely on data collected before the explosive increase in spending on pharmaceuticals in the late 1990s, suggested that

For editorial comment, see page 740.

Rising pharmaceutical expenditures are a concern among healthcare providers, purchasers, and policy makers. Although estimates from

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overall cost growth in managed care settings was similar to that in other settings, although markets dominated by managed care plans may have somewhat lower rates of cost growth.<sup>12,13</sup> Despite a variety of strategies to contain expenditures for prescription drugs in managed care settings, managed care plans have not been immune to rising pharmaceutical spending.<sup>1</sup>

Much of the literature examining cost growth in managed care plans assumes that case-mix differences among plan types primarily affect the level of spending and not the rate of change in spending. Yet some evidence suggests that growth in expenditures was concentrated among the most intensive users of medical services.<sup>14</sup> This would indicate plan types with a more severe case mix would experience greater growth in expenditures, assuming that all else was held constant. Alternatively, cost-containment mechanisms (eg, prospective payment for hospital services) may selectively contain costs among the most seriously ill patients, suggesting that in a managed care environment, one would expect cost growth to be greatest among plan types with the healthiest enrollees.<sup>15</sup>

Data on case-mix differences among plan types were not available in this study. Therefore, our results should not be interpreted as indicating that 1 type of plan controls spending better than another. We do not interpret the differences in trends as causally related to plan type. Rather, we report the patterns in pharmaceutical cost growth that we observed and provide commentary on the underlying dynamics associated with these patterns.

Finally, it is important to recognize that growth in pharmaceutical expenditures is not necessarily undesirable. Although disproportionate increases in the cost of any service focus attention on that service, the cost growth may be desirable and intentional. Pharmaceutical spending may reduce spending on other types of healthcare services and, more importantly, may improve health outcomes. Pharmaceutical therapy has replaced procedure-oriented therapy as front-line treatment for many illnesses. An observation of increased pharmaceutical spending may indicate success in managed care cost-containment efforts.<sup>16</sup>

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... FRAMEWORK ...

Decomposition of pharmaceutical expenditures is based on the following basic accounting identity used widely by others<sup>17</sup>:

$$(1) \text{ Expenditure} = \text{Price} \times \text{Quantity}$$

Because pharmaceutical expenditure represents many different products, aggregate expenditure is the sum of expenditures on individual products, each of which has a price and a quantity component. Measuring changes in prices and quantities must take into account the fact that prices and quantities for different products may change in different ways.

In order to operationalize the decomposition of expenditures, 2 basic decisions must be made. First, one must decide how to define the "product." Second, one must decide how to measure quantity.

**Defining the Product**

Recent work measuring pharmaceutical expenditures used a couple of different product definitions. Some researchers rely on a product definition based on health outcomes.<sup>18,19</sup> Using health outcome (or state of health) as a product definition implies that any change in expenditure that does not improve health is treated as a change in price. For example, if physicians adopt a relatively expensive treatment strategy that does not improve outcomes, the added expense is considered a price increase even if the prices of the individual services used do not change. In essence, any changes in the "efficiency" of medical practice are treated as price changes.

Others define the product as a day of therapy within a disease/drug category. Within this definition, they define changes in dosage and therapeutic mix as price changes. Thus, when a patient moves to either a higher strength dose (eg, 40 vs 20 mg) or a more expensive chemical entity (eg, omeprazole vs cimetidine), it is treated as a change in price. Once again, it is possible that prices for each chemical entity and each dose level remain unchanged, but price is considered to have risen because of changes in the chemical entity or the strength used. This approach does not incorporate any information regarding the effectiveness of treatment.

Our analysis will treat the product as a chemical entity/dose combination. Thus, substitution of a higher dose or a more expensive product is a change in utilization as opposed to a change in price. This approach moves closer to capturing changes in the list or "menu" of prices. However, there are still several ways in which our measure of price could change even if there were no changes in the menu of prices. For example, substitution of a corresponding generic product would be considered a price change even if the price of generic and branded products

did not change. Substitution of a mail order product also would be considered a price change even if the mail order and retail prices were held constant.

Under our definition of product, expenditures for newly available chemical entities and newly available doses were treated as quantity changes. These products had no "price" initially, so price could not change by definition.

Which of these definitions is most appropriate? The answer depends on one's perspective. From a societal perspective, treating health as the product emphasizes the intermediate nature of most medical care services and recognizes that ultimately the healthcare system should strive to provide the best outcomes at the lowest cost. The narrower product definitions are better suited to identify the exact nature of price changes and practice pattern changes. They more accurately highlight changes in behavior related to pharmaceutical pricing versus prescribing (and dispensing) behavior.

**Defining the Measure of Quantity**

Within each chemical entity/dose combination we considered the unit of quantity to be the prescription. Ideally, we would have used the metric quantity as our quantity measure, but this field was not accurately coded in the available data. Days of supply would have been our second-choice measure of quantity, but accurate data on days of supply, at the chemical entity level, were unavailable. By using the number of prescriptions as our quantity measure, our definition of price, within each chemical entity/dose combination, is dollars per prescription. To the extent that days of supply changed over this period, the associated change in expenditures was attributed to price instead of quantity.

... METHODS ...

**Population Data**

Our data are based on the pharmaceutical claims from a larger national employer. We collected data for all active workers from 1996 through 1998. Dependents and retirees were excluded due to uncer-

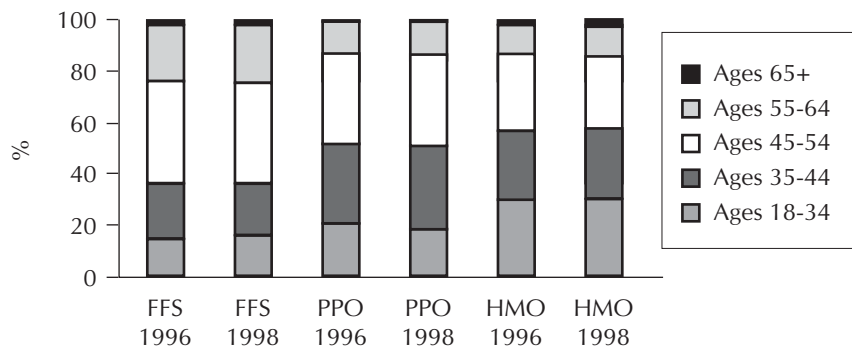
tainty regarding the comprehensiveness of the claims data for these populations. In 1998 the data represented 44,228 hourly and 75,433 salaried employees. The data were drawn from 8 HMOs (44,940 enrollees in 1998) and 3 PPOs (21,697 enrollees in 1998), in addition to the FFS plan (53,024 enrollees in 1998). One of the smaller HMOs reported data only through the second quarter of 1998, and one of the PPOs was not offered in 1998. Enrollment among the plans remained relatively stable, with HMOs gaining enrollment between 1996 and 1998.

Our analysis is based on spending per enrolled member per month (PMPM). Changes in plan enrollment and plan availability only affected findings to the extent that the changes altered case mix. The gender mix, typical of this industry, was similar across the plan types (a bit more than 80% male) and stable over time. **Figure 1** indicates that the FFS population was more heavily skewed toward older workers. The HMO population was skewed toward younger workers. The PPO population had an intermediate age distribution and aged mildly over the study period.

**Total Expenditures**

Expenditures were measured as the sum of insurer and enrollee expenditures on pharmaceuticals. Rebates were not included. During the study period, copayments in the managed care plans were generally stable, but in the FFS plan the copayment changed from a flat \$5.00 in 1996 and 1997 to \$2.00/\$8.00 (generic/brand) in 1998. Total spending

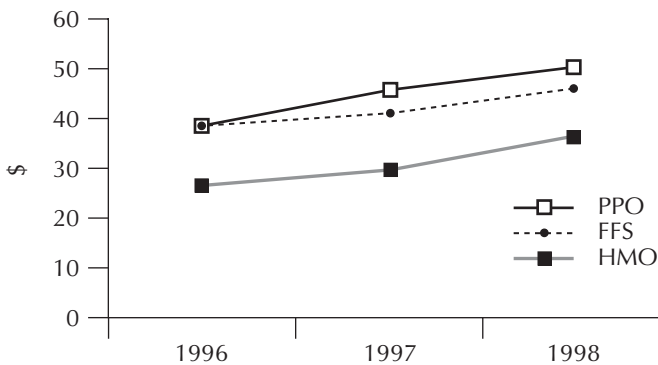
**Figure 1.** Age Distribution by Plan Type



FFS = fee for service; HMO = health maintenance organization; PPO = preferred provider organization.

PMPM is presented in Figure 2. Cost growth varied from 17.3% in the FFS plan to 30.7% in the PPOs to 34.8% in the HMOs. We separated these growth rates into price and quantity components.

**Figure 2.** Per Member per Month Expenditure by Plan Type



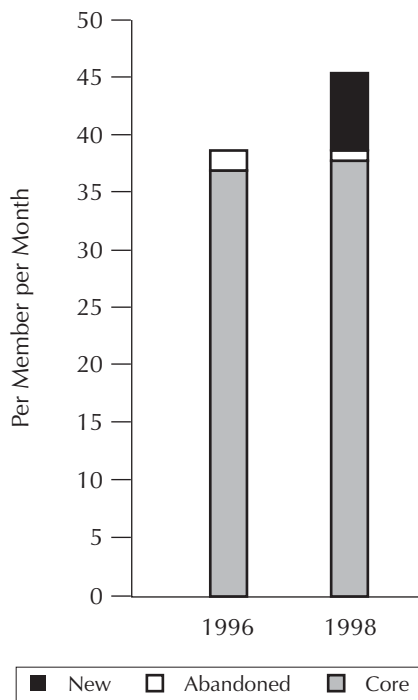
FFS = fee for service; HMO = health maintenance organization; PPO = preferred provider organization.

**Spending Decomposition**

Based on the claims data, we categorized chemical entity/dose combinations into 1 of 3 categories. *Core products* were those chemical entity/dose combinations that were used by all 3 plan types in all 3 years. *New products* were those chemical entity/dose combinations that were not used by any plan type in 1996, but were used by at least 1 plan type in 1998. All other chemical entity/dose combinations (mainly those that were used in 1996 but were not used in 1998 by at least 1 plan type) were classified as *abandoned products*. The share of 1996 spending on core products was 95.3% in the FFS plan, 96.4% in the PPOs, and 96.1% in the HMOs. Figure 3 illustrates the composition of spending among these 3 categories for the FFS plan. Spending growth between 1996 and 1998 was then decomposed into that attributable to increased spending on core products, increased spending on new products, and increased spending on abandoned products according to the following formula:

$$(2) \quad S^{98}/S^{96} - 1 = \theta^C \times (C^{98}/C^{96} - 1) + \theta^O \times (A^{98}/A^{96} - 1) + N^{98}/S^{96}$$

**Figure 3.** Decomposition of Pharmaceutical Spending in the Fee-for-Service Plan



where  $S^t$  = aggregate pharmaceutical spending in year  $t$ ;  $C^t$  = spending on core products in year  $t$ ;  $A^t$  = spending on abandoned products in year  $t$ ;  $N^t$  = spending on new products in year  $t$ ;  $\theta^C$  = share of 1996 spending on core products; and  $\theta^O$  = share of 1996 spending on abandoned products.

The term on the left-hand side of equation 2 represents aggregate growth in pharmaceutical spending PMPM. For example if 1998 spending were \$120 PMPM and 1996 spending were \$90 PMPM, the left-hand side of equation 2 would be  $120/90 - 1 = .33$ , or 33% spending growth. The first 2 terms on the right-hand side of the equation represent analogous calculations for core and abandoned products, weighted by their share of 1996 consumption. The term on the right-hand side of equation 2 captures the contribution of new products to pharmaceutical cost growth, but does not take the analogous form because in 1996 there was, by definition, no spending on products classified as new.

For core products, we constructed a price index for each plan type by computing a price per prescription for each core product for each plan type for 1996 and 1998. The market basket was defined

for each plan type as the 1996 utilization pattern (number of prescriptions for each core product). The price index for each plan type is the cost of that basket using 1998 prices divided by the cost using 1996 prices.

For core products, we then computed a quantity index (QI) using the following formula:

$$(3) \quad QI = (C^{98}/C^{96})/(\text{Price Index})$$

For example, if the PMPM spending on core products in 1998 was \$99, compared with \$90 in 1996,  $C^{98}/C^{96}$  would equal 1.10 (indicating a 10% increase in spending). If the price index was 1.04, indicating a 4% increase in prices, then the QI would be  $1.1/1.04$ , which is about 1.058, indicating about a 6% increase in quantity.

The QI was further divided analogously into a growth-in-prescriptions index and a mix-of-prescriptions index, with the latter being a residual category. The growth-in-prescriptions index was computed as the ratio of prescriptions PMPM in 1998 relative to prescriptions PMPM in 1996. The mix-of-prescriptions index was computed as the QI divided by the growth-in-prescriptions index.

... RESULTS ...

**Table 1** shows the contributions to cost growth of the 3 categories of products: core, new, and abandoned. These are the 3 terms on the right-hand side of equation 2. Spending growth in the traditional FFS plan was dominated by use of new products. In contrast, pharmaceutical spending growth in the PPOs and HMOs was much more evenly split between growth in core and new products. In all plan types, abandoned products were associated with cost decreases.

It is important to note that the higher cost growth for core products in HMOs does not imply that the level of use of these products was greater in the HMOs. In fact, the pattern observed reflects a narrowing in the gap between HMO expenditures on these products and the levels in the FFS plan and PPOs. Likewise, despite the similarity in the impact of new product spending on cost growth across the 3 plan types, HMOs spent less on these products. The impact of new products on cost growth appeared

similar because base expenditures in the HMOs are lower than base expenditures in the other plan types.

**Table 2** further decomposes the growth in core spending into price and quantity effects. Note that the totals reported in Table 2 do not match exactly those in Table 1 because the Table 1 numbers incorporate the share in spending on core products ( $\theta^c \times [C^{98}/C^{96} - 1]$ ) as opposed to just relative core spending ( $C^{98}/C^{96} - 1$ ). Price growth was very similar across plan types, roughly 4% over the 2-year period. However, there was wide variation in the change in quantity. The FFS plan had roughly constant use, while PPOs saw an 8.3% increase in quantity and HMOs a 16.8% increase. In all plans the change in mix of prescriptions was associated with 8% to 10% growth. The key source of the difference in quantity growth was in prescriptions. Numbers of prescriptions were reduced in the FFS plan, held constant in the PPOs, and greatly increased in the HMOs.

Analysis based on observations aggregated to roughly the therapeutic class level suggests that days of supply was increasing over this period in all plan types, with the increase in the PPOs being the most rapid and the increase in the HMOs being the least rapid. To some extent this might reflect substitution among products within a therapeutic class. However, to the extent that it reflects an increase in days of supply with the chemical entity and dose held constant, some of the "price increase" should perhaps be considered a quantity change. This would further bolster the conclusion that rising expenditures reflect changes in utilization rather than changes in prices.

**Table 1.** Component Contribution to Cost Growth by Plan Type

Product Category	Plan Type (%)		
	FFS	PPO	HMO
Core	2.1	12.3	20.1
New	17.4	19.9	15.1
Abandoned	-2.2	-1.5	-0.4
Total cost growth	17.3	30.7	34.8

FFS = fee for service; HMO = health maintenance organization; PPO = preferred provider organization.

... DISCUSSION ...

Increasing expenditures for pharmaceuticals has generated substantial concern among all stakeholders in the healthcare system. Debates regarding the merits of this increase and the appropriate response are ongoing. Although all stakeholders would support appropriate use of prescription medications, defining “appropriate use” is difficult given the vast numbers of products and medical conditions as well as disagreements regarding what thresholds for utilization should be applied. Beyond the detailed debate about prescribing patterns in particular clinical areas, discussions regarding broad plan or regulatory responses are common. For example, 1 approach might be to regulate prices. Another might be to control utilization, perhaps through initiatives such as limiting direct-to-consumer advertising or increasing patient cost sharing. Somewhat ironically, these efforts to constrain cost growth are occurring against a background of pressure to expand pharmaceutical coverage, particularly for the elderly.

Despite the intense interest in this topic, only a few published studies have examined the components of pharmaceutical cost growth in detail. None of them have compared the components of expenditure growth among different types of health plans. The results of this study reveal dramatic growth in all types of health plans. Growth of 17% to 35% over 2 years represents rates of growth more than double the overall rate of increase in medical spending. That these growth rates would draw attention is no surprise.

The highest rates of cost growth occurred in HMOs, which started at the lowest PMPM spending

levels. Although we cannot ascertain with certainty to what extent the differences in growth are attributable to case-mix differences, it appears clear that growth in pharmaceutical spending affected all plan types, and it would require substantial case-mix differences to explain away the differences among FFS plans, PPOs, and HMOs.

Despite persistent calls for price regulation, rising prices were not the primary driver of cost growth. On a product-by-product level, price growth was relatively modest, about 4% over 2 years. Instead what drove expenditure increase was a dramatic shift in utilization patterns. These utilization changes differed substantially across plan types. Among FFS enrollees the dominant force was the use of new products. Use of core products by FFS enrollees actually decreased. Given our data, we cannot ascertain the extent to which the increased use of new products was causally related to the drop in quantity for core products. Among HMO enrollees, use of new products contributed significantly to cost growth, but use of core products also rose substantially. In all plan types there was a shift toward more expensive products, even among the core set of products; but in the HMOs, unlike the other plan types, there was a dramatic rise in the number of prescriptions. Without more detailed clinical data, we cannot assess the extent to which the rise in spending on core products reflected efforts to avoid the newly introduced products (which HMOs were less apt to use). The experience of PPOs (as is commonly observed) was generally somewhere in the middle between that of the FFS plan and HMOs.

This study had several limitations. Most important was our inability to perform detailed case-mix adjustments among plan types. Without these adjustments the differences among plan types cannot be interpreted as causally related to cost-containment activities at the plan level. Still, the case-mix differences would have to have been substantial to explain the differences observed in spending growth. Moreover, other measurement issues (eg, the unavailability of metric quantity and days of supply at the detailed product level) may have resulted in our classification of certain changes as affecting price even though the menu of prices might not have changed. Finally, our data were drawn from the

**Table 2.** Core Product Cost Growth Decomposition by Plan Type

Price and Quantity Effects	Plan Type (%)		
	FFS	PPO	HMO
Price changes	3.9	4.1	3.5
Quantity changes	-1.6	8.3	16.8
• Number of prescriptions	-8.6	0.6	6.4
• Mix of prescriptions	7.7	7.6	9.8
Total core product growth	2.2	12.7	20.9

FFS = fee for service; HMO = health maintenance organization; PPO = preferred provider organization.

experiences of 1 large employer. They are not necessarily representative of the nation as a whole.

Despite these limitations, this work provides insight into recent trends in pharmaceutical utilization. It is crucially important for the policy debate that discussions be explicit about how various concepts such as price are being measured and what types of behavior change are driving changes in expenditures. Because it appears that utilization, as opposed to price, was the primary determinant of expenditure changes, more effort must be made to identify the merits of such utilization increases in specific clinical areas for important patient populations. The patterns of changes in utilization that resulted in higher pharmaceutical spending were clearly complex and varied by plan type. Thus, optimal responses to the observed expenditure growth also may vary to match specific settings and behaviors.

#### **Acknowledgments**

We gratefully acknowledge the valuable research assistance of Aham Gabreilmiriam, MS. We also thank The MEDSTAT Group (Ann Arbor, MI) for providing necessary data and for their assistance with this work.

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