

**Peeling the Onion:  
What Drives Pharmaceutical Expenditures in Canada**  
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## **Introduction**

At \$15 billion per year, pharmaceuticals are the second largest cost component of the Canadian health care system [1]. They are also one of the fastest growing components. Current forecasts [2] suggest that our retail spending on pharmaceuticals could double in the next 6 years. The implications of such rapid cost inflation for such a large component of the health care system are profound. Spending on pharmaceutical care is an investment that has an impact on both the necessity *and* the affordability of other health care services that might be provided to Canadians. The increase in public expenditures on prescription drugs between 2000 and 2001, for example, could have otherwise financed the hiring of 4,000 new doctors or 18,000 new nurses, and paid their salaries indefinitely [3].<sup>1</sup> Interpreted in this light, it is paramount that policy makers both understand the determinants of the use and cost of prescription drugs and ensure that these changes produce the kinds of health system benefits that might come from alternative investment of our scarce health care resources.

What causes the increase in pharmaceutical expenditures? Quantifying the causes of pharmaceutical expenditure growth is not easy [1, 4-14]. Researchers in the field of pharmaceutical sector price and productivity measurement—that is, those who aim to sort out the causes and consequences of drug expenditure inflation—are faced with the challenge of summarizing potentially millions of pharmaceutical “market transactions” in a way that provides policy-makers, prescribers, and the public useful information. The task is sufficiently complicated that arguably no researcher knows with certainty the causes of our national investment in pharmaceutical care, and positively no researcher knows the health and health system consequences of that investment.

In this paper, I review some of evidence and theory regarding the sources of drug expenditure inflation. The mosaic that emerges from putting existing pieces of information together is a complex portrait. The causes of expenditure inflation appear to be many: increased utilization, ongoing substitution of newer for older drugs, and changes in the locus of health care delivery. What emerges with greatest clarity when examining pharmaceutical expenditure inflation is the desperate need to know more about the consequences of our national investment in this form of health care delivery.

## **A Historical Perspective**

*Those who cannot remember the past are condemned to repeat it. — George Santayana*

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\* Supported in part by Health Canada, CIHR Post-Doctoral Fellowship. I am indebted to Sara Stevens for comments and suggestions on an earlier draft. All errors, omissions, and opinions are my own.

<sup>1</sup> In 2000, Canadians spent \$12.8 billion on medical services provided by the 57,000+ physicians in clinical and non-clinical practice in Canada — about \$225,000 per physician. The highest average starting salary of general duty RNs was \$43,000 in 2000 — paid in Nova Scotia — which would amount to about \$50,000 per year after benefits. Between 2000 and 2001, public drug expenditures increased by \$904 million.

Looking back over the history of the pharmaceutical industry, one might not be surprised by the current pace of pharmaceutical spending. Per capita investment in pharmaceutical care has been increasing steadily as far back as (reasonably) reliable data go. Figure 1 illustrates a long-term view of pharmaceutical expenditure growth in Canada. It plots two measures of per-capita spending on pharmaceuticals, each adjusted to constant 2000 dollars using the Canadian consumer price index. The first measure is the wholesale value of manufacturers' shipments of pharmaceutical products and preparations. The second is the retail value of prescription drug purchases. Though not directly comparable, these two series of data illustrate the fact that Canada has observed eras of rapid expenditure inflation before. If this is not perfectly clear from Figure 1, consider Figure 2, which simply rescales the graph for the earlier data series.

At least two lessons might be drawn from the historical view of drug spending. First, spending on pharmaceutical products over the past century has displayed periods of rapid growth in eras characterized by significant innovation and industrial change [15-18]. There have been several periods of joint industrial and scientific change over the past century. The first occurred at the start of the 20<sup>th</sup> century when Paul Ehrlich's affinity theory transformed the European dyestuffs industry into the pioneering pharmaceutical sector, expanding significantly the "ethical" pharmaceutical sector—the component distinct from the somewhat dubious, consumer-oriented proprietary and patent medical industry [17, 19, 20]. The war-time era was characterized by significant investment in pharmaceutical research and manufacturing to bring anti-infective agents to allied forces on the front lines. Following the war, the pharmaceutical industry was revolutionized by regulation and science. Changes in intellectual property laws in the US permitted patents on synthetic versions of naturally occurring substances, making it possible for firms to sell emerging antibiotics and sulfa drugs on a then-unprecedented exclusive basis [17]. In the 1970s, "rational drug design" changed the industry again through target-specific drug research. The research enterprise turned from treatment to prevention, where the discovery of new pharmaceuticals would have significant market appeal. For the first time, in the 1980s, individual pharmaceutical products would achieve the billion dollar sales mark [16, 21].

Figure 1: Real Per Capita Spending on Pharmaceuticals In Canada (Constant 2000 Dollars)  
 Source: CIHI and Statistics Canada

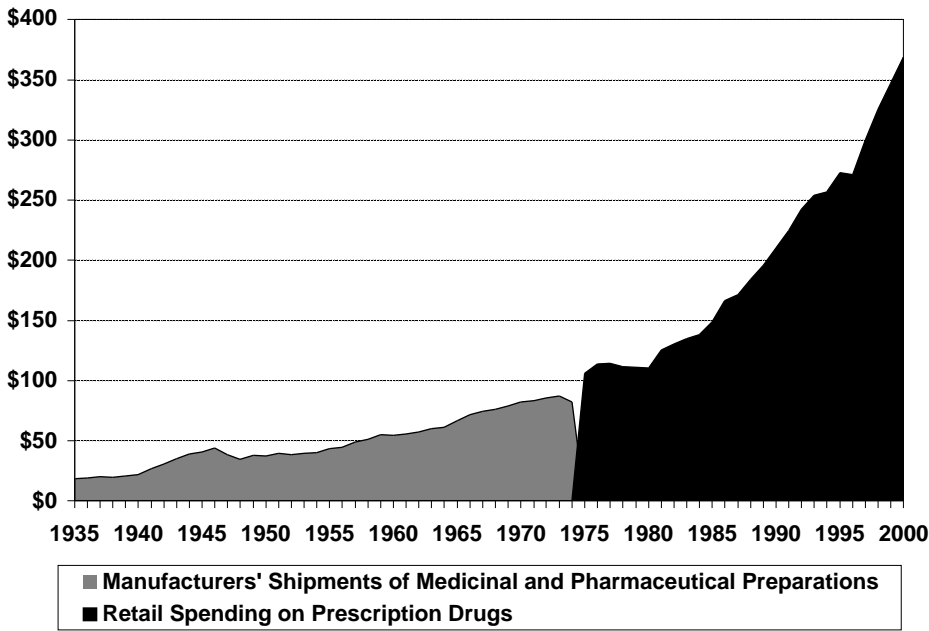
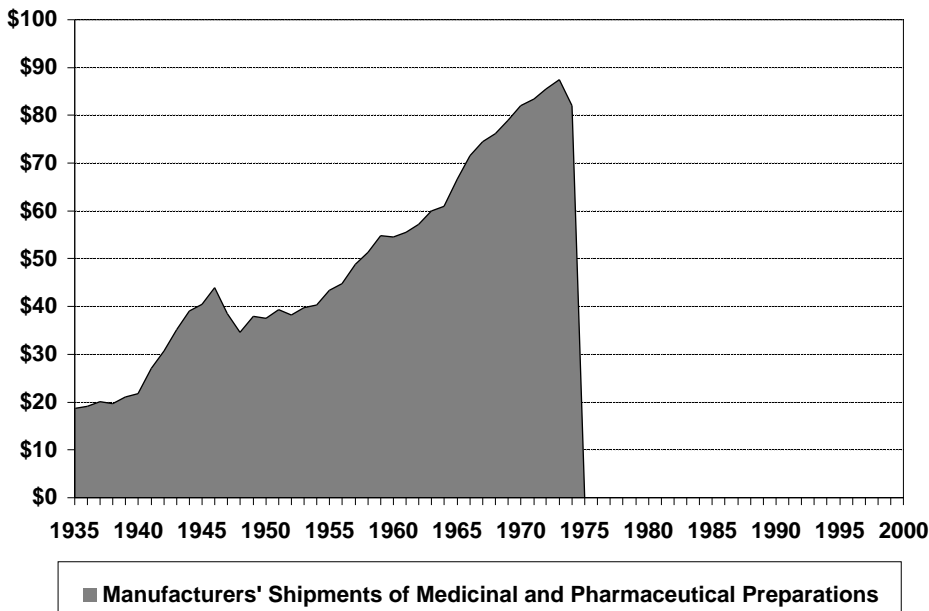


Figure 2: Real Per Capita Spending on Pharmaceuticals In Canada (Constant 2000 Dollars)



The second lesson drawn from the past might be that the spending growth in earlier years provoked little response in terms of policies to control costs. Rapid growth of drug expenditures when they represented a

modest cost in per capita terms, or as a share of health spending, may have illustrated what some call the “importance of being unimportant” [22]— cost containment in the health care systems has, to date, focused on other cost-drivers, especially hospital care. While it is arguable that drug spending has never been “in control,” the scale of spending now still growing at a rapid pace has provoked—I think quite legitimately—a panic that drug costs are “out of control.”

Since the 1980s, drug expenditure inflation since is reflected not only in absolute levels but also in terms of the share of health care spending going to purchase pharmaceuticals. Pharmaceuticals accounted for approximately 8.4 percent of health care spending in 1980 – compared to physicians and hospitals at 14.8 percent and 41.9 percent respectively [1]. The share of health care spending on pharmaceuticals grew steadily over the 1980s and 1990s. By 1998, pharmaceutical products had surpassed physicians’ services in budgetary terms — at just over 14 percent of health expenditures. Drugs now account for 15.2 percent of health care spending, and are second only to hospitals, which constitute 31.4 percent of overall health care costs in Canada.

The rise in pharmaceuticals expenditures within the overall health care budget has occurred in both public and private health care spending [1]. The share of public health expenditures spent on pharmaceuticals – almost exclusively for prescription-only drugs – rose from 3.7 percent in 1985 to 8.1 percent in 2001. In the private sector, where drugs account for a larger share of health expenditures due to the public coverage of most hospital and medical services, the share of health care expenditures spent on drugs rose from 27.5 percent in 1985 to 33.9 percent in 2001. This rise in both private and public drug spending has provoked a great deal of interest in the causes of spending inflation, and the possibility for cost control.

Some of the “blame” may be found in the health system restructuring process that was a response to growth in the cost of other health care components prior to the 1990s. The increased emphasis on pharmaceuticals in Canada during the late 1980s and early 1990s may have resulted from changes in the organization and delivery of health care; this era was characterized by planned cost-reductions in the hospital sector through the process of de-institutionalization. Hospitals were closed, lengths of stay were shortened, and many surgical procedures were being conducted on an outpatient basis. Few would argue that pharmaceuticals played a roll in making such changes feasible. Moreover, many pharmaceutical products brought to market in the 1980s were for the prevention or treatment of conditions that would otherwise result in hospitalizations. Examples abound. New gastrointestinal medicines almost eliminated the need for peptic ulcer surgery; psychotropic medicines increased the viability of de-institutionalizing patients with mental illness; and cardiovascular medicines helped to delay or prevent life-threatening (and costly) events such as heart attack and stroke among those with certain risk factors.

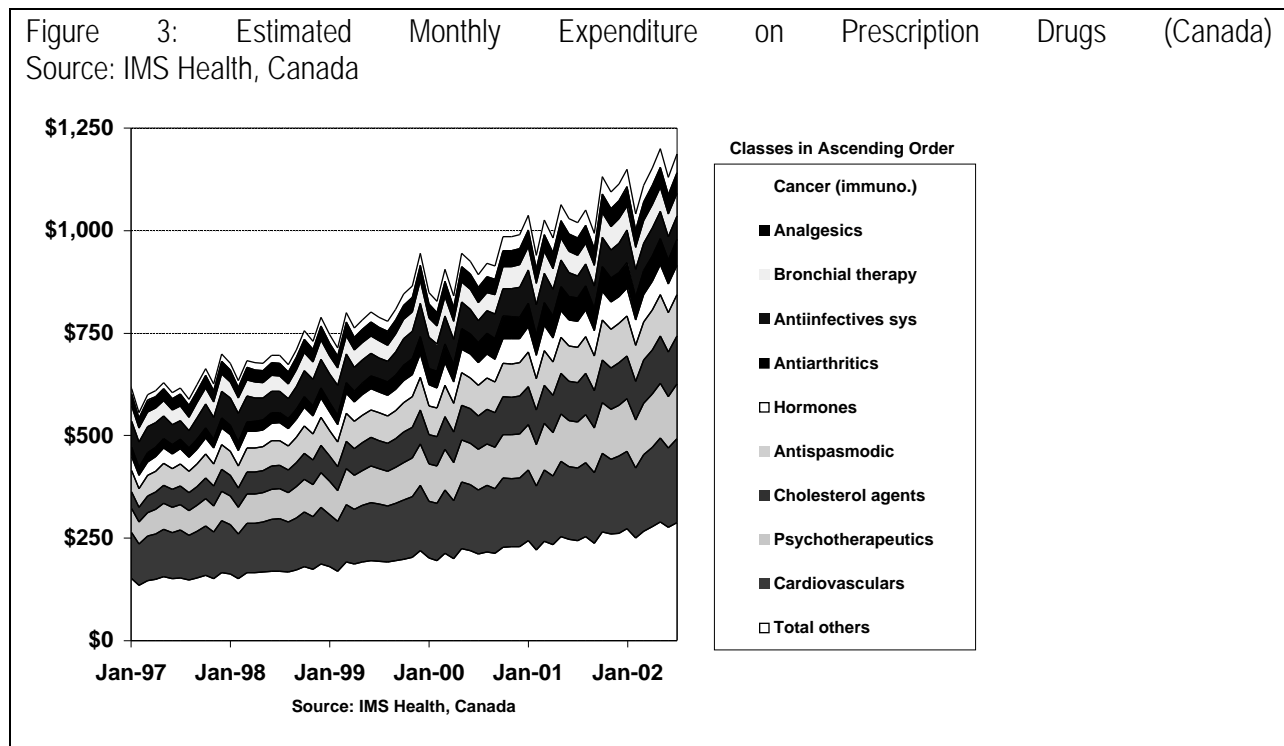
While the causal relationships remain to be rigorously quantified, the rapid pharmaceutical innovation that occurred in the late 1980s and early 1990s was accompanied by both technological change and structural change in the health system, pointing to a reasonable cause of drug expenditure inflation. Over the past five years, by contrast, rapid increases in pharmaceutical expenditures have come in the absence of rapid health system restructuring or increased technological growth. In terms of health system changes, the lion’s share of health care de-institutionalization occurred in the early and mid 1990s. Whether measured in terms of expenditures per capita, bed capacity, or freestanding hospitals, the downsizing of Canada’s hospital sector had, for the most part, concluded by 1998 [23]. In terms of technological change, the fruits of what is widely thought of as the nascent therapeutic revolution have not yet arrived. Despite massive investments in genomic and biotechnological research that promises to revolutionize therapeutics, the past decade has been described as an era of “innovation deficit” in the pharmaceutical sector – research expenditures are increasing and new discoveries are declining [18, 24, 25].

Some “blame” for recent drug inflation may be sought in the aging of our population. While it is true that elderly utilize a disproportionate amount of pharmaceuticals, however, empirical evidence does not suggest that aging is a major driver of pharmaceutical costs [12, 26]. Individuals aged one year at a time, pushing drug costs up at a glacial pace. The pace with which we employ existing technologies and adopt new ones to meet the health care needs of the population (regardless of age) is arguably a far greater determinant of drug expenditure inflation.

## Recent Spending Trends

*Predicting the future is easy. It's trying to figure out what's going on now that's hard. — Fritz R. S. Dressler*

Recent growth in drug spending has provoked many questions about its causes, consequences, and potential to be controlled. One of the first exercises in decomposing drug spending trends is to determine whether the growth in pharmaceutical expenditures is concentrated among particular categories. If inflationary forces were highly concentrated among a specific class of therapeutics, economic analysis and potential policy intervention could be targeted. Unfortunately for those looking for such policy prescriptions, the sources of drug expenditure inflation are diverse. Figure 3 illustrates estimated monthly national prescription drug expenditures for the period January 1997 through July 2002. Expenditures are divided according to the therapeutic class of products purchased.

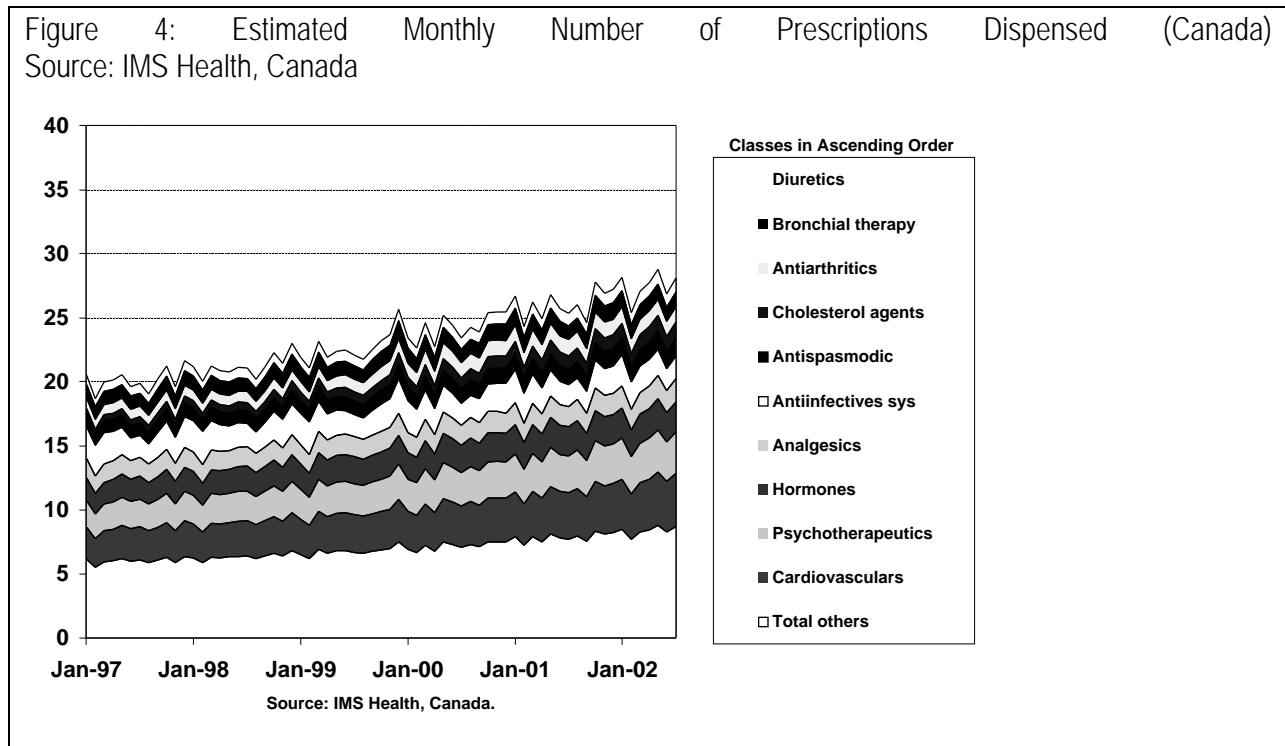


It is clear from the pattern of costs across the therapeutic classes illustrated in Figure 3 that pharmaceutical expenditures are widely distributed across numerous categories of treatment. Even when broadly defined, no therapeutic sub-market comprises as much as 20 percent of pharmaceutical spending in Canada. Perhaps more importantly, no therapeutic class of products accounts for as much as 20 percent of cost

growth in expenditures over the past five years. This is not to say that expenditure growth is not significant in many categories; it is simply a fact that no single category of drug treatments can be pointed to as *the* source of pharmaceutical inflation over recent years. There appears to be a general trend toward increased expenditures across most therapeutic categories of pharmaceutical products.

Figure 4 illustrates the estimated monthly volume of prescriptions dispensed over the period January 1997 through July 2002. Total estimated prescription volume increased by approximately 36 percent between January 1997 and July 2002. This general trend toward increased use of prescription drugs has not been as rapid as the change in the total cost of drugs dispensed. As a result, the average cost per prescription has increased by 41 percent between January 1997 and July 2002. These trends in prescribing volume and average cost are observed in most leading therapeutic classes; the most notable outlier in terms of utilization is the category of cholesterol agents. The number of prescriptions for cholesterol agents dispensed per month almost tripled between January 1997 and July 2002, while the average cost per prescription remained relatively stable.

Notwithstanding the trend in cholesterol lowering drugs, the distribution of prescription drugs dispensed across therapeutic classes reveals that utilization of drugs is spread across many categories. No single therapeutic category accounts for even 20 percent of the prescriptions dispensed in Canada. And, perhaps not surprisingly, the leading categories in terms of costs are those most frequently prescribed. The major cost-drivers in the Canadian pharmaceutical marketplace are preventative, prophylactic, or maintenance treatments for relatively common conditions. For example, leading categories of prescription drugs include those used to manage cardiovascular risk factors (like hypertension), psychotherapeutic agents (especially those to treat depression), cholesterol lowering agents, and drugs used to treat gastrointestinal conditions (including ulcers and reflux).



## The Determinants of Drug Spending

*For every complex problem, there is a solution that is simple, neat, and wrong.*  
— Henry Louis Mencken

Given that a large number of therapeutic sub-markets make up the “pharmaceutical market,” analysts and policy-makers need methods to decompose expenditure trends in the drug sector into simple, comprehensible measures of price and volume change. With statistics about drug utilization and costs, however, it is easy to be misled and to mislead. “Pharmaceutical utilization” comprises many decisions, each of which has cost-related impacts. The challenge of pharmaceutical sector price and productivity measurement is to represent these decisions in a manner that provides policy-relevant information.

One of the simplest ways to describe prescription drug expenditures is to disaggregate them into the effects of price and quantity using cost-of-living indexes [27, 28]. Appropriately constructed cost-of-living indexes can measure the relative cost of achieving “utility” (or consumer satisfaction) given differences in availability and price of products at different points in time or geographic locations [29]. Significant price inflation, so measured, might be regarded as undesirable and potentially worthy of policy intervention. Similarly, measured quantity increases, a portion of which may consist of changes in “quality,” would be indicative of desired increases in health-related-quality-of-life gained through the purchase of more medicines, or more costly ones; in either case, the cost-impact of these “quantity” changes would be considered a worthwhile investment.

The economic approach to measuring the determinants of drug spending is implicitly taken when the relatively slow growth of pharmaceutical prices is cited as evidence that the primary source of drug cost escalation is increased utilization—driven by the un-quantified forces of needs, innovation, and demand [30-32]. As with health care services more generally, however, pharmaceuticals are not “ordinary” commodities [33, 34]; consequently, measuring “utilization” based on standard economic methods used for cost-of-living measurement is likely to generate an inaccurate indicator of pharmaceutical sector dynamics [28]. In the pharmaceutical sector, for example, it may be inappropriate to always assume that the quantity or quality of outcomes is proportional to the cost of prescribed drug products. Both prescribers and insured patients have financial incentives that are inconsistent with the model of consumer behaviour that guarantees a relationship between the relative price and the relative value of goods purchased [28]. Consequently, measures of aggregate “utilization” constructed using conventional economic methods may not provide a reliable basis for policy formulation [14]. The impact of new drugs illustrates this possibility.

## The Impact of New Drugs

*Change is indubitable, whereas progress is a matter of controversy.* — Bertrand Russell

Many researchers have noted that new products have a significant impact on pharmaceutical costs [4, 6, 10]. Newer drugs often compete head to head with therapeutically similar products that have been on the market for some time. The difference in the “vintage” of products competing within therapeutic classes can range from months to decades. This difference in the age of competing products does not, however, correspond to differences in the therapeutic value of the drugs in question. “Newer” is not always “better.”

Often, in fact, older “tried and true” medicines are what scientific evidence points to as the drugs of first choice [35].

Accumulated bodies of evidence concerning the efficacy of older products often cannot compete with the impression made by marketing campaigns for newer products. For prescribers — and increasingly for patients — advertising is a primary source of information about drug therapies. Constrained in the time available to search for information, and lacking much financial incentive to do so, it is not surprising that physicians rely on the pharmaceutical marketing activities for information. The implication for pharmaceutical market dynamics is that prescribers will be selectively informed about only those products for which the seller has sufficient market power to recoup the cost of advertising. Market power and therapeutic quality are not necessarily related. Where there are multiple sellers of an identical product – as is the case in market segments for older drugs with multiple generic competitors – no firm has sufficient market power to recoup the cost of advertising expense. This would be true regardless of how beneficial the off-patent pharmaceutical product might be to potential consumers. Consequently, marketing activity for prescription drugs drops precipitously at patent expiry [36].

The financial consequences of the imbalance of information provided about new and old products can be profound. Evidence of this can be found in the experience of the British Columbia seniors drug plan [6]. From 1987 to 1999, prescription drug costs per senior in British Columbia grew from \$192 to \$497, or 159 percent. Figure 5 illustrates the annual number of prescriptions per senior over this period. Prescriptions are identified by the vintage of the product, as determined by the year in which they were first available. Drugs of the oldest vintage—those available before 1986—were used frequently over the entire period. As indicated in the legend in Figure 5, the average cost of prescriptions of this old vintage was one-sixth the cost of newer medicines. Given the dramatic difference in per prescription costs, the overall cost impact of prescribing even a few of the newer vintage products prescribed was significant, as illustrated in Figure 6.

Figure 5: Number of Prescriptions Dispensed to BC Seniors  
 Source: Unpublished supplementary figures: Morgan, S.G., Statistics and drug utilization: Are prescribing rates really that high? Canadian Medical Association Journal, 2001. 165(11): p. 1507-1508.

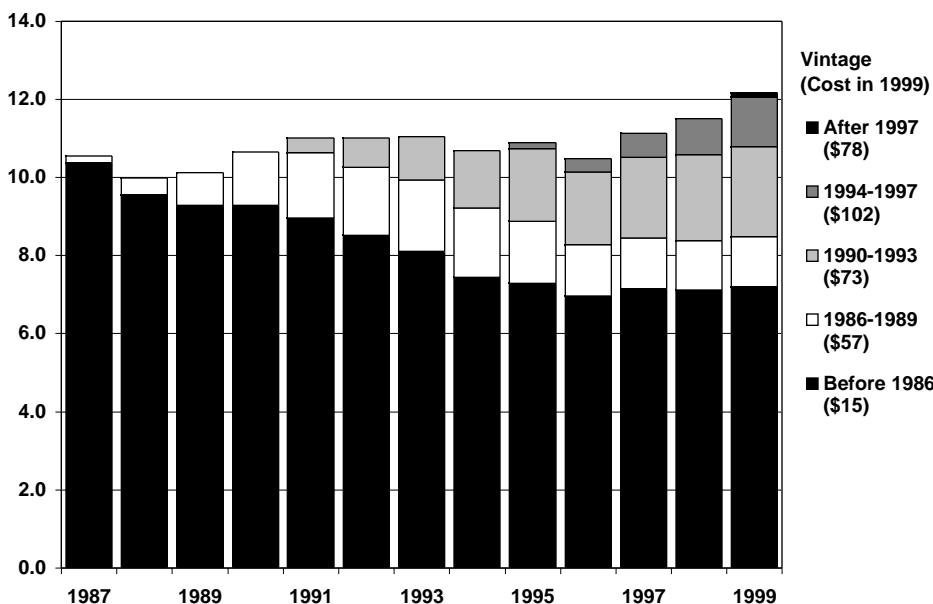
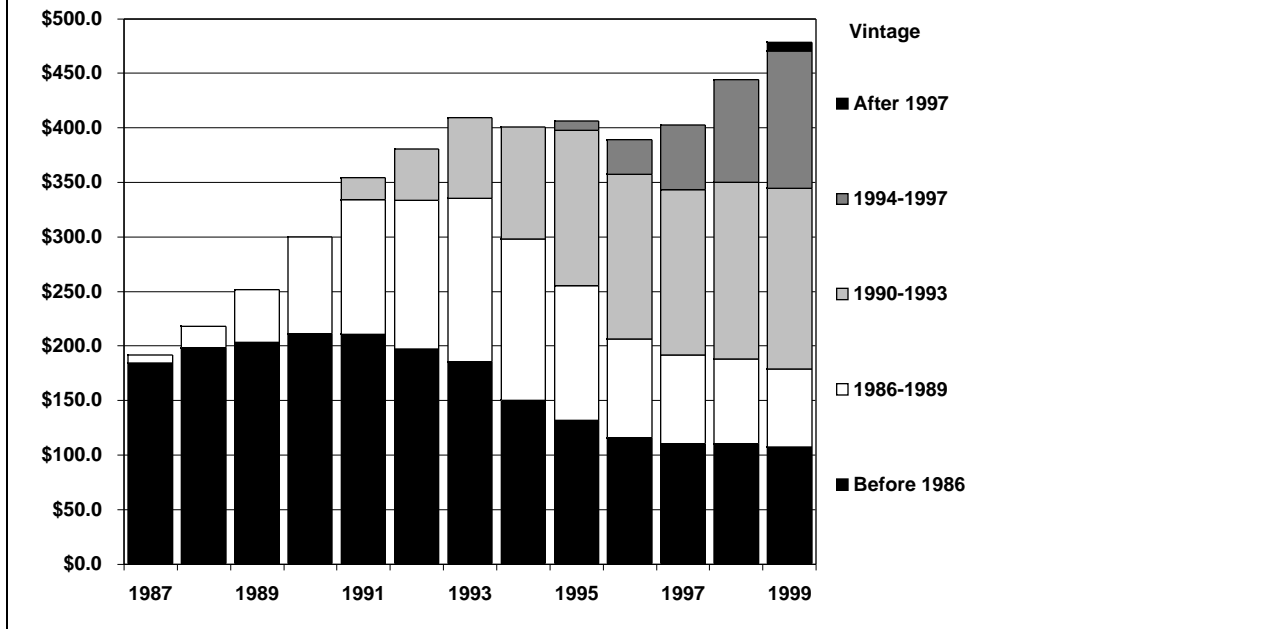


Figure 6: Cost of Prescriptions Dispensed to BC Seniors  
 Source: Unpublished supplementary figures: Morgan, S.G., Statistics and drug utilization: Are prescribing rates really that high? Canadian Medical Association Journal, 2001. 165(11): p. 1507-1508.



### Utilization of Therapy or Consumption of Pills and Tablets

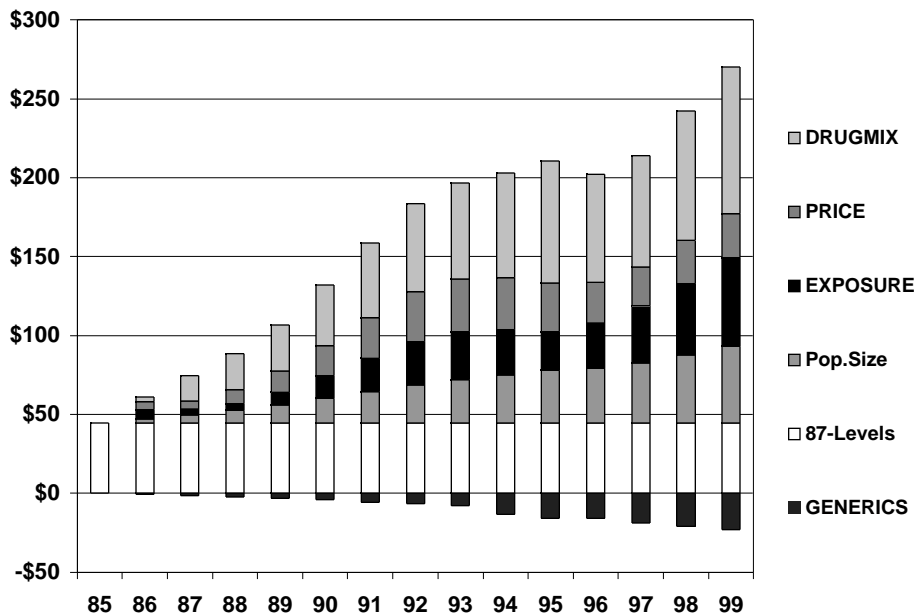
*You better cut the pizza in four pieces because I'm not hungry enough to eat six.*  
 — Yogi Berra

In addition to differences between new and old drugs, pharmaceutical sector analysts must consider the challenges of accounting for differences between 6 tablets at 12 milligrams and 4 tablets at 18 milligrams. Unquestionably, it is outcomes that patients, prescribers, and policymakers ultimately hope to purchase through the use of pharmaceuticals. Short of validated outcomes measures in real world settings, however, analysts of the pharmaceutical sector must use proxies of health outcomes. One such proxy is to measure changes in the pattern of exposure to therapeutic categories of pharmacologic treatment, rather than to count the purchase of various quantities of pills and tablets. In doing so, one gets an indication of the influence that product substitutions among therapeutic categories have on pharmaceutical expenditures. Evidence of this can be found, once again, from expenditures on prescription drugs for seniors in British Columbia.

Expenditures on drugs for seniors in British Columbia have been modeled as a function of five determinants — population size; the pattern of exposure to 206 therapeutic categories of pharmacologic treatment; the quantity and type of drugs used from within those 206 categories; the level of generic drug product selection; and the prices paid for the drug products purchased [5]:

$$\Delta\$TOTAL = \Delta POPSIZE \_ \Delta EXPOSURE \_ \Delta DRUGMIX \_ \Delta GENERICS \_ \Delta PRICES.$$

Figure 7: The Determinants of Seniors Drug Spending in BC  
 Source: Unpublished supplementary figure: Morgan, S., *Quantifying Components of Drug Expenditure Inflation: The British Columbia Seniors' Drug Benefit Plan*. Health Serv Res, 2002.



Over the period 1985 through 1999, the results from that study — illustrated in Figure 7 — suggested that increased frequency of exposure to prescription drug treatment, and changes in the types of products prescribed within therapeutic categories, each accounted for about 40 percent of inflationary pressures. Notably, changes in pharmaceutical prices had very little impact on the cost of prescription drugs for BC seniors. Everything that is left in that analysis — including population size, exposure, drug selection, and generic substitutions — would conventionally be called “utilization,” providing much less information for policymakers and analysts.

### Conclusions

At present there appear to be more questions than answers about the causes and consequences of drug expenditure inflation. *What are the factors that cause spending to rise year after year? Are they controllable? Should they be controlled? For whom are pharmaceutical costs rising most rapidly?*

To manage this important component of our health care system, it is important to understand the dynamics underlying the rise in drug spending. Changes in pharmaceutical expenditures could derive from changes in the actual consumption of drug therapy. A populations' use of drugs to treat illness could be driven by medical needs, patterns of care, or access to technology. If the utilization of pharmaceuticals appears irregular, pharmaceutical policy might aim to ensure access to appropriate drug treatment for potentially under-served populations or to manage utilization among potentially over-served populations. This may imply greater investment in the pharmaceutical component of the health care system — possibly through public drug benefits programs — so that the entire system operates more efficiently and equitably.

Pharmaceutical expenditure increases or variations may, on the other hand, arise from differences in the cost of drugs used to treat similar levels of population health needs. There is, however, more than one

dimension to the cost of drug therapy. Changes in the price of a given drug product has an obvious and direct impact on the cost of treatment. Perhaps more important, however, is the relative price of that product among therapeutic substitutes and the mix of like products selected. The type and mix of drugs selected to treat a given illness can have a profound impact on the cost of an episode of therapy [5, 6]. If health outcomes are comparable, changes in prescribing patterns within therapeutic classes may be interpreted as a form of *de facto* price inflation or deflation, as the case may be. Pharmaceutical policy aimed at controlling the “price” of pharmacologic care might, then, focus not only on price negotiation, but also on utilization management and the promotion of best practices.

Since the ultimate objective of health care, including pharmaceutical consumption, is to improve individual and population health, it is essential to determine whether differential rates of drug utilization correspond to reduced burden of illness and/or reduced demands on other components of the health care system. While the cost-effectiveness of individual drug products is often appraised within the controlled setting of clinical trials [37, 38], and is increasingly being assessed in relation to the real-world use and cost of individual products [39-41], little is known about the population-level health and health system outcomes resulting from the overall investment in pharmaceutical care. To inform policy, it is imperative to know not only about the determinants of populations’ use and cost of pharmaceuticals; the health and health system impact of our national investment in pharmaceutical care must also be rigorously quantified. In the face of the funding crisis that pharmaceutical expenditure inflation poses on our health care system, we might be foolish not to move forward on this research agenda.

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