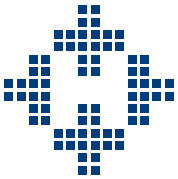
High-Cost Users of Pharmaceuticals: Who Are They?

March 2005



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We thank the University of Manitoba, Faculty of Medicine, Health Research Ethics Board for their review of this project. The Manitoba Centre for Health Policy complies with all legislative acts and regulations governing the protection and use of sensitive information. We implement strict policies and procedures to protect the privacy and security of anonymized data used to produce this report and we keep the provincial Health Information Privacy Committee informed of all work undertaken for Manitoba Health.

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TABLE OF CONTENTS

LIST OF TABLES

List of Appendix Tables

List of Figures

Executive Summary

Why This Report?

We have known for a long time that health care resources and costs are concentrated on a relatively small proportion of the population. These high-level consumers of health care have gained the negative reputation of being "high users" and provide an obvious target for cost containment. With the rising costs of pharmaceuticals over the last two decades, this target group has increasingly become the high-cost users of pharmaceuticals.

The research literature is quite clear on two aspects of high usage of health care. Many high users continue their usage patterns over time. High users are much more likely than other users to have chronic illnesses and often, multiple chronic conditions. Higher users of pharmaceuticals have additional characteristics: they are more likely to use multiple medications and to use newer, expensive drugs. The former, referred to as polypharmacy, predisposes them to adverse events such as hospitalization.

Much of the available literature on heavy users of prescription medications originates from studies of elderly Americans with prescription insurance. Very little is known about high-cost users of pharmaceuticals among a general Canadian population in the context of public prescription insurance. This study provides a description, within the Province of Manitoba, of high-cost users of prescription medications compared with the rest of the population. The intent of this study is to provide a detailed characterization of this population so as to clarify whether its costs can be reduced or whether other interventions are needed. In doing so, answers are sought to the following questions:

- What drug categories account for the higher prescription costs?
- Do differences in disease prevalence explain the higher prescription costs?
- Are there other explanations for high-cost users? Do they use more expensive drugs? Are they taking too many drugs?
- Is it possible to predict transitioning to high prescription cost use?

Focus of the Report

This report focusses on individuals in whom expenditures for prescription medications fell into the top 5th percentile of annual prescription expenditures in fiscal year 2000/01. These individuals are referred to as "high-cost users" throughout the report. The intent of the report was to compare high-cost prescription users to persons who are not high-cost users, in order to answer the question: "what explains high prescription costs?" The primary

objectives of this report were to characterize high-cost users by sociodemographics, prescription medication costs and utilization, underlying conditions and use of the health care system. Additionally, we were interested in documenting the health outcomes of high-cost users and identifying trigger points for transition from low- to high-cost users.

Summary of Findings

Few People yet Disproportionate Share of Prescription Costs

High-cost users of prescription medications (average annual cost of $3,424) accounted for 5% of Manitobans taking prescription medications in 2000/01, yet contributed to 41% of total prescription expenditures that year. Persistent high-cost users (top 5% expenditures in each year from 1997/98 to 2000/01) consumed 18% of prescription expenditures and intermittent high-cost users (top 5% in 2000/01, but not each year since 1997/98) consumed 23% of prescription expenditures. Eighty percent of the former continued to be high-cost users in the following fiscal year.

High-Cost Users are Sick

High-cost users were more likely than non-high-cost users to have underlying chronic physical conditions which required medication therapy. Forty percent of high-cost users had hypertension, 25% had diabetes and 6% had peptic ulcer disease. These prevalence rates were three to six-fold greater in high-cost users than in non-high-cost users. They were also more likely to have mental health conditions; depression was present in 25% and schizophrenia in 9% of high-cost users. The equivalent rates in non-high-cost users were 13% and 1.5% respectively.

High-cost users were also higher consumers of other health care services. They had a greater number of physician visits, were hospitalized more often and stayed in hospital for a longer duration.

High-Cost Users Take Many Medications for Multiple Morbidity

Higher prevalence of chronic disease did not completely explain the high prescription costs among high-cost users. While hypertension and diabetes were more common in high-costs users, medication therapies for these conditions did not assume a greater share of total costs. We asked ourselves whether this discrepancy was due to the greater cost of treating comorbidity in these conditions. Indeed we found that relative to non-high-cost users, high-cost users were more likely to have a higher level of comorbidity and to have received more medications. Close to 40% of high-cost users had two or

more major conditions and over 85% received six or more different medications. The equivalent percentages in non-high-cost users were 7% and 16%, respectively.

Furthermore, high-cost users with a similar level of comorbidity or taking similar volumes of different medications were more costly than non-high-cost users. For example, the average prescription costs for high-cost users taking six or more medications was over $3,000 per year. In comparison the same average costs for non-high-cost users were $1,000. Investigating the use of medication to treat a common comorbidity—cardiovascular comorbidity—we ascribed this difference to the mix of medications needed to treat comorbidity in high-cost users. Only 6% of prescription costs for non-high-cost users were consumed by persons with a high level of cardiovascular comorbidity, requiring treatment with medications for the cardiovascular, nervous, alimentary tract and musculoskeletal systems. Among persistent high-cost users this figure was 30% and in intermittent high-cost users it was 19%.

Not All High-Cost Users are the Same

Not all high-cost users are the same. We identified a group of high-cost users who predictably fell into the top 5% of costs year after year. These persistent high-cost users differed from intermittent high-cost users (with periodic years in the top 5% of costs) by consuming a greater number of different medications—an average number of 12 different medications in comparison to 10 in intermittent high-cost users. Specifically, they were more likely to have a higher level of cardiovascular morbidity, requiring treatment with a greater mix of medications. Intermittent high-cost users on the other hand, were more likely to have cancer or multiple sclerosis which are treated with immunomodulating drugs. Ten percent of all prescription costs in intermittent high-cost users were due to immunomodulators such as Betaseron ® and Neupogen ®, a percentage which was tenfold high than in the other cost groups.

We also observed substantial variation in average annual prescription costs within persistent and intermittent high-cost users. Some high-cost users taking few medications or with uncommon conditions such as cystic fibrosis, multiple sclerosis or HIV/AIDS, had the highest prescription costs.

Some High-Cost Users are Taking Expensive Drugs

The daily cost of medication therapy in high-cost users was double that for non-high-cost users. Some of this additional cost difference can be attributed to the greater illness burden of high-costs users, which requires treatment with high-cost medications or switching to higher cost medications

when initial treatment is not effective. However, we also observed greater daily medication costs in high-cost users which could not be explained by illness burden. These greater costs were documented for therapeutically equivalent medications to treat peptic ulcer disease (proton pump inhibitors, histamine H2-blockers) and to treat hypertension or congestive heart failure (renin-angiotensin system agents). There would be little justification for using one brand name product over another in these therapeutically equivalent drug categories. Yet we observed that the most expensive medications in each of these categories, Losec ® (peptic ulcer drugs) and Vasotec ® (renin-angiotensin system agents), contributed to a greater share of expenditures in persistent high-cost users than in non-high-cost users.

High-Cost Users Have Poor Health Outcomes

The receipt of multiple medications, known as polypharmacy, is a risk factor for hospital readmission, prolonged hospital length of stay and mortality. Consequently, we were interested to know about the health outcome of being a high-cost user. High-cost users were hospitalized, institutionalized and required home care more often than non-high-cost users within the following year of their high prescription costs in 2000/01. While health outcomes worsened in all user groups with a rise in level of comorbidity, persistent high-cost users with high comorbidity were at the highest risk for poor outcomes. Persistent high-cost users with high comorbidity may actually be sicker than those with high comorbidity in the other user groups. Alternatively, they may have reached a critical point with respect to number of medications which led to a need for help from home or institutional care, or worse yet to a hospitalization for an adverse event.

Some Worrisome Patterns

High-cost users are increasingly taking more prescription medications. In 2000/01, high-cost users were taking one more medication than they were four years earlier. Almost 90% of high-cost users met the criterion for polypharmacy, taking six or more different prescription medications. This represented a 10% increase over four years. We noted that the elderly or individuals who are low-income comprised a significant share of high-cost users. The proportion of these types of vulnerable persons has been increasing in the high-cost user group.

Drug interactions and inappropriate medication combinations have been reported to be more common among persons seeing multiple health care providers. In our study, prescription users with the same level of comorbidity stayed in hospital one day longer if they saw three or more family practitioners during the year. Half of high-cost users saw three or more family practitioners.

Some Opportunities for Intervention

High-cost users were more frequent consumers of health care than non-high-cost users, even as far back as three years prior to becoming a high-cost user. This observation suggests that high-cost users had greater underlying illness to begin with, but in addition, we were able to locate transition points in the receipt of health care which increased the likelihood of a person becoming a high-cost user. While health care use increased progressively for all prescription users, increases in hospitalization among high-cost users were substantial in the year before high-cost use. Moreover, high-cost users were more likely than non-high-cost users to be hospitalized or to receive home care for the first time in the year prior to high use. We and others have documented that hospitalization and home care are predictors for future institutionalization. However, these events can also be viewed as opportunities for intervention. They provide the time, physical and human resources for conducting medication reviews and discontinuing unnecessary medications.

Policy Implications

This report has significance to pharmaceutical policy-makers who struggle to offer access to needed pharmaceuticals in an environment of rising prescription costs and constrained budgets. We note that 75% or more of prescription expenditures for high-cost users in Manitoba are reimbursed by provincial drug programs. Here are several actionable messages derived from the characteristics of high-cost users:

- Cost savings are achievable by maximizing use of therapeutically equivalent medications which are less expensive. Manitoba Pharmacare has proceeded in this direction by introducing the lowest cost alternative drug reimbursement policy. This policy will also benefit persons paying out-of-pocket for their prescriptions.
- High-cost users are overwhelmingly characterized by a significant burden of illness for which they take multiple medications. Of note, persistent high-cost users took on average, 12 different medications per year. This number is expected to increase. Beyond maximizing use of less expensive, therapeutically equivalent medications, improved efficiency in the use of pharmaceuticals is likely to be found through medication management programs which focus on delaying disease progression and optimizing disease control with the minimum number of medications.
- Not all high-cost users are the same. 18% of total prescription costs were driven by persistent high-cost users and 23% of costs by persons with intermittent high costs. The latter included a high proportion of persons with cancer and other immunopathologic conditions who are treated

with high-cost biotechnology drugs. While persistent and intermittent high-cost users are candidates for medication management, strategies are needed to address reimbursement of new biotechnology products as they are developed to treat these conditions.

It is reassuring that a large share of prescription medications are being used for persons who need them, and that these persons also have greater access to other health care services. However, health care providers and managers are in a position to improve the health of high-cost users in the following ways:

- While high-cost users may be appropriately using health care services, the use of multiple medications places them at risk for poor health outcomes and increases the demand for future health care. Continuous care with fewer primary care providers may decrease this risk.
- Improved patient care and efficiency with pharmaceuticals is likely to be found through medication management programs provided by primary health care teams which are multidisciplinary in nature and address a broad range of conditions, including mental health problems. These primary health care teams need not be located at one site, but need to include collaboration between physicians, pharmacists, home care nurses and other providers.
- Health care providers should take advantage of transition points to high-cost use as opportunities to improve medication therapy and reduce unnecessary medication use. These transition points include long-stay hospitalizations and home care.

1.0 INTRODUCTION

Health care resources and costs are concentrated on a relatively small proportion of the population. Dating all the way back to the 1950s, this finding has repeatedly been reported in studies of physician visits, (Reid et al., 2003; Gill and Sharpe, 1999; Densen et al., 1959) hospitalizations (Roos et al., 2003; Zook and Moore, 1980) and total health care expenditures (Roos et al., 2004; Roos et al., 1989; Berk and Monheit, 1992). These high-level consumers of health care have gained the negative reputation of being "high users" and provided an obvious target for cost containment. With the rising costs of pharmaceuticals over the last two decades (Morgan, 2004; Morgan et al., 2004; Canadian Institute for Health Information, 2004; Metge et al., 2003), this target group has increasingly become the high-cost users of pharmaceuticals (Thomas et al., 2001; Mueller et al., 1997; Hallas and Nissen, 1994; Isacson and Haglund, 1989).

Also constant over time and place are comparisons of high users with the general population which have been conducted to determine whether the extraordinary use of health care resources in high users is justified. This evidence is also unswerving. High users are much more likely than other users to have chronic illnesses and often, multiple chronic conditions (Roos et al., 2004; Reid et al., 2003; Gill and Sharpe, 1999; Mueller et al., 1997; Zook and Moore, 1980). They are frequently members of disadvantaged groups such as the poor and the elderly (Roos et al., 2004; Roos et al., 2003; Gill and Sharpe, 1999; Berk and Monheit, 1992). Higher users of pharmaceuticals have additional characteristics: they are more likely to use multiple medications and to use newer, expensive drugs (Thomas et al., 2001). The latter suggests an element of non-evidence-based prescribing by physicians or inappropriate patient requests for newly-marketed drugs (Fischer and Avorn, 2004; Mintzes et al., 2002; Mason and Freemantle, 1998).

If high users are sicker in the long-term or possess characteristics which put them at risk for poor health, then opportunities exist to address their health care needs.

Why is our society so interested in knowing about the high users? What relevance do characterizations of high users have to policy-makers and health care professionals? None, if health care needs are random events such that identification of high users in any one time period provides no information on future needs. However, if high users are sicker in the long-term or possess characteristics which put them at risk for poor health, then opportunities exist to address their health care needs. The research literature is quite clear—many high users continue their health care usage patterns over time (Densen et al., 1959; Roos et al., 1989). The same can be said for high-cost users of pharmaceuticals (Wrobel et al., 2003; Thomas et al., 2001; Coulson and Stuart, 1992; Isacson and Haglund, 1989). Further, there are other dangers of high-cost users of pharmaceuticals which are predictable—their use of multiple medications, referred to as polypharmacy, predisposes them to adverse events such as hospitalization (Campbell et al., 2004).

This study provides a description, within the Province of Manitoba, of high-cost users of prescription medications compared with the rest of the population.

Much of the available literature on heavy users of prescription medications originates from studies of elderly Americans with prescription insurance (Wrobel et al., 2003; Thomas et al., 2001; Mueller et al., 1997; Coulson and Stuart, 1992). A few studies on whole populations come to us from Denmark and Sweden (Hallas and Nissen, 1994; Isacson and Haglund, 1989). Very little is known about high-cost users of pharmaceuticals among a general Canadian population in the context of public prescription insurance. This study provides a description, within the Province of Manitoba, of high-cost users of prescription medications compared with the rest of the population. The intent of this study is to provide a detailed characterization of this population so as to clarify whether its costs can be reduced or whether other interventions are needed. In doing so, answers are sought to the following questions:

- What drug categories account for the higher prescription costs?
- Do differences in disease prevalence explain the higher prescription costs?
- Are there other explanations for high-cost users? Do they use more expensive drugs? Are they taking too many drugs?
- Is it possible to predict transitioning to high prescription cost use?

The primary objectives of this report were to characterize high prescription cost users by sociodemographics, prescription medication costs and utilization, underlying conditions and use of the health care system. Additionally, we were interested in documenting the health outcomes of high-cost users and identifying trigger points for transition from low- to high-cost users.

2.0 METHODS

2.1 Focus of the Report

This report focuses on individuals in whom expenditures for prescription medications fell into the top 5th percentile of annual prescription expenditures in 2000/01. These individuals are referred to as "high-cost users" throughout the report. The intent of the report is to compare high-cost prescription users to persons who are not high-cost users, in order to answer the question: What explains high prescription costs? As such, non-users of prescription medications were excluded from the analysis. This report has relevance to health care policy-makers who must struggle with their budgets to contain costs. The report also has value for health care providers and administrators, as high-cost users are at risk for poor health outcomes.

2.2 Data Sources

Data for this report were derived from anonymized (no names, no addresses) health care administrative data contained in the Population Health Research Data Repository, housed at the Manitoba Centre for Health Policy. We used the full range of databases: population registry, prescription records, physician reimbursement claims, hospital files, home care files, personal care home files, vital statistics and Statistics Canada census files. Records from these files were linked through the use of a scrambled health identification number.

2.3 Definition of Prescription Cost Groups

Annual prescription costs for persons receiving at least one prescription in fiscal year 2000/01 were determined. Prescription costs for Pharmacare and Family Services recipients were totalled from the cost information in the DPIN prescription database, which included the medication acquisition cost and the dispensing fee. Costs for prescriptions insured by other payers were imputed from Pharmacare costs.

Persons were placed into three prescription cost groups: Persistent High-Cost Users, Intermittent High-Cost Users and Non-High-Cost Users. Persistent and intermittent high-cost users were drawn from the high-cost user group. The terms "costs" and "expenditures" have been used interchangeably in the report, and "cost" was removed altogether from category label in tables and from acronyms for the category labels to simplify reporting of results.

2.3.1 Persistent High-Cost Users – PHUs

These were individuals in whom yearly prescription expenditures were persistently high over a number of years. Specifically, they were persons in whom annual prescription expenditures exceeded the 95th percentile in 2000/01 and in each of the previous three years since 1997/98.

2.3.2 Intermittent High-Cost Users – IHUs

These individuals had high prescription expenditures in one year, and sporadic or intermittent high expenditures in previous years. They were persons in whom annual prescription expenditures exceeded the 95th percentile in 2000/01, but did not exceed the 95th percentile in each of the previous three years since 1997/98.

2.3.3 Non-High-Cost Users – NHUs

These were persons in whom annual prescription expenditures did not exceed the 95th percentile in fiscal year 2000/01.

2.4 How This Report is Organized

The findings in this report are presented in two sections: descriptive findings and inferential analyses. In the descriptive analysis section, information is reported on the characteristics of the cost groups, such as sociodemographics, prescription utilization, health care utilization, prescription costs, underlying illnesses and health outcomes. This information is presented under a series of questions which culminate into a profile of high-cost users. No comparative statistics are reported in this section to denote whether group differences were statistically significant.

The second section describes the results of three sets of analyses to examine factors related (i.e., predictors) to the transition to a high-cost user. A case-control design was used; the cases were individuals who were not high-cost users in 1997/98–1999/2000 but became high-cost users in 2000/01. The controls were age and sex matched Manitoba residents who were not high-cost users in 1997/98–2000/01. In the first set of analyses, the predictors were measures of health care use for each year in the four-year period from 1997/98 to 2000/01. In the second set of analyses, the predictors were measures of health care use in the year prior to cases becoming high-cost users (i.e., 1999/2000). The third set of analyses examines predictors for two high-cost user groups: (1) continuing high users, individuals who were high-cost users in 2000/01 and who remained in the high-cost user group in 2001/02, and (2) non-continuing high-cost users who were in

the high-cost use group in 2000/01 but not in 2001/02. The purpose of all three analyses was to test the significance of prior use of home care, physicians, hospitals, and prescription drugs on the odds of individuals transitioning into the high-cost use category, and possibly continuing in this category. Logistic regression techniques were used to conduct these analyses.

2.5 Measures Used to Compare Cost Groups

2.5.1 Descriptive Findings

The three prescription cost groups were compared using variables which fell under the following domains:

- Sociodemographics (age, gender, income quintile, urban/rural location and mortality).
- Prescription utilization (number of prescriptions per person, number of different medications per person, percent with 6 or more different medications, number of days of medication therapy per person).
- Health care utilization (number of physician visits, percent seeing family practitioners (FPs) only, percent seeing FPs and specialists, percent seeing three or more FPs, number of hospitalizations and hospital days per user).
- Prescription cost (average cost per prescription, average prescription cost per days of therapy, percent of prescription cost paid by public insurance, costs per drug category, cost per brand name product).
- Underlying disease (percent with medical conditions in Extended Disease Clusters (EDC), percent with major/minor conditions, percent with comorbidity).
- Health outcome (new hospitalizations, new hospital treatment days, new admissions to personal care homes and long-term care facilities, new admissions to home care).

The Anatomical Therapeutic Chemical (ATC) classification was used to define drug categories for prescription cost and utilization comparisons. The ATC system was also used to create a measure of cardiovascular comorbidity. The Adjusted Clinical Group (ACG) classification system was used to define disease categories (EDC, major/minor conditions) and comorbidity levels (low, medium and high). Definitions for each variable are provided in Appendix I.

Table 1 reports the distribution of the number of major conditions in persons with high comorbidity (variables derived from the ACG classification

system). On average, each user group had 4.3 major conditions. Seventy percent of high-cost users had four major conditions in comparison to 75% of NHUs. Six or more major conditions were present in 5% of high-cost users and 4% of NHUs. We interpreted these findings as slight differences and concluded that persons with high comorbidity across the three user groups were comparable in their illness burden.

Table 1 : Distribution of the number of major conditions in high comorbidity persons by user group

Number of Major Conditions	Persistent High User	Intermittent High User	Not High User
4	68.7%	71.0%	74.3%
5	25.7%	23.8%	21.3%
6	5.4%	4.8%	4.1%

2.5.2 Case-Control Study

Measures which may explain the transition to the high-cost user group included measures of overall health care use for the period 1997/98–2000/01 as well as measures of new health care use in 1999/2000. Measures of prevalent health care use were examined for each year from 1997/98–2000/01. They included:

- One or more home care contacts: A binary variable to identify individuals who had at least one home care contact per year.
- One or more hospitalizations: A binary variable to identify individuals who had at least one in-patient hospitalization per year.
- Seven or more hospital days: A binary variable to identify individuals who spent seven or more days in hospital as an in-patient each year.
- Seven or more physician visits: A binary variable to identify individuals with seven or more physician visits (both FP and specialist visits) each year.
- Three or more differenct physicians: A binary variable to identify individuals with three or more different physicians (FP or specialists) each year.
- Six or more different drugs: A binary variable to identify individuals with six or more different drugs each year.

Measures of new health care use were examined for 1999/2000, the year before cases transitioned to the high use group. They included:

- New home care use: A binary variable to identify individuals who had no homecare use for 1997/98–1998/99, but at least one homecare contact in 1999/2000.
- New hospital use: A binary variable to identify individuals who had no hospital separations for 1997/98–1998/99, but at least one hospital separation in 1999/2000.

- New hospital long-stay use: A binary variable used to identify individuals who had no hospital separations with a length of stay greater than seven days for 1997/98–1998/99, but at least one separation with a length of stay greater than seven days in 1999/2000.
- New high physician use: A binary variable to identify individuals who had visits to fewer than three different physicians (FP or specialists) for each year in 1997/98–1998/99, but visits to at least three different physicians in 1999/2000.
- New high drug use: A binary variable to identify individuals who had fewer than 6 different drugs in each of 1997/98–1998/99, but at least six different drugs in 1999/2000.

Personal care home use was also examined, but the number of cases and controls who were admitted to PCH was too small to warrant further analyses. All analyses were adjusted for region of residence, income quintile, and comorbidity.

2.6 Data Limitations

All of the data are derived from contacts with the health care system. Because not everybody seeks medical attention this may underestimate true prevalence of the medical conditions and levels of comorbidity, which are used in the report to explain medication use differences between the user groups. Similarly, health care contact data are not sufficiently detailed to explain health outcome differences between the user groups, which may be attributed to medication use.

3.0 RESULTS

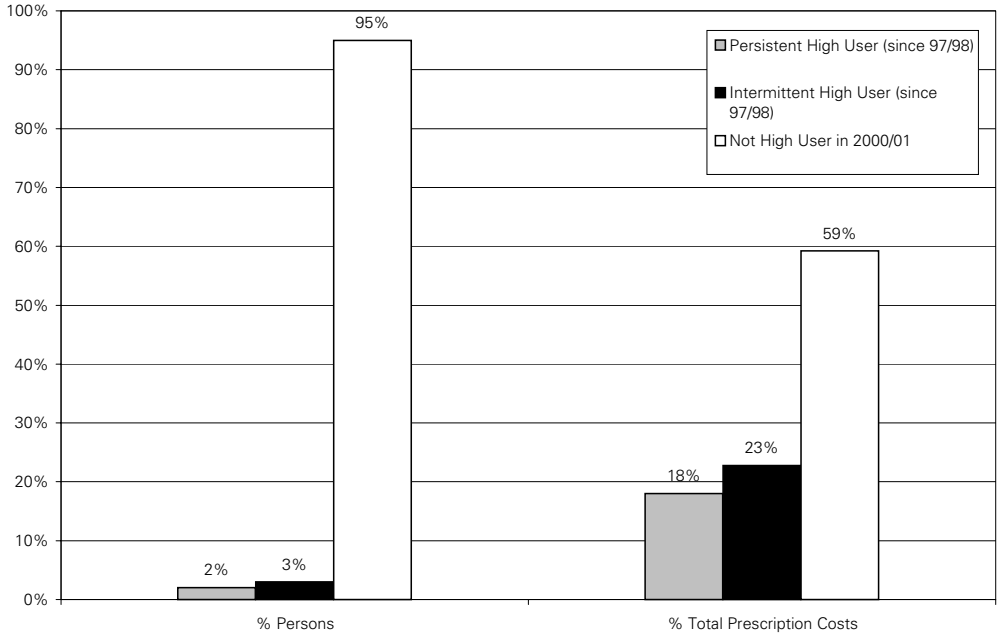
3.1 What are the Characteristics of a High-Cost User?

In 2000/01, 68% of Manitobans (n=780,293) received prescription medications, totaling $328 million in prescription expenditures. Annual prescription expenditures exceeded the 95th percentile value, the lower cut-off for a high-cost user, in 39,015 persons. The average expenditure in this high-cost user group was $3,424 and the median expenditure was $2,567 (see Appendix II for annual expenditures by five-percentile groupings). As per our definition, the high-cost user group was further divided into PHUs, if annual prescription expenditures were in the top 5th percentile in each of the previous years since 1997/98, and into IHUs, if this was not the case. Sixty percent of IHUs met the high-cost user definition in at least one of the preceding three years and 40% of IHUs were high-cost users for the first time in 2000/01. Only three percent of NHUs had had at least one previous year of high-cost use. Eighty percent of PHUs were high-cost users in the following fiscal year, in comparison to 62% of IHUs and 1.5% of NHUs.

High-cost users of prescription medications accounted for 5% of Manitobans taking prescription medications, yet contributed to 41% of total prescription expenditures.

PHUs consisted of 15,567 persons whose prescription expenditures were $59,934,126.60. The IHU group included 23,448 persons in whom prescription expenditures totaled $74,651,081.10. In the remaining 741,278 persons, defined as NHUs, prescription expenditures were $194,175,054.70. **Thus, high-cost users of prescription medications accounted for 5% of Manitobans taking prescription medications, yet contributed to 41% of total prescription expenditures** (**Figure 1**). Specifically, PHUs represented 2% of the population and consumed 18% of prescription expenditures and IHUs represented 3% of the population and consumed 23% of prescription expenditures.

Figure 1: High-Cost Pharmaceutical Users in 2000/01 - Percentage of Prescription Costs vs Percentage of Population Across User Groups



High-cost users were more likely to be seniors or to be low-income than non-high-cost users.

In comparison to NHUs, PHUs and IHUs were 3-4 times more likely to be older. About 30% of persons in both high-cost user groups were age 75 years and older; in NHUs this statistic was less than 10 (Table 2). The female-male ratio was around 60:40 and did not vary by user group. High-cost users were more likely to be low-income. Approximately one-quarter of high-cost users lived in the lowest income neighbourhood, in comparison to 20% of NHUs. Two-thirds of persons lived in urban centres and this did not differ across user groups. High-cost users were three times more likely to die during 2000/01.

Table 2: Sociodemographic characteristics by user groups, 2000/01

Percentage of Users	Persistent High User (since 97/98) (15,567 users)	Intermittent High User (since 97/98) (23,448 users)	Not High User in 2000 (741,278 users)	Ratios	
				PHU/not HU	IHU/not HU
Age Groups					
0-18 yrs	1.0	1.6	24.3	0.0	0.1
19-29 yrs	1.9	3.3	14.1	0.1	0.2
30-44 yrs	10.4	12.3	22.1	0.5	0.6
45-59 yrs	24.4	23.4	19.6	1.2	1.2
60-74 yrs	34.4	31.4	12.4	2.8	2.5
75+ yrs	27.9	28.1	7.5	3.7	3.7
Gender					
Male	42.1	41.9	44.6	0.9	0.9
Female	57.9	58.1	55.4	1.0	1.0
Income					
Q1 (lowest)	26.7	25.1	19.7	1.4	1.3
Q2	21.9	21.6	19.8	1.1	1.1
Q3	19.8	20.6	20.3	1.0	1.0
Q4	15.6	15.7	19.7	0.8	0.8
Q5 (highest)	14.3	15.4	19.9	0.7	0.8
Residence					
Urban*	63.2	60.2	62.2	1.0	1.0
Rural South	32.9	35.5	32.5	1.0	1.1
Rural North	3.9	4.3	5.4	0.7	0.8
Died in 2000/01					
Yes	2.0	2.0	0.7	2.9	2.9

*Includes Winnipeg and Brandon

Table 3: Prescription costs, average cost and percentage of total cost, by sociodemographic characteristics across user groups, 2000/01

	Persistent High User			Intermittent High User			Not High User		
	Average Cost per Person	Category Cost	% Total Cost	Average Cost per Person	Category Cost	% Total Cost	Average Cost per Person	Category Cost	% Total Cost
Age Groups									
0-18 yrs	$9,653	$1,486,585	2.5	$5,133	$1,878,806	2.5	$78	$14,012,087	7.2
19-59 yrs	4,511	25,736,156	43.7	3,895	35,627,185	47.7	234	96,705,339	49.8
60-74 yrs	3,364	18,038,239	30.6	2,719	20,009,153	26.8	529	48,460,581	25.0
75+ yrs	3,164	13,673,147	23.2	2,605	17,135,938	23.0	626	34,997,048	18.0
Gender									
Male	3,980	26,111,672	44.3	3,275	32,200,420	43.1	241	79,823,689	41.1
Female	3,644	32,822,454	55.7	3,118	42,450,661	56.9	278	114,351,365	58.9
Income									
Q1 (lowest)	3,985	16,473,365	28.0	3,242	19,017,629	25.5	273	39,783,154	20.5
Q2-Q4	3,673	32,828,057	55.7	3,126	42,471,382	56.9	262	116,489,032	60.0
Q5 (highest)	3,806	8,532,867	14.5	3,288	11,915,426	16.0	247	36,335,702	18.7
Residence									
Urban*	3,833	37,667,887	63.9	3,333	47,101,747	63.1	262	120,713,101	62.2
Rural North	3,412	2,088,197	3.5	2,947	2,968,099	4.0	227	9,067,145	4.7
Rural South	3,741	19,178,043	32.5	2,959	24,581,235	32.9	267	64,394,809	33.2
Died in 2001/02	4,063	2,986,659	5.1	3,918	4,623,081	6.2	668	3,390,499	1.7

*Includes Winnipeg and Brandon

High-cost users received a greater number of prescriptions for a greater number of different medications and use the health care system more often than non-high-cost users.

On average PHUs received close to 80 prescriptions in 2000/01 for 12 different types of medications (Table 4). In contrast, NHUs received nine prescriptions and three different medications over this same period. The duration of medication treatment was 7-8 times longer in PHUs than NHUs. The same pattern was observed for IHU prescriptions, but the difference from NHUs was of a lesser magnitude. The average cost of a prescription or medication days supply in the high-cost user groups was double the value in NHUs. Eighty percent of prescription costs in PHUs was paid by public insurance; this amount decreased to 73% in IHUs and 35% in NHUs.

In 2000/01, high-cost users had a greater number of physician visits, were hospitalized more often and stayed in hospital for a longer duration. In contrast to the prescription use patterns, it was the IHU group that had greater use of hospital services—the hospitalization rate was four times higher and days in hospital were six times higher than in NHUs.

In summary, PHUs and IHUs received a greater number of prescriptions for a greater number of different medications and use the health care system more often than NHUs.

Table 4: Prescription and health care use by user groups, 2000/01

	Prescription and Health Care Use by User Group				
				Ratios	
	Persistent High User (since 97/98)	Intermittent High User (since 97/98)	Not High User in 2000/01	PHU/not HU	IHU/not HU
Prescription Use					
Total prescription costs	$58,934,127	$74,651,081	$194,175,055	--	--
Percentage of total prescription costs	0.2	0.2	0.6	--	--
Number of prescriptions/person	78.5	57.9	8.7	9.0	6.7
Number of different medications/person	12.1	10.3	3.3	3.7	3.1
Number of defined daily doses/person	2371.3	1699.2	293.3	8.1	5.8
Number of prescribed daily doses/person	1936.7	1463.1	286.1	6.8	5.1
Average cost/prescription	48.2	54.9	30.2	1.6	1.8
Average cost/days supply	1.5	1.7	0.9	1.7	1.9
Percentage of prescription cost paid by public insurance	79.5	73.0	34.5	2.3	2.1
Health Care Use					
Average number of physician visits	24.7	23.7	8.8	2.8	2.7
Percentage seeing general practitioner only	20.5	21.7	50.2	0.4	0.4
Percentage seeing general practitioner & specialist	74.3	73.6	33.9	2.2	2.2
Average number of hospitalizations	1.0	1.1	0.3	3.5	3.8
Hospital days per user	6.9	7.7	1.2	5.5	6.2

3.2 What Drug Categories Account for Differences in Costs?

Nervous system medications, and medications to treat gastrointestinal disease and diabetes accounted for a greater share of expenditures in high-cost than non-high-cost users.

Approximately $15 million was spent in each of the high-cost user groups on drugs acting on the nervous system (Figure 2 and Table 5). Nervous system medications contributed to a greater share of prescription expenditures in PHUs (25%) and IHUs (22%), than in NHUs (17%). Medications to treat gastrointestinal disease and diabetes also accounted for a greater share of prescription expenditures in PHUs ($9 million or 16% of total costs) than NHUs ($21 million or 11% of total costs). Antineoplastic (cancer) medications accounted for a greater share of expenditures in IHUs (15%) than in NHUs or PHUs. However, the costs of prescriptions for cardiovascular drugs and antibiotics consumed more of the total prescription expenditures in NHUs than in the high-cost user groups.

Figure 2: Percentage of Total Prescription Costs by Drug Category Across User Groups

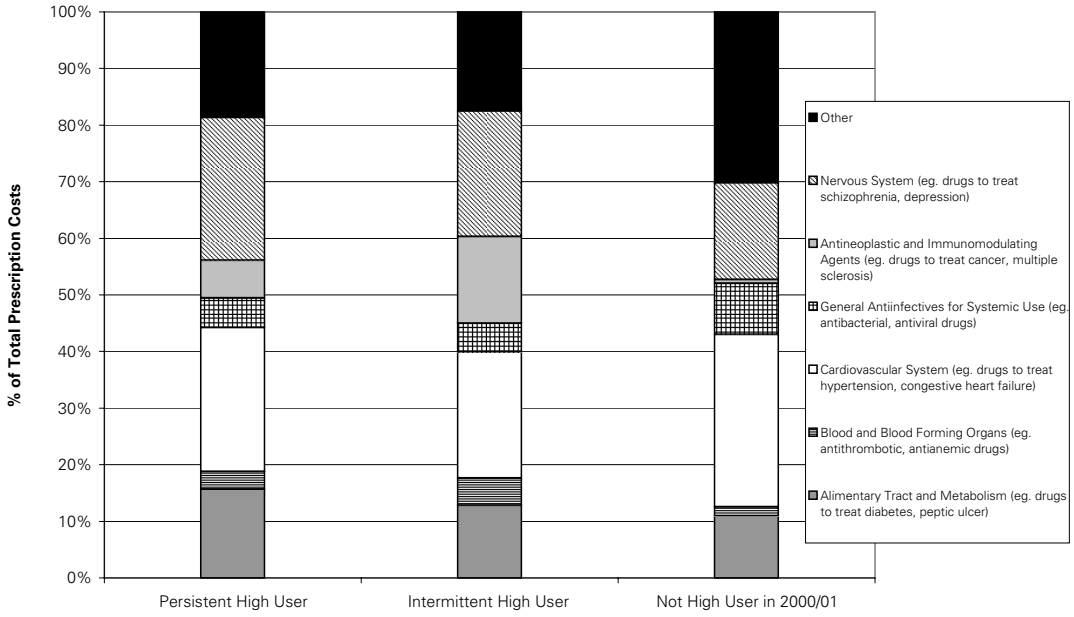


Table 5: Prescriptions costs and percentage of total cost by broad drug category across user groups, 2000/01

ATC (1st level) Drug Category	Persistent High User (since 97/98)		Intermittent High User (not High User since 97/98)		Not High User in 2000/01	
	Total $	%	Total $	%	Total $	%
A. Alimentary tract and metabolism	$9,240,834	15.7	$9,560,966	12.8	$21,241,219	10.9
B. Blood And blood forming organs	1,852,064	3.1	3,590,823	4.8	3,192,557	1.6
C. Cardiovascular system	14,969,869	25.4	16,633,870	22.3	59,060,028	30.4
D. Dermatologicals	484,126	0.8	637,909	0.9	6,030,633	3.1
G. Genito urinary system and sex hormones	1,079,472	1.8	1,316,325	1.8	14,343,955	7.4
H. Systemic hormonal preparations, excluding sex hormones	884,174	1.5	1,247,790	1.7	2,444,691	1.3
J. General antiinfectives for systemic use	3,089,794	5.2	3,790,277	5.1	17,493,928	9.0
L. Antineoplastic and immunomodulating agents	3,910,580	6.6	11,453,761	15.3	1,392,966	0.7
M. Musculo-skeletal system	2,732,811	4.6	3,779,183	5.1	13,087,512	6.7
N. Nervous system	14,893,205	25.3	16,539,932	22.2	33,193,405	17.1
P. Antiparasitic products, insecticides and repellents	145,889	0.2	135,982	0.2	420,309	0.2
R. Respiratory system	3,631,225	6.2	3,284,490	4.4	12,064,934	6.2
S. Sensory organs	880,917	1.5	952,606	1.3	5,044,677	2.6
V. Various	75,418	0.1	55,226	0.1	30,491	0.0
No assigned ATC code	1,063,748	1.8	1,671,940	2.2	5,133,749	2.6
Total	58,934,127	100.0	74,651,081	100.0	194,175,055	100.0

Table 6 divides the above broad drug categories (ATC first level) into more specific drug categories (ATC second level). Within these finer groupings, we note that drug categories that contributed to the greatest share of prescription expenditures in each cost group were:

- Drugs to treat peptic ulcer disease (antacids, histamine H2-receptor blockers, proton pump inhibitors) accounted for 9% of total costs in PHUs.
- Immunomodulating agents (interferon alpha and beta, filgrastim) accounted for 10% of prescription expenditures in IHUs.
- Drugs acting on the renin-angiotensin system (angiotensin converting enzyme inhibitors, angiotensinogen receptor blockers) accounted for 10% of prescription expenditures in NHUs.

Percent expenditures for immunomodulating agents were tenfold greater in intermittent high-cost users than other cost groups.

Medications to treat peptic ulcer disease contributed slightly more to expenditures in PHUs than NHUs. The only other gastrointestinal drugs whose costs were higher in PHUs than NHUs were the digestive enzymes. Percent expenditures for drugs acting on the renin-angiotensin system were moderately higher in NHUs than in the high-cost user groups. However, percent expenditures for immunomodulating agents were tenfold greater in IHUs than the other cost groups.

Although the nervous system category of drugs contributed to a greater share of prescription expenditures among PHUs and IHUs than NHUs, this was primarily due to the analgesics, antiepileptics, anti-Parkinson drugs and psycholeptics. The psychoanaleptics (or antidepressants) consumed similar shares of total expenditures among the user groups.

Table 6: Prescription costs and percentage of total cost by drug category across user groups, 2000/01

ATC (2nd level) Drug Category	Persistent High User (since 97/98)		Intermittent High User (not High User since 97/98)		Not High User in 2000/01	
	Total $	%	Total $	%	Total $	%
A02.Antacids, drugs for treatment of peptic ulcer and flatulence	$5,167,231	8.8	$5,227,316	7.0	$11,887,182	6.1
A03.Antispasmodic and anticholinergic agents and propulsives	392,807	0.7	276,543	0.4	759,457	0.4
A04.Antiemetics and antinauseants	161,430	0.3	402,923	0.5	312,950	0.2
A07.Antidiarrheals, intestinal antiinflammatory/antiinfective agents	477,885	0.8	611,478	0.8	1,467,679	0.8
A09.Digestives, including enzymes	315,286	0.5	66,752	0.1	84,909	0.0
A10.Drugs used in diabetes	1,832,386	3.1	1,918,530	2.6	5,722,305	2.9
A16.Other alimentary tract and metabolism	332,850	0.6	538,814	0.7	12,677	0.0
B01.Antithrombotic agents	1,259,518	2.1	2,268,161	3.0	2,853,698	1.5
B03.Antianemic preparations	579,568	1.0	1,303,724	1.7	282,099	0.1
C01.Cardiac therapy	1,470,813	2.5	1,551,129	2.1	4,016,155	2.1
C02.Antihypertensives	342,489	0.6	238,460	0.3	929,111	0.5
C03.Diuretics	517,297	0.9	599,224	0.8	2,486,917	1.3
C07.Beta blocking agents	908,569	1.5	1,146,103	1.5	5,125,439	2.6
C08.Calcium channel blockers	3,175,042	5.4	3,215,203	4.3	10,393,627	5.4
C09.Agents acting on the renin-angiotensin	3,723,923	6.3	4,772,706	6.4	19,357,772	10.0
C10.Serum lipid reducing agents	4,709,923	8.0	4,945,549	6.6	16,405,642	8.4
G03.Sex hormones and modulators of the genital system	557,002	0.9	765,277	1.0	12,261,929	6.3
G04.Urologicals	449,632	0.8	514,747	0.7	1,712,431	0.9
H01.Pituitary, hypothalamic hormones and	556,928	0.9	836,900	1.1	213,448	0.1
J01.Antibacterials for systemic use	1,409,592	2.4	1,520,075	2.0	15,899,548	8.2
J05.Antivirals for systemic use	1,556,094	2.6	2,091,805	2.8	877,527	0.5
L01.Antineoplastic agents	194,121	0.3	885,837	1.2	525,175	0.3
L02.Endocrine therapy	873,958	1.5	1,656,092	2.2	666,274	0.3
L03.Immunomodulating agents	606,269	1.0	7,429,240	10.0	37,880	0.0
L04.Immunosuppressive agents	2,236,233	3.8	1,482,593	2.0	163,638	0.1
M01.Antiinflammatory and antirheumatic products	1,902,506	3.2	2,727,804	3.7	10,165,725	5.2
M05.Drugs for treatment of bone diseases	477,768	0.8	695,386	0.9	1,961,767	1.0
N02.Analgesics	3,131,800	5.3	2,791,915	3.7	5,710,222	2.9
N03.Antiepileptics	1,591,230	2.7	1,695,847	2.3	2,725,994	1.4
N04.Anti-parkinson drugs	1,318,170	2.2	759,255	1.0	745,025	0.4
N05.Psycholeptics	4,690,716	8.0	5,373,103	7.2	6,296,612	3.2
N06.Psychoanaleptics	3,998,544	6.8	5,739,459	7.7	17,306,670	8.9
R03.Anti-asthmatics	2,970,541	5.0	2,873,659	3.8	9,356,342	4.8
R05.Cough and cold preparations	335,378	0.6	95,680	0.1	91,532	0.0
S01.Ophthalmologicals	870,822	1.5	940,420	1.3	4,815,387	2.5
Total	58,934,127	100.0	74,651,081	100.0	194,175,055	100.0

Within the above-mentioned high-cost drug categories, the following brand name drugs accounted for the highest costs (see Appendix III for full listing of brand name drugs):

- Among drugs to treat peptic ulcer disease in PHUs, the proton pump inhibitor Losec ®, accounted for 66% of costs in this group and 6% of all expenditures in PHUs. Expenditures for the other proton pump inhibitors, Pantoloc ® and Prevacid ®, were 9% and 7% respectively. Collectively the histamine H2-receptor blockers (ranitidine, nizatidine, famotidine and cimetidine) represented 15% of expenditures in this group. The majority of histamine H2-receptor blocker prescriptions were for generic products. Losec ® accounted for 64% and 48% of expenditures for peptic ulcer medications in IHUs and NHUs, respectively.

- Among the immunomodulating agents in IHUs, Betaseron ® (interferon beta used in multiple sclerosis) consumed 32% of expenditures in this group. The other multiple sclerosis drug, Rebif ®, accounted for 14% of expenditures. Neupogen ® (filgrastim), used to restore blood cell counts following antineoplastic drug therapy, represented 25% of prescription expenditures.

- Vasotec ® accounted for 24% of expenditures for drugs acting on the renin-angiotensin system in NHUs. Among the other angiotensin converting enzyme inhibitors, Monopril ® represented 11% and Altace ® represented 10% of expenditures. Vasotec ® accounted for 31% and 36% of expenditures for drugs acting on the renin-angiotensin system in IHU and PHUs, respectively.

3.3 Do Differences in Disease Prevalence Explain the Cost Differences?

The prevalence of various medical conditions, defined according to Extended Disease Clusters of the ACG classification system, was determined per user group. Chronic physical conditions requiring treatment with prescription medications were more prevalent in high-cost users than NHUs (Figure 3). Forty percent of high-cost users received health care for hypertension, in comparison to 14% of NHUs. Congestive heart failure was 11 times more common in high-cost users than NHUs (Table 7). A diagnosis of diabetes was present in 28% of PHUs, 23% of IHUs and 5% of NHUs. Chronic renal failure was also more common among PHUs. Health care for peptic ulcer disease was observed in 7% of high-cost users and 2% of NHUs.

Figure 3: Select Medical Conditions by User Groups, 2000/01

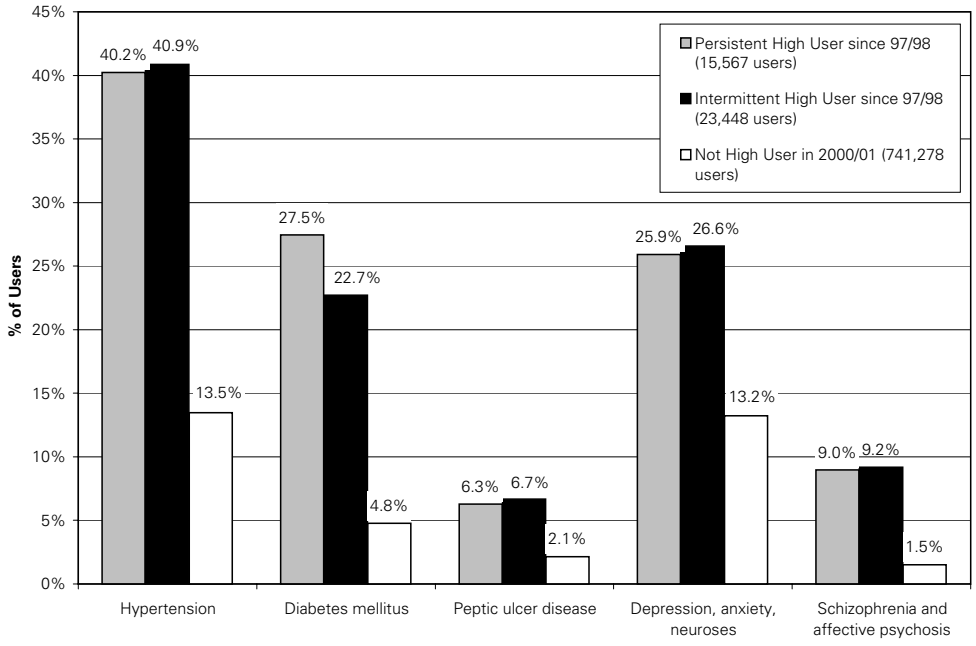


Table 7: More prevalent medical conditions by user groups, 2000/01

Percentage of Users Extended Disease Clusters	Persistent High User (since 97/98) (15,567 users)	Intermittent High User (since 97/98) (23,448 users)	Not High User in 2000/01 (741,278 users)	Ratios PHU/not HU	 NHU/not HU
Hypertension	40.2	40.9	13.5	3.0	3.0
Ischemic heart disease	26.1	22.2	3.2	8.0	6.8
Congestive heart failure	12.1	10.6	1.1	11.2	9.8
Cardiac arrhythmia	9.2	8.3	1.6	5.9	5.3
Diabetes mellitus	27.5	22.7	4.8	5.8	4.8
Gastrointestinal signs and symptoms	6.4	5.7	2.0	3.1	2.8
Peptic ulcer disease	6.3	6.7	2.1	2.9	3.1
Iron deficiency, other deficiency anemias	7.6	7.3	2.1	3.7	3.5
Low impact malignant neoplasms	7.6	9.4	2.4	3.1	3.9
Degenerative joint disease	16.3	15.7	4.6	3.5	3.4
Cerebrovascular disease	6.4	7.2	1.0	6.1	6.9
Depression, anxiety, neuroses	25.9	26.6	13.2	2.0	2.0
Schizophrenia and affective psychosis	9.0	9.2	1.5	5.9	6.0
Chronic renal failure	5.1	3.1	0.2	26.1	16.0
Emphysema, chronic bronchitis, COPD	12.4	10.3	1.9	6.6	5.5
Autoimmune and connective tissue diseases	5.3	4.8	1.1	4.7	4.3

Differences between user groups were also apparent for less prevalent medical conditions (Table 8). HIV/AIDS were 40 times more common in the high-cost groups than the NHU group. Conditions affecting the nervous system such as Parkinson's disease, were 20 times more common in PHUs than NHUs. Cystic fibrosis, a genetic disorder which requires treatment with digestive enzymes, was virtually non-existent in the IHU and NHU groups. Various cancers (neoplasms) and multiple sclerosis were the few conditions that were more common in IHUs than in NHUs or PHUs.

In addition, mental health conditions treated with prescription medications were also more common in high-cost users (Table 7). Health care for depression was recorded in one quarter of high-cost users in comparison to 13% of NHUs. Schizophrenia diagnoses were reported in 9% of PHUS and IHUs, but only in 1.5% of NHUs.

The higher prevalence of conditions in high-cost users relative to non-high-cost users explained the higher costs of medications used to treat these conditions (i.e., The higher prevalence of schizophrenia in high-cost users was consistent with greater costs for psycholeptics.)

In many instances, the higher prevalence of conditions in high-cost users relative to NHUs explained the higher costs of medications used to treat these conditions. For example, the higher prevalence of schizophrenia in high-cost users was consistent with greater costs for psycholeptics (Table 6). Peptic ulcer was more common in high-cost users and this translated into greater costs for peptic ulcer medications. The higher prevalence of neoplastic diseases and multiple sclerosis in IHUs explained the higher costs of medications to treat them (antineoplastic and immunomodulators). However, this was not the case for all conditions. Hypertension and congestive heart failure were much more common in high-cost users, but the percentage costs for cardiovascular medications was highest in NHUs. Further, diabetes was

more prevalent in high-cost users, but the percentage costs for antidiabetic medications were similar across the user groups. Discrepancies between cardiovascular disease prevalence and percentage medication costs are explored further in this report.

Table 8: Less prevalent medical conditions by user groups, 2000/01

Percentage of Users	Persistent High User (since 97/98)	Intermittent High User (since 97/98)	Not High User in 2000/01	Ratios	
Extended Disease Clusters	(15,567 users)	(23,448 users)	(741,278 users)	PHU/not HU	NHU/not HU
Cardiac valve disorders	1.5	1.6	0.3	4.7	4.9
Cardiomyopathy	1.4	1.0	0.1	12.7	9.5
Generalized atherosclerosis	0.9	0.9	0.1	9.6	9.5
Osteoporosis	3.8	3.9	1.1	3.3	3.5
Inflammatory bowel disease	1.8	1.6	0.4	4.6	4.1
Gastroesophageal reflux	3.6	3.6	0.6	5.9	6.0
Irritable bowel syndrome	0.4	0.3	0.1	3.7	3.3
Peripheral vascular disease	3.2	3.0	0.4	7.5	7.1
HIV, AIDS	0.3	0.2	0.0	37.3	33.0
High impact malignant neoplasms	1.8	3.4	0.5	4.0	7.5
Parkinson's disease	3.0	1.8	0.1	20.3	12.2
Seizure disorder	2.2	1.5	0.5	4.7	3.3
Multiple sclerosis	0.6	1.7	0.2	3.7	9.8
Muscular dystrophy	0.2	0.2	0.1	3.9	3.0
Dementia and delirium	1.1	2.5	0.3	4.5	9.8
Obesity	2.7	2.2	1.2	2.3	1.9
Personality disorders	1.6	1.5	0.2	6.4	6.2
Chronic ulcer of the skin	3.0	2.6	0.4	7.7	6.6
Chronic renal failure	5.1	3.1	0.2	26.1	16.0
Cystic fibrosis	0.2	0.0	0.0	1,246.6	122.6
Arthropathy	0.4	0.3	0.1	7.7	6.1
Adverse effects of medicinal agents	1.2	1.0	0.2	5.3	4.7

Table 5 and Table 6 report on the distribution of costs for specific therapeutic categories of medications by user group, which we have compared to the distribution of discrete medical conditions in order to determine whether medication costs can be explained by disease prevalence. What additional information can be gained by determining the total costs of medication therapy for persons with discrete medical conditions? Is there a better correlation between these total prescription costs and prevalence of the condition, than medication category prescription costs and prevalence of condition? Table 9 reports the total prescription costs for persons with select medical conditions listed in Table 7 and Table 8. We see that the share of total prescription costs for many conditions were indeed similar to the prevalence of that condition in high-cost users. For example, 40% of persons had hypertension and consumed 35% of prescription costs. Twenty-eight percent of PHUs had diabetes which translated into 26% of total prescription costs. Six percent of prescription costs were for persons with peptic ulcer disease, which accounted for 6% of the population.

Table 9: Prescription costs, average cost and percentage of total cost, by medical condition across user groups, 2000/01

	Persistent High User			Intermittent High User			Not High User		
Extended Disease Clusters	Average Cost per Person	Category Cost	% Total Cost	Average Cost per Person	Category Cost	% Total Cost	Average Cost per Person	Category Cost	% Total Cost
Hypertension	$3,422	$20,597,685	35.0	$2,660	$24,493,194	32.8	$626	$58,264,421	30.0
Congestive heart failure	3,736	6,739,464	11.4	2,863	6,837,816	9.2	870	6,482,614	3.3
Diabetes	3,731	15,326,113	26.0	2,774	14,210,515	19.0	674	22,224,025	11.4
Peptic ulcer	4,061	3,820,950	6.5	2,893	4,360,105	5.8	500	7,387,984	3.8
Depression	3,926	15,220,950	25.8	3,105	18,600,412	24.9	414	37,861,363	19.5
Schizophrenia	4,600	6,167,979	10.5	3,349	6,918,080	9.3	611	6,425,358	3.3
Cystic fibrosis	19,894	537,148	0.9	7,856	31,425	0.0	1,777	1,777	0.0
Multiple sclerosis	7,573	727,015	1.2	11,697	4,526,602	6.1	471	571,352	0.3
Chronic renal failure	5,342	4,075,777	6.9	4,110	2,897,876	3.9	878	1,183,293	0.6
Parkinson's	4,257	1,894,217	3.2	3,018	1,213,077	1.6	838	847,583	0.4
HIV/AIDS	13,164	552,894	0.9	9,138	511,707	0.7	487	25,304	0.0
Low or high impact neoplasms	4,030	5,678,181	9.6	4,528	13,067,384	17.5	539	10,740,188	5.5
Seizure disorder	4,211	1,364,448	2.3	3,448	1,196,622	1.6	490	1,567,263	0.8
Iron deficiency and other anemia	3,939	4,502,160	7.6	3,396	5,566,305	7.5	452	6,497,001	3.3

Let's explore the prescription cost differences between Table 9 and Table 5 or Table 6 more closely. Table 6 reports the costs for anti-diabetic medications to be $2 million in PHUs, while the prescription costs for PHUs with diabetes are $15 million in Table 9. The total costs for cardiovascular medications in Table 5 is $15 million for PHUs, which is less than the $20 million prescription costs reported for PHUs with hypertension in Table 9. It is important to note that Table 9 reports total prescription costs for persons with a specified disease, which would include the medication costs for any comorbid conditions. Thus, high-cost users may have a higher prevalence of diabetics with comorbid conditions whose total prescription costs exceed the costs of anti-diabetic medications. Similarly, more prevalent cardiovascular comorbidity in high-cost users may be translated into higher total prescription costs for persons with hypertension and congestive heart failure, but not necessarily higher costs for cardiovascular medications. This would explain why cardiovascular medications and anti-diabetics did not account for a greater share of prescription costs in high-cost users than NHUs, although the prevalence of cardiovascular disease and diabetes was much higher in these groups.

Medications in the high-cost user group to treat cystic fibrosis, multiple sclerosis and HIV/AIDS cost more than $10,000 per person in comparison to $3,000 to $4,000 for other conditions.

Table 9 has additional information of interest. The prescription costs for some conditions such as cystic fibrosis, multiple sclerosis, HIV/AIDS and cancer were disproportionately higher than the prevalence of these conditions. The annual cost of medications to treat cystic fibrosis, multiple sclerosis and HIV/AIDS was more than $10,000 per person in the high-cost user groups, in comparison to an annual cost of $3,000 to $4,000 for other conditions.

In sum, chronic conditions requiring treatment with prescription medications were more common in high-cost users relative to NHUs. This finding supports the statement that prescription cost differences can be attributed to underlying disease prevalence, but this is not the complete answer. With the exception of high-cost conditions like cystic fibrosis, multiple sclerosis, HIV/AIDS, cancer and schizophrenia, higher disease prevalence did not always translate into similarly high prescription costs in PHUs and IHUs. This discrepancy may be due to the effect of comorbidity in inflating prescription costs in high-cost users. We explore this explanation further in the next section by looking at the prescription cost of comorbidity.

3.4 Do Differences in Disease Burden (Comorbidity) Explain the Cost Differences?

More than three-quarters of the high-cost users had at least one major condition in comparison to 30% of NHUs. As shown in Table 10, the higher prevalence of major conditions in high-cost users included many different conditions, ranging from major infections and injuries to chronic medical conditions. PHUs had the highest prevalence of chronic medical conditions and IHUs had the highest prevalence of malignancies (neoplasms). Almost 100% of persons in all user groups had had at least one minor condition.

Table 10: Burden of medical condition by user groups, 2000/01

Percentage of Users	Persistent High User (since 97/98) (15,398 users)	Intermittent High User (since 97/98) (23,222 users)	Not High User in 2000/01 (734,917 users)	Ratios	
				PHU/not HU	NHU/not HU
Aggregated Diagnosis Groups					
Major	77.2	77.1	30.3	2.5	2.5
Minor	97.0	97.0	93.2	1.0	1.0
Aggregated Diagnosis Groups					
Major: Acute					
03 Time-limited major	11.6	11.7	3.3	3.5	3.6
04 Time-limited major (infections)	11.3	10.9	4.8	2.3	2.2
22 Major injuries/adverse effects	17.7	17.5	11.4	1.5	1.5
Major: Persistent					
09 Likely to recur (progressive)	12.2	12.4	1.7	7.0	7.1
11 Persistent medical (unstable)	60.3	55.2	12.2	4.9	4.5
16 Persistent specialty - orthopedic (unstable)	2.1	2.3	0.9	2.3	2.5
25 Psychosocial-persistent/recurrent (unstable)	12.9	14.2	2.6	5.0	5.5
32 Malignancies	10.3	13.1	3.2	3.2	4.0

Major ADGs include ADGS 3, 4, 9, 11, 16, 22, 25 and 32. ADGs 15 and 19 are no longer in use. ADG 31 (preventive and administrative) and ADG 34 (dental) are excluded.

* 172 people have no ADG information in the Persistent High Users group. Therefore 15,395 people were used for the Persistent High User analysis.

* 226 people have no ADG information in the Intermittent High Users group. Therefore 23,222 people were used for the Intermittent High User analysis.

* 6,361 people have no ADG information in the Not High Users group. Therefore 734,917 people were used for the Not High User analysis.

Table 11 reports the prevalence and associated prescription costs of multiple morbidity, firstly by grouping persons according to the number of different conditions (major and minor) they had and secondly, by level of comorbidity, based on the number of major conditions. About 50% of PHUs and IHUs had more than six different conditions, in comparison to 16% of NHUs. In addition, the annual prescription costs for persons with at least six different conditions were five to six times greater in high-cost than non-high-cost users. PHUs had higher annual prescription costs than IHUs. However, unlike in NHUs, annual prescription costs in high-cost users did not increase linearly with the number of different conditions. PHUs and IHUs with one condition had some of the highest prescription costs.

Table 11: Prescription costs, average cost and percentage of total cost, by comorbidity level across user groups, 2000/01

	Persistent High User				Intermittent High User				Not High User			
	% Population	Average Cost per Person	Category Cost	% Total Cost	% Population	Average Cost per Person	Category Cost	% Total Cost	% Population	Average Cost per Person	Category Cost	% Total Cost
Aggregated Diagnosis Group (ADG)												
0-1 ADGs	6.0	$3,878	$3,598,669	6.1	5.7	$3,629	$4,885,176	6.5	21.8	$148	$23,962,762	12.3
2-3 ADGs	18.6	3,645	10,571,600	17.9	19.3	3,276	14,805,670	19.8	38.8	212	60,910,138	31.4
4-5 ADGs	23.8	3,565	13,195,931	22.4	24.6	3,051	17,601,878	23.6	23.6	302	52,799,932	27.2
6-9 ADGs	35.6	3,787	20,978,645	35.6	36.2	3,133	26,567,128	35.6	14.0	453	47,031,559	24.2
10+ ADGs	16.0	4,241	10,589,282	18.0	14.2	3,238	10,791,228	14.5	1.8	698	9,470,663	4.9
Low Comorbidity (0-1 ADG)	62.7	3,594	35,099,210	59.6	62.9	3,075	45,351,939	60.8	92.8	237	162,854,438	83.9
Med Comorbidity (2-3 ADG)	31.7	4,005	19,789,919	33.6	31.7	3,348	24,902,217	33.4	6.6	577	28,129,788	14.5
High Comorbidity (4+ ADG)	5.5	4,703	4,044,998	6.9	5.4	3,479	4,396,925	5.9	0.6	737	3,190,829	1.6

Close to 40% of high-cost users had two or more major conditions in comparison to 7% of NHUs (Table 11). A high level of comorbidity was seen in 6% of high-cost users in comparison to less than one percent of NHUs. High-cost users in each level of comorbidity had higher annual prescription costs than NHUs, and PHUs had higher annual prescription costs than IHUs. Level of comorbidity (based on number of major conditions, including chronic medical conditions) did discriminate prescription costs within high-cost users, with the highest annual costs observed in persons with high comorbidity and the lowest prescription costs in the low comorbidity group.

In summary, our data show that a much greater percentage of high-cost users had more illness or more serious illness, based on the presence of multiple, major conditions. Further, the annual prescription costs for high-cost users with multiple conditions were considerably higher than their equivalents among non-high-cost users. These findings add support to the explana-

tion that the higher prescription costs for treating chronic disease in high-cost users is due to the added cost of treating more severe disease and/or associated comorbidity. Can this be attributed to a greater number of different medications?

Earlier, we reported that PHUs received on average, 12 different types of medications and IHUs received 10 different medications. NHUs received three different medications over this same period. What is the cost of taking multiple medications?

Over 90% of PHUs and 85% of IHUs took more than six different medications; in NHUs this proportion was only 16% (Table 12). If we count the number of persons taking 10 or more medications, the proportions were 65%, 51% and 4% of PHUs, IHUs and NHUs respectively. Among high-cost users, the overwhelming majority of prescription costs were consumed by persons taking multiple medications. For example 91% and 82% of prescription costs were attributed to persons with six or more different medications. Further, at $3,800 per year, the annual cost of polypharmacy (six or more different medications) was more than five times higher among PHUs than NHUs. Annual prescription costs increased linearly with the number of different medications in NHUs, but this was not the case in high-cost users. Within the latter, yearly costs for persons taking one or less medications were more than double those for persons taking 10 or more different medications. However, persons with these high annual prescription costs accounted for less than one percent of high-cost users, although they were more likely to be found in IHUs.

Comorbidity and comedication is more common in high-cost users. It is also more costly.

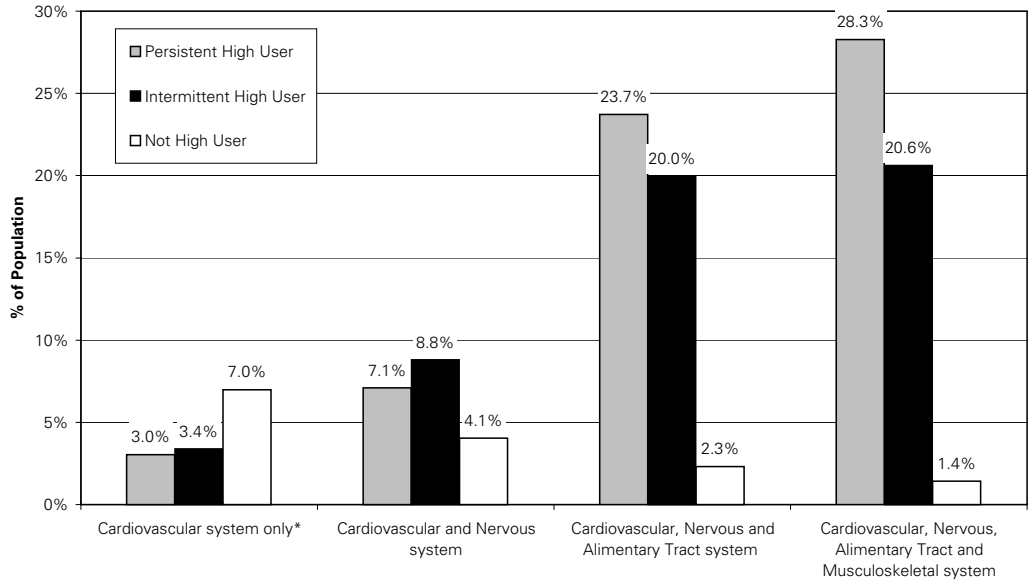
Table 12: Prescription costs, average cost and percentage of total cost by co-medication level across user groups, 2000/01

	Persistent High User				Intermittent High User				Not High User			
	% Population	Average Cost per Person	Category Cost	% Total Cost	% Population	Average Cost per Person	Category Cost	% Total Cost	% Population	Average Cost per Person	Category Cost	% Total Cost
Number of Different Medications												
0-1	0.3	$9,040	$461,022	0.8	0.6	$8,234	$1,152,810	1.5	29.66	$58	$12,661,929	6.5
2-3	2.6	4,072	1,616,723	2.7	4.2	4,248	4,154,389	5.6	36.52	168	45,525,599	23.4
4-5	6.0	3,585	3,323,416	5.6	10.2	3,388	8,080,767	10.8	17.55	378	49,109,791	25.3
6-9	26.5	3,243	13,378,553	22.7	34.4	2,976	23,973,299	32.1	12.63	647	60,594,381	31.2
10+	64.7	3,989	40,154,413	68.1	50.7	3,136	37,289,816	50.0	3.65	972	26,283,355	13.5
6+ Medications	91.2	3,772	53,532,966	90.8	85.1	3,072	61,263,114	82.1	16.28	720	86,877,736	44.7

Thus far we have learned that comorbidity and comedication is more common in high-cost users. It is also more costly. How does this information help us determine what type of comorbidity and what mix of medication accounts for higher prescription costs? We return to our ATC classification system to look at specific combinations of drugs in persons with cardiovas-

cular disease. This analysis was also undertaken to help us understand why prescription costs for cardiovascular drugs in high-cost users contributed to a lower share of total costs than in NHUs, yet prescription costs for persons with cardiovascular disease were proportionally higher in this group.

Figure 4: Percentage of Persons with Cardiovascular Comorbidity by User Groups, 2000/01



* no concomitant nervous, alimentary tract or musculoskeletal system diseases
Note: 38% of Persistent High User, 47% of Intermittent High User and 85% of Not High User had no cardiovascular disease.

Figure 4 reports the distribution of conditions concomitant with cardiovascular disease in each of the user groups, as defined by the ATC classification system. ATC categories characterize body systems according to prescription medications which act on these body systems, so this data also provide information on the mix of medications received. Unlike the findings in Table 7, persons were placed in mutually exclusive disease groups. Sixty-two percent of PHUs had at least one prescription for a cardiovascular condition in comparison to 53% of IHUs and 15% of NHUs. Three percent of PHUs received prescription medications for a cardiovascular condition alone, seven percent for cardiovascular and nervous system conditions, 23% for cardiovascular, gastrointestinal and nervous system conditions, and 28% for cardiovascular, gastrointestinal, musculoskeletal and nervous system conditions. This pattern of increased prevalence of level of cardiovascular comorbidity was also observed in IHUs (although the gradient was flatter), but the reverse was found in NHUs, such that the majority of NHUs received medication treatment for cardiovascular disease on its own. Although our focus was on cardiovascular comorbidity, we also observed that high-cost users were much more likely to have concurrent medication treatment for nervous system disorders and any other medical condition (81% of PHUs, 77% of IHUs and 32% of NHUs—data not shown).

Table 13: Prescription costs, average cost and percentage of total cost, by cardiovascular comorbidity across user groups, 2000/01

	Persistent High User			Intermittent High User			Not High User		
ATC (1st level) Combinations	Average Cost per Person	Category Cost	% Total Cost	Average Cost per Person	Category Cost	% Total Cost	Average Cost per Person	Category Cost	% Total Cost
Cardiovascular system only*	$2,911	$1,376,684	2.3	$2,491	$1,983,114	2.7	$452	$23,377,593	12.0
Cardiovascular and nervous system	3,113	3,436,888	5.8	2,630	5,423,920	7.3	649	19,481,098	10.0
Cardiovascular, nervous and alimentary tract system	3,645	13,463,900	22.8	2,974	13,927,976	18.7	902	15,458,284	8.0
Cardiovascular, nervous, alimentary tract and musculoskeletal system	3,984	17,537,651	29.8	2,935	14,184,998	19.0	1,007	10,659,770	5.5
Other disease clusters	3,922	23,119,004	39.2	3,534	39,131,074	52.4	198	125,198,310	64.5

* no concomitant nervous, alimentary tract or musculoskeletal system diseases

The share of prescription costs and annual prescription costs followed the prevalence patterns of increasing level of cardiovascular comorbidity (Table 13). Any cardiovascular comorbidity accounted for 61% of the prescription costs, 48% of the prescription costs and 36% of prescription costs in PHUs, IHUs and NHUs respectively. Other diseases accounted for 39%, 52% and 64% of prescription costs in PHUs, IHUs and NHUs. Persons with the highest level of cardiovascular comorbidity (cardiovascular, gastrointestinal, musculoskeletal and nervous system conditions) accounted for 30% and 19% of prescription costs in PHUs and IHUs, but only 6% in NHUs. Annual prescription costs for all levels of cardiovascular comorbidity were highest in PHUs.

This last analysis illustrates the prominence and prescription cost impact of cardiovascular comorbidity in the high-cost user group.

This last analysis illustrates the prominence and prescription cost impact of cardiovascular comorbidity in the high-cost user group. It also confirms that the higher costs of cardiovascular disease can be explained by the presence of comorbidity which is treated by many different medications. High-cost users, especially the PHUs, were more likely to have a higher level of cardiovascular comorbidity and to receive a greater mix of medications to treat the comorbidity. The concept of comorbidity-related mix of medications better differentiated prescription costs within the high-cost user groups than did number of conditions or number of different drugs, which were not linearly related to prescription costs. In contrast, persons with successively higher levels of cardiovascular comorbidity, treated with an increasingly greater mix of medications, had higher annual prescription costs than those with lower cardiovascular comorbidity. Thus, while comorbidity and comedication were more prevalent in high-cost users, these measures were not sufficient on their own to explain prescription costs in the high user groups. Rather, it was the greater mix of medications associated with cardiovascular comorbidity that identified a high-cost group of individuals which was uncommon in non-high-cost users.

3.5 Profile of a High-Cost User

In general we can state that persistent and intermittent high-cost users:

1. Consume a disproportionate share (40%) of prescription costs (Figure 4).
2. Use more prescription drugs (Table 4).
3. Use more health care services (Table 4).
4. Are older or close to death (Table 2).
5. Are lower income (Table 2).
6. Have chronic diseases such as hypertension and diabetes, which require drug therapy (Table 7).
7. Have mental health conditions such as schizophrenia and depression, which require drug therapy (Table 7).
8. Have multiple morbidities which require therapy with many different medications (Table 11 and Table 12).

These findings are consistent with the broader literature on high users of health care services, as well as with specific research on pharmaceutical expenditures. Regardless of the definition of high user or time period, numerous studies have shown that a small proportion of prescription users account for a substantial share of prescription costs (Thomas et al., 2001; Mueller et al., 1997; Hallas and Nissen, 1994; Isacson and Haglund, 1989). Our high-cost users used a greater share of prescription costs than the 30% of physician costs consumed by the top 5% of users of physician services in British Columbia (Reid et al., 2003). High-cost prescription users have commonly been characterized as the elderly or those close to death (Mueller et al., 1997; Stuart and Coulson, 1993; Isacson and Haglund, 1989). No other studies have studied the utilization of other health care services by high prescription users, but there is no reason to expect the pattern to be different from high users of physician services (Reid et al., 2003).

Chronic disease is a significant determinant of prescription medication utilization or costs, and high-cost users of prescriptions are more likely to have multiple chronic problems.

Chronic disease is a significant determinant of prescription medication utilization or costs, and high-cost users of prescriptions are more likely to have multiple chronic problems (Al Windi et al., 2004; Wrobel et al., 2003; Mueller et al., 1997). Compatible with this observation, and as we have reported, are findings by Thomas et al. (2001) that the highest cost users receive two and a half times the number of different medications than others. Further, high-cost pharmaceutical users are more likely to receive medications for diabetes, and cardiovascular and gastrointestinal conditions. Higher usage rates of antidepressants or higher rates of psychological distress have also been reported in frequent utilizers of health care (Kotzan et al., 2001; Thomas et al., 2001; Katon et al., 1990).

Not all high-cost users are the same. Persistent high-cost users differ from intermittent high-cost users in the following ways:

- PHUs take the greatest number of different prescription medications (Table 4).
- PHUs have the highest comorbidity, specifically cardiovascular comorbidity (Table 13).
- PHUs are more likely to have Parkinson's disease or cystic fibrosis which require treatment with expensive medications (Table 8 and Table 9).
- IHUs are more likely to have cancer or multiple sclerosis which require treatment with expensive medications (filgrastim, interferon beta) (Table 8 and Table 9).

Few studies have considered persistent high users separately from intermittent high users, (Coulson and Stuart, 1992; Isacson and Haglund, 1989) but like our study, there appear to be some important distinctions. The heaviest users of prescription medications tend to be persistent users (Coulson and Stuart, 1992). While some studies report higher usage rates of anti-diabetic agents or psychotropics in persistent high users, we found no appreciable differences between PHUs and IHUs in the cost contributions of these categories of drugs, although the total prescription costs of persons with diabetes were proportionally greater in PHUs (Isacson and Haglund, 1989). Generally, we could not find evidence that the greater prescription costs in persistent high-cost users relative to intermittent high-cost users were due to a higher prevalence of disease. However, cardiovascular comorbidity was more prevalent in PHUs.

High-cost users are high-cost users because they are sicker.

The important distinction between persistent and intermittent high-cost users in our study was that persistent users received a greater number of different medications. This finding is important because persistent high users contribute to 18% of prescriptions costs, costs which can be expected to recur in future years. In addition, it is important to know that cancer and multiple sclerosis are more common in intermittent users because intermittent high-cost use cannot be predicted from year to year.

In summary, we conclude as others have (Hallas and Nissen, 1994), that high-cost users are high-cost users because they are sicker. They also take multiple prescription medications for multiple chronic conditions. Thus, we have partially answered the question whether high prescription costs equal high prescription use. However, how much of this medication use is required to treat more illness? Are there other explanations for the higher prescription costs in higher cost users? In the next section, we investigate some of the other explanations, namely: 1) whether high-cost users use more expensive drugs than non-high-cost users, and 2) whether high-cost users are taking too many prescription medications.

3.6 Other Explanations for High-Cost Users: Do They Take More Expensive Drugs?

The following three categories of drugs were chosen for this analysis because they were major contributors to total expenditures in each user group: cardiovascular, gastrointestinal and central nervous system drugs. Within these categories, the average cost per days of therapy was compared across user groups for therapeutically similar drugs, defined by select ATC codes at the two and three digit level (Table 4). Two categories, renin-angiotensin system drugs and drugs for the treatment of peptic ulcer, contained drugs considered to be therapeutically equivalent.

Cardiovascular agents

The average cost per day for beta-blockers, calcium channel blockers, drugs acting on the renin-angiotensin system and serum lipid reducing agents ranged from $0.50 to $2.00. The cost of one day of therapy with serum lipid reducing agents was comparable across the user groups. However, average daily costs for beta-blockers, calcium channel blockers, renin-angiotensin system drugs was 1.2 to 1.4 times higher in PHUs than NHUs. The costs per day of these drugs for IHUs were in between PHUs and NHUs.

Central nervous system agents

In PHUs and IHUS, the average cost for antiepileptics, anti-Parkinson drugs, antidepressants and antipsychotics ranged from $1.50 to $4.00 per day. The cost of one day of therapy with these medications was closer to $1.00 in NHUs. This cost difference was in the magnitude of 2-4 times higher for antiepileptics, anti-Parkinson drugs, and antipsychotics; the cost difference was lower for antidepressants.

Gastrointestinal drugs

The daily cost of treating peptic ulcer with H2 antagonists or proton pump inhibitors was over $2.00 for PHUs and IHUs. This represented a 1.3-fold increase in the daily costs of the same treatment in NHUs.

Table 14: Average cost per days supply by select therapeutic category,* all users, 2000/01

Percentage of All Users	Persistent High User (since 97/98)	Intermittent High User (not High User since 97/98)	Not High User in 2000/01	Ratios	
				PHU/not HU	IHU/not HU
	Average $	Average $	Average $	$ only	$ only
Cardiovascular Drugs					
C07.Beta blocking agents	$0.7	$0.7	$0.5	$1.4	$1.3
C08.Calcium channel blockers	1.6	1.5	1.3	1.2	1.2
C09.Agents acting on the renin-angiotensin system	1.5	1.4	1.2	1.2	1.2
C10.Serum lipid reducing agents	2.1	2.1	1.9	1.1	1.1
Central Nervous System Drugs					
N03a.Antiepileptics	1.5	1.6	0.7	2.3	2.4
N04.Anti-parkinson drugs	2.4	1.9	0.9	2.6	2.0
N06a. Antidepressants	1.6	1.6	1.2	1.3	1.3
N05a. Antipsychotics	4.0	4.0	1.0	3.9	3.9
Gastrointestinal Drugs					
A02b.Drugs for treatment of peptic ulcer	2.3	2.2	1.7	1.3	1.3

*ATC 2nd and 3rd level

Table 15: Average cost per days supply by select therapeutic category,* high comorbidity users, 2000/01

Percentage of High Comorbidity	Persistent High User (since 97/98)	Intermittent High User (not High User since 97/98)	Not High User in 2000/01	Ratios	
				PHU/not HU	IHU/not HU
	Average $	Average $	Average $	$ only	$ only
Cardiovascular Drugs					
C07.Beta blocking agents	$0.6	$0.6	$0.5	$1.3	$1.2
C08.Calcium channel blockers	1.7	1.5	1.3	1.3	1.2
C09.Agents acting on the renin-angiotensin system	1.4	1.3	1.2	1.2	1.2
C10.Serum lipid reducing agents	2.1	2.1	1.9	1.1	1.1
Central Nervous System Drugs					
N03a.Antiepileptics	1.5	1.5	0.7	2.2	2.3
N04.Anti-parkinson drugs	2.7	1.8	1.2	2.2	1.6
N06a.Antidepressants	1.4	1.3	1.0	1.4	1.3
N05a.Antipsychotics	2.3	2.5	1.0	2.3	2.5
Gastrointestinal Drugs					
A02b.Drugs for treatment of peptic ulcer	2.5	2.3	1.8	1.4	1.3

*ATC 2nd and 3rd level

The cost analyses were repeated for persons with the same level of comorbidity to adjust for differences in complexity of disease (see Methods section). Table 15 reports average costs per days supply in high comorbidity users. With the exception of the antipsychotics, whose daily costs were higher in all users than in high comorbidity users, the daily costs of the above medications in PHUs and IHUs with high comorbidity were similar to those for all PHUs and IHUs. The cost differences between high and not high-cost users were also of a similar magnitude.

These analyses indicate that the higher average daily cost of therapeutically similar drugs in PHUs and IHUs cannot be explained by more complex disease. We recognize however, that our measure of comorbidity was not an optimal measure of disease severity, nor did our analyses indicate whether persons were initially tried on older, less expensive agents first. Use of higher cost medications may indicate switching to or adding second-line agents when initial treatment is not effective (Jobst and Holmes, 2004). However, there would be little justification for using one drug over another in the therapeutically equivalent renin-angiotensin system or peptic ulcer category of drugs. Thus, some of the higher average daily cost of therapeutically equivalent medications in the high-cost user groups can be attributed to initial selection of more expensive medications. Thomas et al. (2001) observed a $20 difference in the average cost per prescription for brand name drugs between very high and high-cost prescription users. In Section 2, we noted greater expenditures in persistent high-cost users than non-high-cost users for brand name medications, Vasotec ® and Losec ®. The cost per days supply of $2.17 for Vasotec ® was among the highest in the renin-angiotensin system category of drugs. Similarly at $3.08 per days supply, the daily cost of Losec ® was among the highest in therapeutically equivalent peptic ulcer drugs.

The higher daily cost of therapeutically equivalent medications in high-cost users can be attributed to selection of more expensive medications.

3.7 Other Explanations for High-Cost Users: Do They Take Too Many Drugs?

Although there is no "right" number of medications that a person should take, polypharmacy has been defined as taking more than six different medications per person. The rational for this definition is evidence that persons with six or more medications are at increased risk for medication-related adverse events (Veehof et al., 1999). Systematic reviews of the literature have identified polypharmacy as a risk factor for hospital readmission, prolonged hospital length of stay and mortality (Campbell et al., 2004). In this section we report on potential outcomes of polypharmacy in the following year, 2001/02, of persons who were and were not high users in 2000/01. Persons

who died in either year were excluded and for the reporting of hospital outcomes, persons admitted to personal care homes were also excluded. This left 15,188 persons in the PHU group, 22,894 in the IHU group and 735,100 NHUs.

In 2001/02, high-cost users were hospitalized on average, once yearly in comparison to an average of 0.2 hospitalizations in NHUs. High-cost users spent on average, one week in hospital, while NHUs stayed in hospital for one day.

Approximately 2% of high-cost users were institutionalized (admission to a personal care home or long-term care facility) in the following year, in comparison to 0.3% of NHUs (Figure 6). New admissions to home care occurred in approximately 8% of high-cost users and only in 1% of NHUs.

In summary, high-cost users in 2000/01 were hospitalized and institutionalized more often within the next year than NHUs. When hospitalized, they spent six additional days in hospital. Further, high-cost users were six times more likely to require home care in the following year.

Figure 5: Hospital Outcomes in 2001/02 by User Groups, All Users

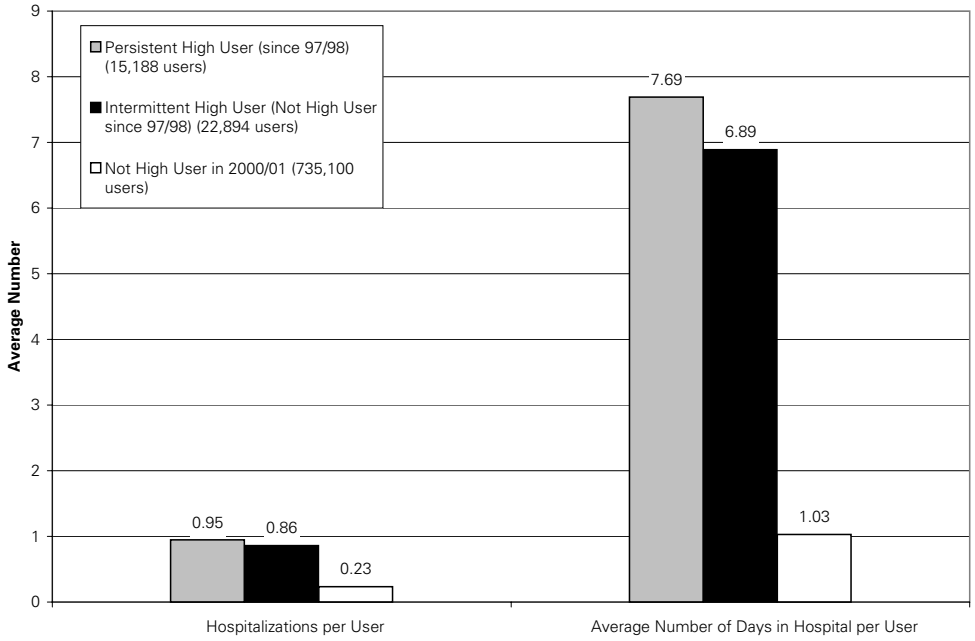
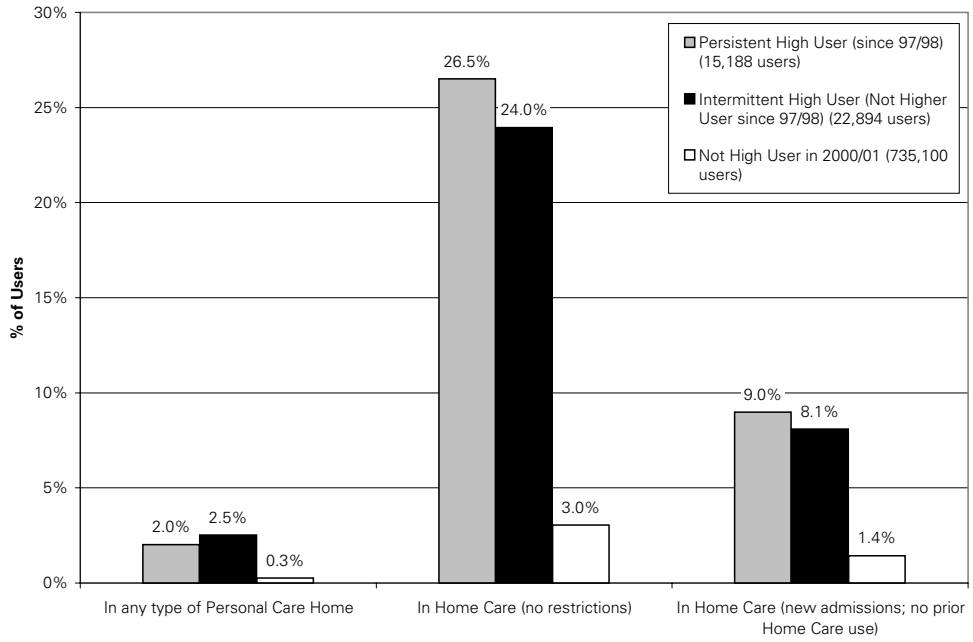


Figure 6: Personal Care Home & Home Care Outcomes of High-Cost Pharmaceutical Users 2001/02



Our data show that high-cost users were more likely than non-high-cost users to be elderly or to have higher comorbidity, which may explain the higher rates of health care use in the following year. Therefore, we needed to determine whether the higher rates of hospitalization and institutionalization in PHUs and IHUs were due to higher morbidity burden in these groups or due to problems and/or challenges in taking so many medications. As reported previously, PHUs consumed four times as many (average=12) and IHUs three times as many (average=10) different medications as NHUs. In an attempt to answer this question, we adjusted for the level of morbidity (see Methods section), such that results were reported in persons with the same level of morbidity. Here we report the outcomes of persons with high morbidity, which was defined as the presence of four or more major conditions. This analysis included 758 PHUs, 1,113 IHUs and 3,191 NHUs with high morbidity.

In persons with high morbidity, in 2001/02, hig-cost users were hospitalized on average, twice yearly in comparison to an average of 1.3 hospitalizations in NHUs (Figure 7). PHUs were hospitalized, on average, for 25 days; IHUs and NHUs stayed in hospital for 17 days. Approximately 5-6% of high-cost users were institutionalized within the year in comparison to 3.5% of NHUs (Figure 8). New admissions to home care occurred in approximately 13% of IHUs and NHUs, but 17% of PHUs. These outcomes did not change in each of the user groups when the analyses were repeated for persons with high comorbidity who were elderly (age greater than 60 years).

Figure 7: Hospital Outcomes in 2001/02 by High Comorbidity Users

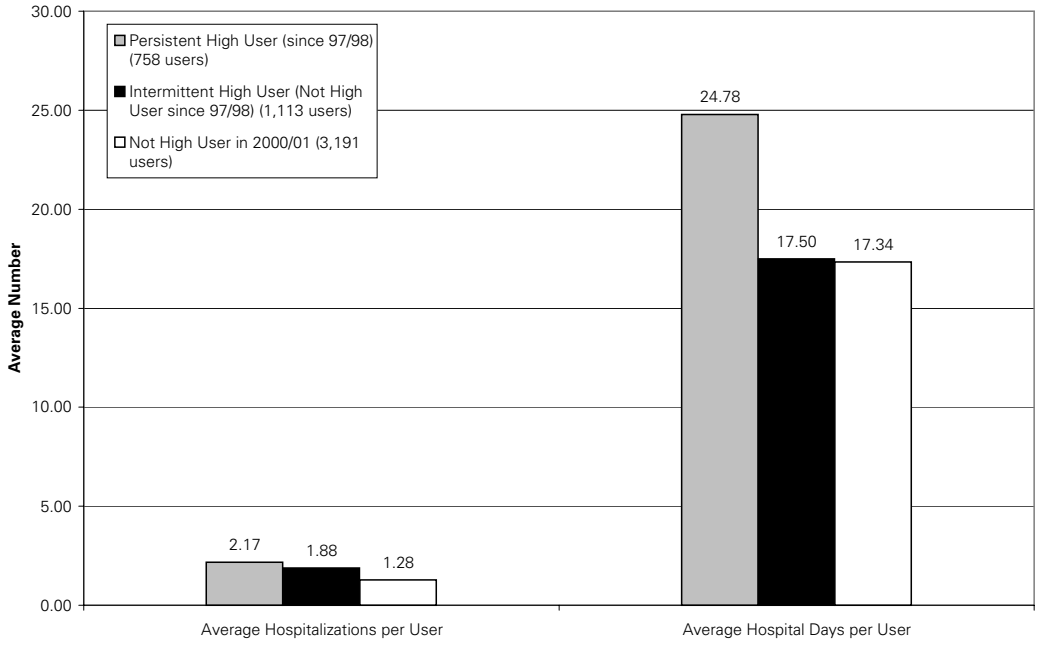
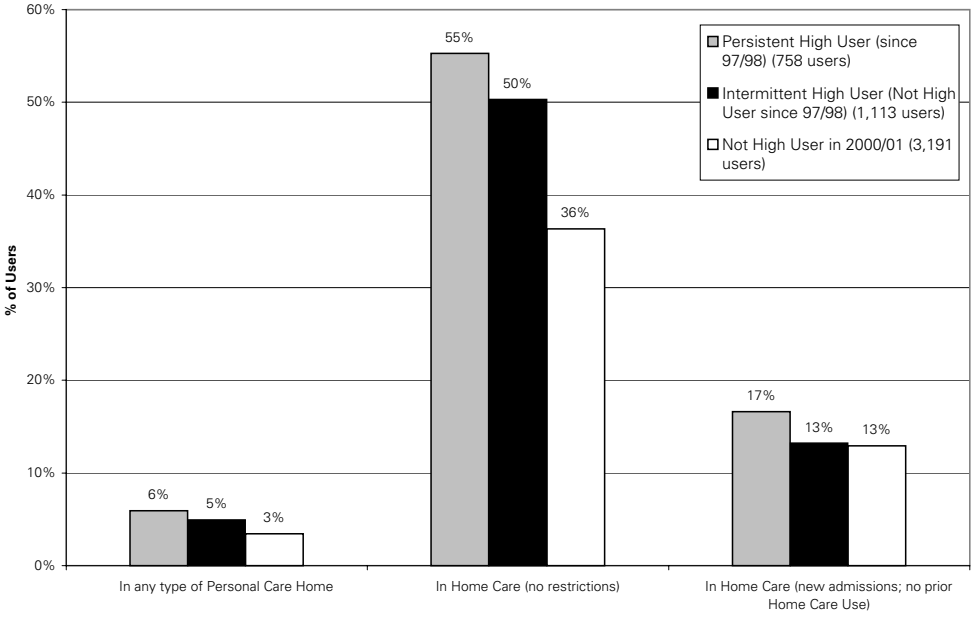


Figure 8: Personal Care Home & Home Care Outcomes in 2001/02 by High Comorbidity Users



Thus, hospital length of stay was comparable for IHUs and NHUs with high morbidity and a similar proportion in each group required home care within a year. However, PHUs spent an additional eight days in hospital and had a greater need for home care. These findings indicate that our report of poorer outcomes for IHUs relative to NHUs may be explained by their greater level of illness. PHUs had the worst health outcomes, which remained when adjustments were made and cannot be entirely explained by morbidity level. Among persons with high morbidity, PHUs took 18 different medications in comparison to NHUs which consumed nine different medications. However, IHUs received a similar number of different medications (n=15) to PHUs and their risk of poorer outcomes diminished in IHUs when adjustments were made.

Persistent high-cost users with higher comorbidity were at the greatest risk for poor outcomes.

In summary, health outcomes worsened in all user groups with a rise in level of comorbidity and number of prescription medications taken. However, PHUs with high comorbidity, taking a high number of different medications were at the highest risk for poor outcomes. Their morbidity burden may actually be higher than IHUs. Alternatively, they may have reached a critical point with respect to number of medications which led to a need for help from home or institutional care, or worse yet to a hospitalization for an adverse event.This explanation is compatible with Veehof et al.'s (1999) research which shows that adverse drug reactions are more common in elderly who used 14 different drugs than the elderly that used eight different drugs.

There are many reasons for polypharmacy: availability of many new drugs, shortened hospital length of stay, increased patient demand subsequent to Internet information, televisions and direct-to-consumer advertising, and increased patient expectations to improve quality of life. While the benefits of polypharmacy are questionable (Schumacher et al., 2003), improved treatment of conditions such as congestive heart failure, has been delivered at the expense of greater polypharmacy (Ledwidge et al., 2004). So polypharmacy may be here to stay and with medications such as antidepressants, is expected to be on the rise in Canada (Patten, 2004).

3.8 Opportunities for Intervention

We close our descriptive analysis of the high-cost prescription users with a look at some data which predict the future for high-cost users or offer opportunities for intervention. One analysis describes the characteristics of high-cost users over time and the other reports on the health utilization patterns of high-cost users which can be altered to improve outcomes.

Persons with annual prescription costs in the top 5% of expenditures have consumed a relatively constant share of total prescription expenditures, from 40.3% in 1997/98 to 40.8% in 2000/01. However, high-cost users have been increasingly taking more prescription medications. From 1997/98 to 2000/01, the average number of major conditions in high-cost users increased by 13%, while the average number of different medications increased by 14% (Figure 9). In 2000/01, high-cost users were taking one additional medication than they were four years earlier. Almost 90% of high-cost users met the criterion for polypharmacy—a 10% increase over four years (Figure 10). We note that the proportion of high-cost users who are older or who are low-income has slowly increased.

Figure 9: Major Conditions and Different Medications in High-Cost Users Over Time, 1997/98 - 2000/01

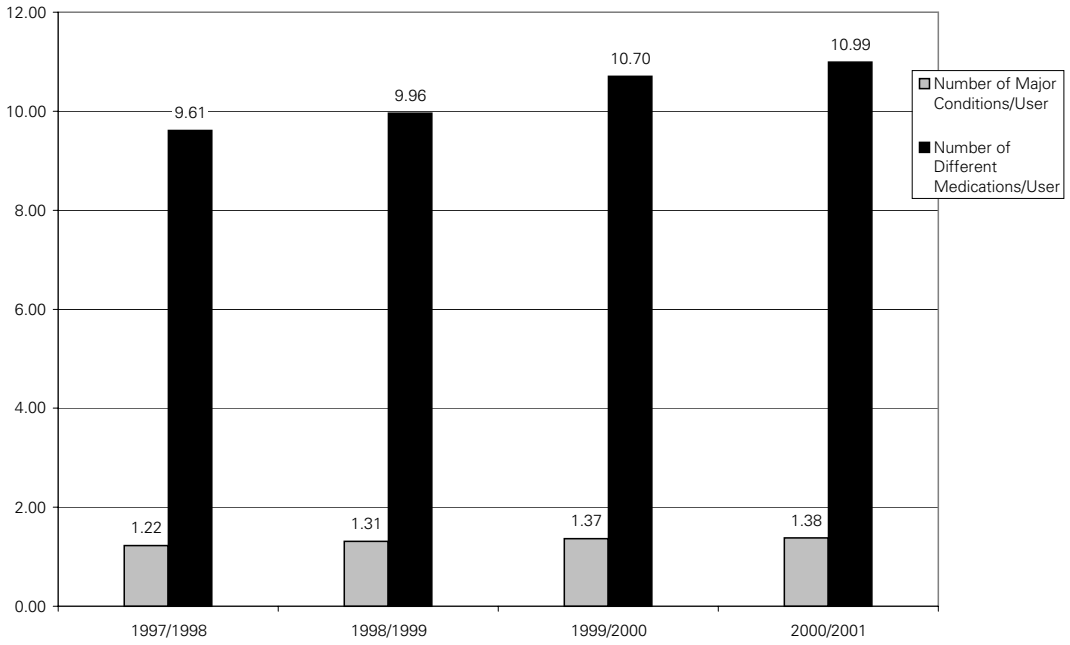
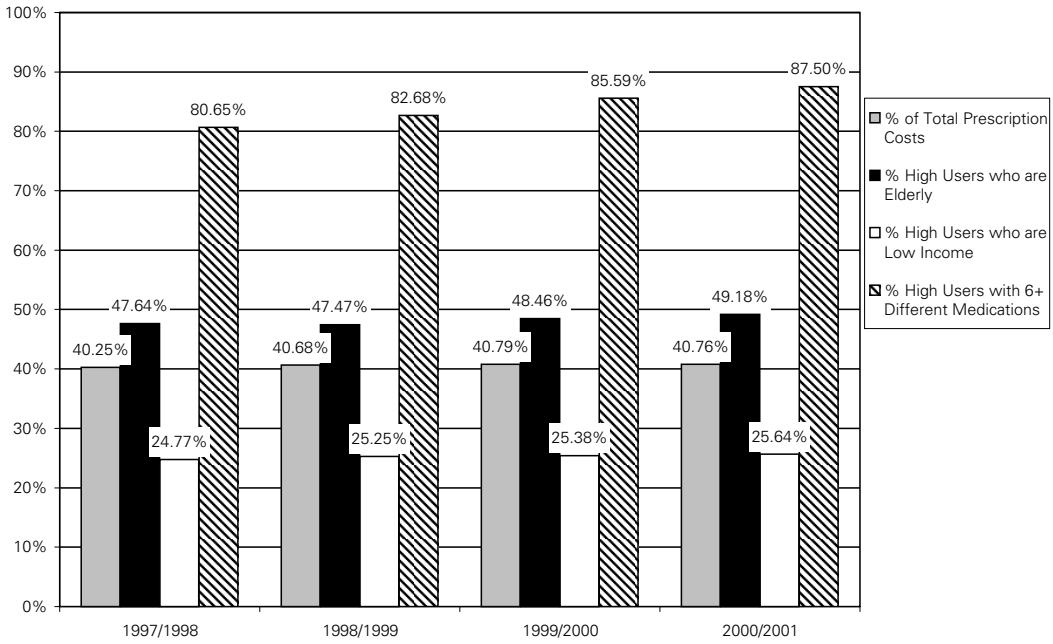


Figure 10: Characteristics of High-Cost Users Over Time, 1997/98 - 2000/01



Valuable information for policy-makers in the budget planning process is knowing that the utilization of multiple medications will continue to increase.

Similar trends in prescription costs have been reported by Thomas et al. (2001). They observed changes in consumption over time: 25% of prescription costs consumed by 1.5% and 6% of the population in 1997 and 2000, respectively. Others have also reported on the trends of increased medication use in seniors (Menec et al., 2002). We know that persons who take the greatest number of medications repeatedly fall into the high prescription costs categories. Knowing that the utilization of multiple medications will continue to increase is valuable information for policy-makers in the budget planning process.

Certain patterns of health care system utilization can be expected to exacerbate the negative outcomes of polypharmacy. Drug interactions have been reported to be more common among persons seeing multiple providers and multiple pharmacies (Davidson et al., 1994; Tamblyn et al., 1996). Among high-cost users, the use of multiple physicians and multiple pharmacies increases the risk of receiving concomitant SSRI therapy (Kotzan et al., 2001). In our study, close to 50% of high-cost users saw three or more primary care physicians in 2000/01 in comparison to 29% of NHUs. With respect to number of different pharmacies frequented, the percentage was 20% of high-cost users and 11% of NHUs.

Few differences were observed in the extent of hospitalization, institutionalization or home care use between all prescription users and those seeing multiple family practitioners in any of the user groups. However, Table 16

shows us that utilization of multiple family practitioners was associated with more days in hospital. Among high-cost users, the hospital length of stay increased by two to three days in persons seeing three or more family practitioners. In NHUs, length of stay was increased by almost one day. Independent of comorbidity level, the pattern of seeing three or more family practitioners was associated with an additional day in hospital for each user group. Obtaining prescriptions from three or more pharmacies was also associated with an extended hospital stay in our study, but this was attributed to higher rates of specialist use among persons visiting multiple pharmacies.

Table 16: Hospital length-of-stay by physician use patterns and comorbidity level among user groups, 2001/02

Average Number of Days in Hospital per User	Persistent High User (since 97/98)	Intermittent High User (Not High User since 97/98)	Not High User in 2000/01	Ratios	
				PHU/not HU	IHU/not HU
All comorbidity					
All persons	7.7	6.9	1.0	7.5	6.7
Persons seeing 3+ FPs*	10.7	9.3	1.7	6.1	5.3
High comorbidity					
All persons	24.8	17.5	17.3	1.4	1.0
Persons seeing 3+ FPs*	26.3	18.5	18.8	1.4	1.0

*FP = Family Practitioner

The physician utilization patterns of high prescription cost users are worrisome. They were almost twice more likely to visit multiple family practitioners, a health care use pattern which was found to be associated with extended hospital stay. While medication problems on admission could have contributed to increased hospital length of stay, our outcome measures were not sufficiently sensitive to detect medication therapy problems secondary to the use of multiple care providers that have been reported in the literature. Having said this, our data seem to indicate that consulting fewer family practitioners may lead to improved health outcomes in high prescription cost users.

3.9 The Transition to High-Cost User: Results of the Case-Control Study

In this section of the report, we describe results from the case-control study to identify factors which explain the transition from non-high-cost user to high-cost user. As noted previously, cases were individuals who were not high users in 1997/98–1999/2000 but were new (i.e., first-time) high-cost users in 2000/01. Controls were individuals who were not high-cost users in any of the years from 1997/98 to 2000/01. Four controls were matched to

each case on the basis of age (in 2000/01) and sex. Cases and controls were continuously resident in the province from 1997/98 to 2000/01. A total of 7,548 cases were identified, and were matched to 30,192 controls.

In the first set of analyses, measures of health care use in 1997/98–2000/01 were compared for cases and controls. Table 17 shows the number and percentage of cases and controls who used different types of health services in this four-year period. A higher proportion of cases than controls had contact with home care, hospitals, and physicians even three years before becoming high users. A higher percentage of cases than controls used multiple drugs and saw multiple practitioners in the three years prior to becoming high-cost users. However, for all measures with the exception of home care, there was a sharp increase the year prior to the transition to the high-cost category.

Table 17: Frequency distribution of cases and controls by measures of health care use, 1997/98 - 2000/01

	Cases (N=7,548)		Controls (N=30,192)	
	N	%	N	%
One or More Home Care Contacts				
1997/98	1,520	20.1	2,104	7.0
1998/99	1,617	21.4	2,253	7.5
1999/2000	1,614	21.4	2,248	7.4
2000/01	1,622	21.5	2,259	7.5
One or More Hospitalizations				
1997/98	1,072	14.2	2,522	8.4
1998/99	1,321	17.5	2,821	9.3
1999/2000	2,120	28.1	3,000	9.9
2000/01	2,650	35.1	3,375	11.2
7+ Hospital Days				
1997/98	483	6.4	915	3.0
1998/99	650	8.6	1,112	3.7
1999/2000	1,348	17.9	1,282	4.2
2000/01	1,750	23.2	1,675	5.5
7+ Physician Visits				
1997/98	4,258	56.4	10,717	35.5
1998/99	4,791	63.5	11,626	38.5
1999/2000	5,758	76.3	12,236	40.5
2000/01	6,403	84.8	12,906	42.7
3+ Different Physicians				
1997/98	3,975	52.7	11,350	37.6
1998/99	4,413	58.5	12,063	40.0
1999/2000	5,320	70.5	12,877	42.7
2000/01	5,726	75.9	13,666	45.3
6+ Different Medications				
1997/98	2,872	38.0	4,751	15.7
1998/99	3,475	46.0	5,518	18.3
1999/2000	4,935	65.4	6,517	21.6
2000/01	6,297	83.4	7,475	24.8

We fit two logistic regression models to these data to determine the relative importance of the association between type of users (i.e., case/control) and either current use (i.e., use in 2000/01) or prior use (i.e., use in 1997/98–1999/2000). We included two other variables that may influence use: region of residence (urban, rural south, rural north) and income quintile. Comorbidity (based on 2000/01 data) was also included in these models. Results for these models (not shown) revealed that the odds of being a high-cost user were greater for individuals with higher current health care use or with higher prior health care use, even after controlling for differences in comorbidity and sociodemographic characteristics.

The second set of models was used to focus specifically on new use of health services in the year prior to becoming a high-cost user. As the previous longitudinal analyses showed, this appeared to be a transition point for a change in use among many individuals in the high use group.

Descriptive analyses are found in Table 18. Compared to the age and sex matched controls, cases were more likely to be new (i.e., first-time) users of home care, hospitals, and of a high number of drugs in the year before they became high-cost users. They were also more likely to be long-stay patients in hospital in the year prior to the transition to the high user group.

Table 18: Frequency distribution of cases and controls by measures of new health care use in 1999/2000

	Cases (N=7,548)		Controls (N=30,192)	
	N	%	N	%
New home care use	483	6.4	624	2.1
New hospital use	1,273	16.9	1,979	6.6
New hospital long-stay use	779	10.3	755	2.5
New high physician use	1,088	14.4	3,365	11.1
New high drug use	990	13.1	1,294	4.3

Two logistic regression models were applied to the data (Table 19). Model 1 included the following explanatory variables: (a) new home care use, (b) new hospital use, (c) new physician use, and (d) new high drug use. Model 2 included all of the same predictors with the exception of new hospital use, which was replaced with new hospital long-stay use. Both models also included region of residence and income quintile. Each of these models was applied to the data for each comorbidity category (i.e., low, moderate, and high comorbidity). For comorbidity, 59.1% of cases and 86.8% of controls were in the low comorbidity group, 34.0% of cases and 8.5% of controls were in the moderate comorbidity group, and 6.1% of cases and 1.1% of controls were in the high comorbidity group.

Table 19: Logistic regression results for measures of new health care use in 1999/2000 for cases and controls

	Low Comorbidity (N = 30,683)		Moderate Comorbidity (N = 6,120)		High Comorbidity (N = 797)	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Model 1:						
New home care	2.04*	1.71 - 2.44	1.55*	1.25 - 1.92	1.31	.70 - 2.43
New hospital use	2.47*	2.23 - 2.75	1.46*	1.26 - 1.69	1.87*	1.22 - 2.87
New high physician use	1.16*	1.06 - 1.28	1.22*	1.04 - 1.43	1.15	.74 - 1.80
New high drug use	1.46*	1.31 - 1.62	1.17	1.00 - 1.37	1.33	.87 - 2.04
Model 2:						
New home care	1.76*	1.45 - 2.12	1.44*	1.16 - 1.80	1.30	.69 - 2.45
New hospital long-stay use	4.07*	3.48 - 4.79	1.79*	1.49 - 2.15	1.65*	1.03 - 2.64
New high physician use	1.23*	1.12 - 1.35	1.24*	1.06 - 1.45	1.26	.82 - 1.96
New high drug use	1.51*	1.36 - 1.67	1.17	1.00 - 1.37	1.30	.85 - 2.00

Note: Odds ratios with * are statistically significant. Odds ratios for both models are adjusted for income and region of residence. Cases and controls were matched on age and sex.

The analyses show that the odds of being a high-cost user were greater for new users of home care with either low or moderate comorbidity. The odds of being a high-cost user were higher for individuals who were new users of hospitals and new hospital long-stay users irrespective of the level of comorbidity, and for new high users of physicians in both the low and moderate comorbidity categories. The odds of being a new high-cost user were greater for individuals who were new high users of prescriptions only when the level of comorbidity was low.

In the last set of analyses we compared continuing and non-continuing high-cost users on measures of new health care use for 1999/2000. As noted previously, continuing high users were individuals who remained in the high-cost group in 2001/02 while non-continuing user transitioned back into the group that did not have high costs. Table 20 shows the number and percentage of continuing and non-continuing users who were new users of health services. These reveal few differences between the two groups. This is confirmed by the results of the logistic regression analyses (Table 21) which show that the only significant differences were for new home care use and new hospital long-stay use. The odds of being a non-continuing high-cost user were lower for individuals with low comorbidity who were new home care users or new hospital long-stay users.

Table 20: Frequency distribution of continuing and non-continuing high users by measures of new health care use in 1999/2000

	Continuing High Users (N=3,550)		Non-Continuing High Users (N=4,008)	
	N	%	N	%
New home care use	286	7.1	206	5.8
New hospital use	699	17.4	586	16.5
New hospital long-stay use	454	11.3	333	9.4
New high physician use	582	14.5	520	14.6
New high drug use	792	19.8	729	20.5

Table 21: Logistic regression results for measures of new health care use in 1999/2000 for continuing and non-continuing high users

	Low Comorbidity (N = 4,461)		Moderate Comorbidity (N = 2,568)		High Comorbidity (N = 461)	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Model 1:						
New home care	1.41*	1.05 - 1.88	1.08	.80 - 1.44	1.39	.69 - 2.81
New hospital use	1.01	0.85 - 1.20	1.14	.92 - 1.40	1.17	.73 - 1.88
New high drug use	0.98	0.84 - 1.13	0.91	.75 - 1.12	0.76	.45 - 1.30
Model 2:						
New home care	1.28	0.95 - 1.73	1.07	.80 - 1.44	1.39	.67 - 2.87
New hospital long-stay use	1.33*	1.05 - 1.69	1.14	.90 - 1.45	1.09	.64 - 1.86
New high drug use	0.95	0.82 - 1.11	0.92	.75 - 1.12	0.79	.46 - 1.33

Note: Odds ratios with * are statistically significant. Odds ratios are adjusted for income, region of residence, age group, and sex. Non-continuing high users are the reference group.

The study located transition points in the receipt of health care which increased the likelihood of a person becoming a high-cost user. These events can also be viewed as opportunities for intervention.

In summary, we were able to locate transition points in the receipt of health care which increased the likelihood of a person becoming a high-cost user. While health care use increased progressively for all prescription users, increases in hospitalization among high-cost users were substantial in the year before high-cost use. Moreover, high-cost users were more likely than non-users to be hospitalized, to be hospitalized for a longer time period or to receive home care for the first time in the year prior to high use. We and others have documented that hospitalization and home care is a predictor for future institutionalization (Kozyrskyj et al., 2003; Glazebrook et al., 1994; Liu et al., 1991). However, these events can also be viewed as opportunities for intervention. They provide the time, physical and human resources for conducting medication reviews and discontinuing unnecessary medications.

3.10 Policy Implications of Our Report

This report has significance to pharmaceutical policy-makers who struggle to offer access to needed pharmaceuticals in an environment of rising prescription costs and constrained budgets. We note that 75% or more of prescription expenditures for high-cost users in Manitoba are reimbursed by provincial drug programs. Here are several important characteristics of high-cost users:

- The daily costs of therapeutically equivalent medications are greater in high-cost users.
- High-cost users are overwhelmingly characterized by a significant burden of illness. They have chronic disease comorbidity for which they take multiple medications. Of note, persistent high-cost users took on average, 12 different medications per year. This number is expected to increase.
- Not all high-cost users are the same. 18% of total prescription costs were driven by persistent high-cost users and 23% of costs by persons with intermittent high costs. The latter included a high proportion of persons with cancer and other immunopathologic conditions, who are treated with high-cost biotechnology drugs.

How do these findings translate into actionable messages:

- Cost savings are achievable by maximizing use of therapeutically equivalent medications which are less expensive. Manitoba Pharmacare has proceeded in this direction by introducing the lowest cost alternative drug reimbursement policy. This policy will also benefit persons paying out-of-pocket for their prescriptions.
- Beyond maximizing use of less expensive, therapeutically equivalent medications, improved efficiency in the use of pharmaceuticals is likely to be found through medication management programs which focus on delaying disease progression and optimizing disease control with the minimum number of medications.
- While both persistent and intermittent high-cost users are candidates for medication management, strategies are needed to address reimbursement of new biotechnology products as they are developed to treat cancer and other immunopathologies in intermittent high-cost users. These strategies may include consultation with external technology assessments to guide formulary decisions and monitoring of product use according to treatment criteria.

It is reassuring that a large share of prescription medications are being used for persons who need them.

It is reassuring that a large share of prescription medications are being used for persons who need them, and that these persons also have greater access to other health care services. However, health care providers and managers are in a position to improve the health of high-cost users in the following ways:

- While high-cost users may be appropriately using health care services, the use of multiple medications places them at risk for poor health outcomes and increases the demand for future health care. Continuous care with fewer primary care providers may decrease this risk.
- Improved patient care and efficiency in the use of pharmaceuticals is likely to be found through disease management interventions which integrate multidisciplinary care for a broad range of conditions, including mental health problems. These primary health care teams need not be located at one site, but need to include collaboration between physicians, pharmacists, home care nurses and other providers.
- Health care providers should take advantage of transition points to high-cost use as opportunities to improve pharmacotherapy and reduce unnecessary medication use. These transition points include long stay hospitalizations and home care.

GLOSSARY

Adjusted Clinical Group (ACG)
The Adjusted Clinical Group (ACG) case-mix adjustment system characterizes clinical conditions from ICD9 diagnoses extracted from physician reimbursement claims and hospital discharges.

Age group
Using age groups were selected: 0-18 years, 19-29 years, 30-44 years, 45-59 years, 60-74 years and 75+ years, as determined by age at the end of the calendar year (December). These age groups were selected to facilitate comparison with Reid et al. (2003) descriptions of high-cost users of health care.

Cardiovascular comorbidity
Using the ATC classification, persons were classified by increased level of cardiovascular comorbidity on the basis of receiving at least one medication for the following categories of conditions: cardiovascular; cardiovascular and nervous system; cardiovascular, nervous and alimentary tract system; and cardiovascular, nervous, alimentary tract and musculoskeletal system. All persons with at least one prescription for a cardiovascular system drug were selected and then placed in the above mutually exclusive categories. The remainder of persons was classified as not receiving treatment for cardiovascular conditions.

Comorbidity level
Aggregated diagnosis groups (ADGs) of the ACG classification system were used to classify comorbidity. Low comorbidity were persons with 0-1 major ADGs, medium comorbidity were persons with 2-3 major ADGs and high comorbidity included persons with four or more ADGs.

Days of medication therapy
Two estimated average days of therapy were reported: Number of Defined Daily Doses (DDD) per user-year and Number of Prescribed Daily Doses (PDD) per user-year. The DDD is the assumed average maintenance dose per day for a drug used for its main indication. The PDD is the average daily amount that is actually prescribed.

Different medications
Defined at the 4th level of the Anatomical-Therapeutic-Chemical (ATC) classification system to denote chemical/therapeutic/pharmacological subgroup not the drug molecule.

Discrete medical condition
The definition for Extended Disease Cluster (EDC) in the ACG classification system was applied to group diagnosis codes that represented discrete clinical conditions or problems, for example hypertension, diabetes and schizophrenia.

Drug category
The Anatomical-Therapeutic-Chemical (ATC) classification system was used to define drug categories. Drug categories ranged from broad categories of body systems in which drugs are used (ATC 1st level) to more specific chemical/therapeutic/pharmacological categories of drugs (ATC 4th level).

Family practitioner
Physician specialty of general practice or primary care, as recorded in the physician supply database which identifies the physician specialty classification.

Gender
Female or male as reported in the Manitoba Health registry.

Home care
Persons registered as home care clients in the Manitoba Support Services Payroll database. We identified individuals as new clients if they were not registered for home care in the year prior.

Hospitalizations
Persons discharged from a Manitoba hospital. We identified new hospitalizations if there were no hospital discharges in the year prior.

Hospital Days
Length of stay for a hospitalization. We identified new hospital days if there were no hospital discharges in the year prior.

Income quintile
Postal code of residence classified by income quintile. The income quintile measure was derived from Canada Census 1996 data by aggregating household income to the enumeration area and ranking neighbourhoods from 20% of the population residing in the lowest income neighbourhoods to 20% residing in the highest income neighbourhoods.

Major/minor condition
Aggregated diagnosis groups (ADGs) of the ACG system were used to count the number of conditions and to define conditions as major or minor on the

basis of resource use and clinical outcomes. Major ADGS included the following: ADG3, ADG4, ADG9, ADG11, ADG16, ADG22, ADG25, ADG32.

Mortality status
Mortality status as recorded in the Manitoba Department of Vital Statistics.

Personal care home/long-term care
Persons admitted or panelled (on waiting list) to a Personal Care Home or long-term care facility, as recorded in the Personal Care Home file. We identified individuals as new clients if they were not registered in the Personal Care Home file in the year prior.

Physician visits
Physician care as recorded in physician reimbursement claims records, which includes office visits, calls and special tests.

Polypharmacy
Persons taking six or more different medicaitons per year.

Prescription cost
Total cost (ingredient cost plus professional fee) of prescription recorded in the DPIN prescription database. Costs for prescriptions not reimbursed by Pharmacare or Family services were imputed using a formaula described in the MCHP concept dictionary.

Prescriptions
Any prescription dispensed in a retail pharmacy and recorded in the provincial prescription database (Drug Programs Information Network). This includes prescriptions paid out-of-pocket and prescriptions reimbursed by Manitoba's Pharmacare and Family Services drug insurance programs, by federal drug insurance programs such as Health Canada and Veteran Affairs, and by private drug insurance programs.

Public insurance
Prescriptions reimbursed by Manitoba's Pharmacare (post-deductible level only) and Family Services drug insurance programs, and by federal drug insurance programs such as Health Canada and Veteran Affairs. Costs prior to a person's deductible level were defined as not being paid by public insurance.

Specialist
Physician specialty of specialist, as recorded in the physician supply database which identifies the physician specialty classification. This included physicians in the area of psychiatry, O&G, medical specialty (internal, neurology, geriatrics, rheumathology, dermatology), oral surgery, and surgery specialist (thoracic & cardio, plastic, urological, orthopaedic, neurological, ophthalmology, otorhinnolaryncology).

Urban/rural location
Postal code of residence classified by urban region (Winnipeg, Brandon), the rural north (Nor-Man, Churchill, Burntwood) and the rural south (Central, North Eastman, South Eastman, Interlake, Parkland, Assiniboine (Marquette and South Westman).

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APPENDIX A: ANNUAL PRESCRIPTION COSTS

Appendix Table A.1: Annual prescription costs divided into five-percentile groupings, 1997/2000

	1997/98	1998/99	1999/2000	2000/01
Percentile	Average Annual Cost	Average Annual Cost	Average Annual Cost	Average Annual Cost
0-5	6.7	7.0	7.1	7.8
6-10	9.8	10.2	10.5	11.2
11-15	12.5	13.1	13.9	15.0
16-20	16.2	17.1	18.4	20.2
21-25	20.6	21.8	23.8	26.4
25-30	25.8	27.6	30.5	34.0
31-34	32.2	34.5	38.4	42.9
35-40	40.0	43.0	48.3	54.5
41-45	50.1	54.1	61.3	69.5
46-50	63.1	68.5	78.0	89.3
51-55	80.5	87.5	100.5	115.8
56-60	103.9	113.3	130.7	151.0
61-65	135.7	148.1	170.0	195.3
66-70	176.8	192.2	220.6	258.2
71-75	231.5	256.1	299.5	354.3
76-80	319.6	355.3	413.9	487.7
81-85	447.8	499.3	578.2	673.7
86-90	644.4	717.4	819.5	947.8
91-95	982.2	1,087.4	1,233.1	1,422.4
96-100	2,289.5	2,573.7	2,959.5	3,423.9

APPENDIX B: PHARMACEUTICALS: HIGH USER AND COST ANALYSIS

Appendix Table B.1: Prescription costs for brand name drugs in the drugs for peptic ulcer category for persistent high users

Brand Name Drug	Prescription Cost	% Total Costs in Persistent High User	% Costs for Drugs for Treatment of Peptic Ulcer
Alti-Famotidine	$103	0.0	0.0
Alti-Ranitidine	10,961	0.0	0.2
Alugel	209	0.0	0.0
Amphojel 600mg Chew Tabs	209	0.0	0.0
Amphojel 60mg/Ml Susp	1,333	0.0	0.0
Antacid Plus Antiflatuent	90	0.0	0.0
Apo-Cimetidine	5,015	0.0	0.1
Apo-Famotidine	38,532	0.1	0.7
Apo-Nizatidine	25,272	0.0	0.5
Apo-Ranitidine	176,720	0.3	3.4
Apo-Sucralfate	6,855	0.0	0.1
Axid	652	0.0	0.0
Cytotec	70,657	0.1	1.4
Diovol	1,178	0.0	0.0
Diovol Ex	27	0.0	0.0
Gaviscon Tab - Fruit Flavour	1,726	0.0	0.0
Gelusil	70	0.0	0.0
Gelusil Extra Strength	28	0.0	0.0
Gelusil Tablets	76	0.0	0.0
Gen-Cimetidine	3,849	0.0	0.1
Gen-Famotidine	42,212	0.1	0.8
Gen-Ranitidine	219,620	0.4	4.3
Losec	3,431,943	5.8	66.4
Maalox	40	0.0	0.0
Maalox Cherry Flavour	230	0.0	0.0
Maalox Mint Flavour	209	0.0	0.0
Maalox Plus Extra Strength (Chewable)	76	0.0	0.0
Maalox Plus Suspension Mint Flavor)	42	0.0	0.0
Maalox Plus Xtra Strength Susp	20	0.0	0.0
Maalox Quick Dissolve	39	0.0	0.0
Maalox Suspension	56	0.0	0.0
Maalox Tc	292	0.0	0.0
Maalox Tc Tablet	7	0.0	0.0
Magnesium 100mg Tab	5,079	0.0	0.1
Magnesium 50mg Tab	286	0.0	0.0
Magnesium Oxide Tab 420mg	111	0.0	0.0
Neutralca-S	40	0.0	0.0
Novo-Cimetine	7,379	0.0	0.1
Novo-Famotidine	56,656	0.1	1.1
Novo-Nizatidine	4,982	0.0	0.1
Novo-Ranidine	163,767	0.3	3.2
Novo-Sucralate	13,292	0.0	0.3
Nu-Cimet	14	0.0	0.0
Nu-Ranit	1,440	0.0	0.0
Pantoloc	470,026	0.8	9.1
Pepcid	443	0.0	0.0

Appendix Table B.1 continued

Pepcid Ac Tab 10mg	474	0.0	0.0
Peptol	113	0.0	0.0
Pms-Cimetidine	81	0.0	0.0
Pms-Nizatidine	5,933	0.0	0.1
Pms-Sucralfate	34	0.0	0.0
Prevacid	342,608	0.6	6.6
Riopan Sus 480mg/5ml	7	0.0	0.0
Riopan Tab 480mg	7	0.0	0.0
Scheinpharm Ranitidine	17,573	0.0	0.3
Sulcrate Suspension Plus	22,367	0.0	0.4
Tagamet	197	0.0	0.0
Tums Regular Tab 500mg	455	0.0	0.0
Zantac	15,520	0.0	0.3

Appendix Table B.2: Prescription costs for brand name drugs in the immunomodulating agent category for intermittent high users

Brand Name Drug	Prescription Cost	% Total Costs in Intermittent High User	% Costs for Immunomodulating agents
Avonex	$928,193	1.2	12.5
Bcg Therapeutic	338	0.0	0.0
Betaseron	2,349,373	3.1	31.6
Intron A	230,412	0.3	3.1
Intron A Premixed	1,645	0.0	0.0
Intron A With Diluent	69,300	0.1	0.9
Intron Multidose Pen	248,503	0.3	3.3
Neupogen	1,820,291	2.4	24.5
Proleukin	722,584	1.0	9.7
Rebif	1,058,499	1.4	14.2
Roferon-A	94	0.0	0.0
Roferon-A Pws 6mu/Ml	7	0.0	0.0

Appendix Table B.3: Prescription costs for brand name drugs in the renin-angiotensin agent category for not high users

Brand Name Drug	Prescription Cost	% Total Costs in Not High User	% Costs for Agents Acting on the Renin-Angiotension system
Accupril	$982,120	0.5	5.1
Accuretic	57,787	0.0	0.3
Altace	1,874,549	1.0	9.7
Apo-Capto	145,032	0.1	0.7
Apo-Lisinopril	327,893	0.2	1.7
Atacand	420,592	0.2	2.2
Avalide	119,309	0.1	0.6
Avapro	1,129,349	0.6	5.8
Capoten	8,368	0.0	0.0
Captopril-25 Tab 25mg	7	0.0	0.0
Coversyl	342,677	0.2	1.8
Cozaar	1,114,737	0.6	5.8
Diovan	702,344	0.4	3.6
Diovan-Hct	22,382	0.0	0.1
Gen-Captopril	114,110	0.1	0.6
Hyzaar	574,488	0.3	3.0
Hyzaar Ds	103,864	0.1	0.5
Inhibace	876,443	0.5	4.5
Inhibace Plus	91,715	0.0	0.5
Lotensin	76,333	0.0	0.4
Micardis	234,718	0.1	1.2
Monopril	2,136,058	1.1	11.0
Novo-Captoril	114,758	0.1	0.6
Nu-Capto	10	0.0	0.0
Nu-Enalapril	52,365	0.0	0.3
Pms-Captopril	5,206	0.0	0.0
Prinivil	1,528,194	0.8	7.9
Prinzide	370,057	0.2	1.9
Syn-Captopril	7,295	0.0	0.0
Vaseretic	141,545	0.1	0.7
Vasotec	4,697,759	2.4	24.3
Zestoretic	416,414	0.2	2.2
Zestril	569,293	0.3	2.9

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