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DO DRUG PLANS MATTER? EFFECTS OF DRUG PLAN ELIGIBILITY ON DRUG USE AMONG THE ELDERLY, SOCIAL ASSISTANCE RECIPIENTS AND THE GENERAL POPULATION

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ABSTRACT

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The 1984 Canada Health Act does not require that the provinces subsidize prescription drugs. Many provinces do, however, provide categorical coverage to the elderly, social assistance recipients and others, although the generosity of coverage is highly variable. A system of parallel private insurance covers the non-elderly ineligible for social assistance. In this study, we assessed the socio-economic, health and demographic determinants of private drug insurance. We also assessed the effect of inter-provincial variations in drug insurance coverage for the elderly and low income on variations in drug insurance coverage for the elderly and low income on their drug use. In addition, using instrumental variables methods, we considered the effect of prescription drug insurance coverage status on drug use in the non-elderly population ineligible for social assistance. Consistent with the previous literature, we find that for most seniors and non-indigent, drug coverage has only minor effects on drug use. The drug use of social assistance recipients was, however, sensitive to even relatively modest copayments of $0-$6.

Do Drug Plans Matter? Effects of Drug Plan Eligibility on Drug Use Among the Elderly, Social Assistance Recipients and the General Population

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Executive Summary

A central theme in the development of the Canadian health care system has been a public commitment to remove financial barriers to necessary care. The Medical Care Act of 1965 and the subsequent Canada Health Act of 1984 outline a set of principles that define a national public insurance system for "medically necessary" physician and hospital care. Although drugs taken outside of hospitals are not covered under the Canada Health Act, each provincial government has established some form of drug insurance program for selected beneficiary groups, including seniors (those 65 years and older), those receiving social assistance income, and those residing in long term care facilities. A system of parallel private insurance covers primarily the "general population": those under 65 who are not receiving social assistance. Yet, many individuals ineligible for public coverage do not have good access to private coverage and others remain underinsured. In response, the National Forum on Health recommended that the current patchwork quilt of private and public drug coverage be replaced by a national pharmacare program, with the same terms and conditions as currently exists for medical services, including the removal of any financial barriers to prescription drugs.

The establishment of such a policy could have far-reaching impacts on the health care system. First, patient health could be improved if financial barriers which previously limited access to essential medications were removed. Second, a reduction in the user cost of prescription medicines would potentially affect the overall use of and expenditures on prescription medicines, as patient ability to pay no longer constrained access. Third, a reduction in the user cost of prescription medicines would potentially affect the use of other health services including over the counter medicines (at least those which are substitutable for prescription medicines) and physician services (patients might be more apt to visit the physician if they know that any prescriptions received will be free of charge).

Despite these potentially important effects of prescription drug user fees on the health system, the evidence on their effects is incomplete. There is no information on the direct effect of user fees on patient health, and little recent Canadian evidence on the effects of user fees on the use of prescription drugs, over the counter drugs and physicians' services. There are also gaps in our knowledge of the extent of prescription drug insurance among Canadians. While recent studies have estimated the number of Canadians by level of drug insurance coverage (full, partial or none) and by various socio-economic and demographic characteristics (such as age, sex and employment status), less attention has been paid to the distribution of direct charges for prescription drugs paid by senior and social assistance beneficiaries of the provincial drug plans and how these charges vary by province. There is also little known about the socio-economic and demographic *determinants* of prescription drug insurance coverage among the population typically ineligible for comprehensive drug coverage from the provincial drug plans. We used data from the 1994 and 1996 Statistics Canada National Population Health Surveys (NPHS) to address these questions and hopefully improve the evidential basis for decision making by provincial drug program policy makers and others considering national pharmacare.

In order to estimate the distribution of drug charges, we first identified seniors and social assistance recipients in the NPHS and then determined which provincial drug plan they would likely receive drug coverage from. Finally, we applied the plan-specific cost sharing rules to

examine the price that these individuals pay for their drugs. To identify the determinants of prescription drug coverage among the general population, we modeled whether or not these individuals reported having insurance coverage as a function of a variety of their socio-economic, demographic and health characteristics. These models permitted us to assess the relative importance of specific factors such as income on drug insurance, while holding constant potentially confounding factors such as age and education.

To assess the effects of drug charges on health outcomes, drug use, and use of physicians' services, we developed statistical models of these outcomes as a function of drug insurance status and a set of socio-economic, demographic and health variables included to reduce the likelihood of confounding. The specific drug insurance status variables we considered varied with our target group – for seniors and social assistance recipients, we estimated the price that they faced for prescription drugs under their provincial drug plan. For the general population, we used variations in drug insurance coverage status (some vs. none) attributable to their occupational status (such as full time student, self employed professional, farmer, technician, etc.). This variable turned out to be a useful predictor of insurance coverage that had the desirable statistical feature that it was independent of latent differences in individuals' need for prescription drugs.

We found considerable inter-provincial variation in direct charges for senior beneficiaries of the provincial drug plans. Mean charges ranged from $0 (Ontario 1994-95) to $26.62 (Saskatchewan 1996-97). Drug charges for seniors were increasing over time, especially for residents of 2 of Canada's most populous provinces – Ontario and Quebec. Charges for social assistance recipients were much lower – most provinces charged nothing, and those that did charge, typically charged $2 per prescription. A notable exception was the province of Quebec, which introduced deductibles and coinsurance rates upwards of $6 per prescription beginning in August, 1996.

Our results point to three important determinants of drug insurance coverage among the general population 19-64 years of age. The first is household income, which is not entirely surprising – those with higher levels of household income are better able to pay for drug insurance coverage, or perhaps are employed in occupations which offer drug insurance benefits. The likelihood of insurance increases monotonically from 40% for those with incomes of $10,000-$19,999 to 80% for those with incomes of $60,000 or more. After controlling for income, however, we discovered interesting differences in coverage by occupational categories: 77% of technicians, high level management and full time students reported insurance, whereas only 30% of farmers, 43% of farm labourers and 44% of self-employed professionals did. The inter-provincial differences in drug insurance coverage were also surprising, given the many socio-economic and demographic factors that had been controlled for. Coverage rates were highest in 2 of Canada's richest provinces, Alberta and Ontario (73% each) and lowest in Saskatchewan (44%), Manitoba (53%) and British Columbia (60%).

Having established the variations in prescription drug insurance coverage in Canada, our next question is: does this make a difference in the use of drugs and physicians services and ultimately health status? The short answer is that, conditional upon the variation in drug prices that we could use in our study (about 75% of observations on seniors were removed owing to

measurement problems), drug prices do not seem to affect most seniors' use of drugs and physicians services. Our models of general population suggest the same thing – those with drug insurance coverage seem to make about the same use of drugs and doctors as those without coverage. Although this is consistent with the existing body of research evidence, it should be noted that the nature of our drug use measure – the number of different prescription drugs taken in the last 2 days – is not sensitive to variations in the dosage of the drug taken. Hence, our models cannot assess if drug charges lead seniors to take only a portion of their prescribed dosages. This problem not withstanding, it appears that public drug subsidies have the primary effect of shifting the financial cost of drugs from consumers to government – the overall amount of drugs taken will not change much for the average consumer.

This is not necessarily true for lower income individuals however. We found the drug use of social assistance recipients to be sensitive to even relatively modest copayments of $0-$6. Hence for this group, the removal of all drug charges will likely increase drug use even more. These individuals also made slightly fewer physician visits when required to pay more for drugs.

The health status implications of prescription drug subsidies remain somewhat unclear. Even though the NPHS tracks the health status of individuals over time, we were unable isolate the effects of cost sharing changes from other time varying factors among those whose prescription drug coverage changed between the 1994 and 1996 surveys. We did use several indirect methods. First, we note that for most seniors and general population, drug use is quite insensitive to modest changes in drug prices (there is very little evidence on responses to large changes in drug costs) hence it is unlikely that health will change as a result. Those with lower incomes, on the other hand, are much more price sensitive and could be adversely affected by increases in drug costs. Second, for seniors and social assistance recipients we estimated separate price sensitivities for those with varying levels of gross household income. We found evidence that lower income social assistance recipients were more price responsive than those with higher income, but the results for seniors remained inconclusive. Third, we determined the effects of drug charges on the use of potentially needed medications by those with specific chronic disorders. We estimated the effect of variations in direct charges on the use of insulin and oral glyceamics among individuals diagnosed with diabetes, anti-hypertensives use among those diagnosed with high blood pressure, and asthma medications among individuals with asthma. We found that the probability of drug use was generally independent of drug charges, even among social assistance recipients. Again, an interpretive word of caution is in order – the drug use question pertains to whether or not the drug was used at any time during the last 4 weeks. Our analysis does not identify variations in medications non-compliance associated with drug charges, beyond the simple use vs. non-use of these drugs during at least 1 point in the last 4 weeks. Future work will correct this deficiency by examining detailed information on 2 day drug use.

Based on the evidence generated in this study, and in combination with evidence from other sources we would conclude that for most individuals, expansion of the drug subsidies in the form of a national pharmacare program would not have much impact on their drug utilization behaviour. There are important subgroups of low income and sick individuals, however, for whom drug prices are a barrier to care and for whom drug subsidies would encourage additional drug use, possibly improving their health status. Finally, we remind that reader that there may be

valid reasons for national pharmacare that have not been discussed here. These may include concerns over distributional equity, or a belief that centralizing the purchase of prescription drugs will result in lower drug prices.

1. Introduction

A central theme in the development of the Canadian health care system has been a public commitment to remove financial barriers to necessary care. The Medical Care Act of 1965 and the subsequent Canada Health Act of 1984 outline a set of principles that define a national public insurance system for "medically necessary" physician and hospital care. Although out-of-hospital prescription drugs are not covered under the Canada Health Act, each provincial government has established some form of drug insurance program for selected beneficiary groups, including seniors (those 65 years and older), individuals receiving social assistance income, and those residing in long term care facilities. The non-Atlantic provinces subsidize some of the drug costs of the remainder of the population who incur high drug costs relative to income. Individuals who do not qualify for public coverage have access to private drug insurance coverage, although the terms and conditions of coverage vary widely. Because these programs were not established under the Canada Health Act, drug insurers have not been bound by national terms and conditions and have taken different approaches to designing benefit packages. Differences between these programs act as a natural experiment that can supply important information on the effects of different policy options – information that can add to the evidential base for policy making.

The use of prescription drugs has important clinical and economic implications. Prescription drugs are an integral component of medical care and can be among the most effective and cost-effective forms of care. Yet, recent studies have suggested that some Canadians do not have adequate drug insurance coverage. To reduce direct charges for prescription drugs, the National Forum on Health(1) recommended that the current patchwork quilt of private and public drug coverage be replaced by a national pharmacare program, with the same terms and conditions as currently exists for medical services, the consequence being that all Canadians should receive drugs free of charge.

The purpose of this paper is to provide evidence pertinent to the formulation of a national pharmacare program using data from the National Population Health Surveys (NPHS), which were administered to a randomly selected sample of the non-institutionalized population of the 10 provinces in 1994-95 and again in 1996-97. We first examine some aspects of the comprehensiveness of current prescription drug insurance in Canada. While this issue has recently been addressed elsewhere(2), the NPHS offers some new perspectives on the issue, including the levels of cost sharing among seniors (those 65 years and older) and social assistance recipients – the 2 primary beneficiary groups of the provincial drug programs, and the determinants of prescription drug insurance coverage among the general population – the non elderly population (19 – 64 years) not receiving social assistance benefits.

A national pharmacare program, should it be implemented, will alter the prices that some individuals pay for prescription drugs. This may cause intended effects – such as encouraging the use of drugs by those who are price sensitive (who may also tend to be lower income and of lower health status), but changes in drug prices may also lead to unintended effects. For example, lowering prescription drug prices might induce some to seek additional physician care, as access to prescription drugs requires physician consent. We therefore examine how drug

prices – and household income – affect the utilization of prescription drugs (both those used for acute and chronic conditions), the use of over the counter drugs and the number of physician consultations by individuals. We assess these effects in three different groups – seniors, social assistance recipients and the general population. Variation in drug charges comes from the differences in the generosity of the provincial drug plans. Finally, we assess how drug charges affect the use of specific medicines by groups with specific chronic diseases, i.e. the use of insulin and oral glyceamics by individuals diagnosed with diabetes, antihypertensives use by those diagnosed with high blood pressure, and asthma medications use by individuals with asthma. Again, similar studies have been reported in the literature. Nevertheless, it is informative to determine if our price elasticity estimates (estimated using up-to-date data on the residential population of Canada – who are the intended recipients of a national pharmacare program) correspond to those reported in the literature which pertain to different jurisdictions at different periods.

2. Methods

2.1 The 1994-95 and 1996-97 National Population Health Surveys

Our primary sources of data are the 1994-95 and 1996-97 NPHS. These were two comprehensive cross-sectional surveys of Canadian residents to assess population health status, and to ascertain disease risk factors and use of health services. The target population of the 2 surveys was all residents of dwellings in the provinces of Canada over the survey period June 1994 through June 1995, and June 1996 through August 1997. A total of 26,429 individuals were interviewed in the 1994 NPHS and 81,804 in the 1996 NPHS(3). Residents in Canada's northern territories, Indian reserves, Canadian Forces Bases, institutions and remote areas of Ontario and Quebec were excluded. Details of the NPHS survey frame are found in Appendix 2.

2.2 Measurement of drug use

The 1994 NPHS collected several sources of information on drug use. The respondent was first asked whether they had taken any of 20 specific types of drugs, or any others not listed, during the last month. The drug use categories were (listed in the order in which they were asked): "pain relievers", "tranquilizers such as valium", "diet pills", "anti-depressants", "Codeine, Demerol or Morphine", "allergy medications such as 'Sinutab'", "asthma medications", "cough or cold medications", "penicillin or other antibiotics", "medicine for the heart", "medicine for blood pressure", "diuretics or water pills", "steroids", "insulin", "pills to control diabetes", "sleeping pills", "stomach remedies", "laxatives", "hormones for menopause or aging symptoms", and "birth control pills". The 1996 NPHS identified use of the same list of drugs and also identified the use of thyroid medications.

Using these data, we constructed three indicator variables of use of "medicine for blood pressure"; use of "insulin" or "pills to control diabetes"; and use of "asthma medications" in the past month. As we explain below, we modeled the use (vs. non-use) of these three medications as a function of the drug insurance status of those diagnosed with hypertension, diabetes, and asthma, respectively.

If the respondent reported taking at least one drug over the last month, s/he was asked how many different medications were taken in the last two days. The interviewer then asked for the exact name of each of the medications taken, and, according to the NPHS Interviewer's Manual, was required to ask the respondent to look at the bottle, tube or box. Interviewers were further instructed to obtain the medicine's brand name or generic name and to get as much descriptive information (including dosage form and strength) as possible. The respondent was then asked, "do you use other health products such as ointments, vitamins, herbs, etc?" The names of all drugs taken were recorded and subsequently categorized by Statistics Canada using a drug classification developed specifically for the NPHS. The drug code consists of 7 characters and distinguishes drugs with different active ingredients; the first 5 characters distinguishes drugs with different therapeutic effect but generally used to treat the same health conditions and the first 3 characters distinguishes the health condition. Hence, for example, the 5-character code *A02BA* identifies the H2-receptor antagonists, while the 7 character code identifies the individual H2-receptor antagonists such as cimetidine, ranitidine, etc. The 3-digit code *A02* identifies the drugs commonly used to treat stomach or intestinal ulcers and includes, the proton pump inhibitors, and the antacids in addition to the H2-receptor antagonists.

A pharmacist categorized each 5-character drug code as being available only by prescription or available over the counter, and applied this coding to all 7-character drugs sharing the same 5-character prefix. Drugs that did not conveniently fall into these 2 categories were classified as prescription. These included over the counter drugs typically prescribed by a physician (e.g. insulin, nitrates) and therefore attract a dispensing fee. These also included drug codes which combine prescription and over the counter drugs into the same category; one such example is the code which describes "appetite pills/meds, bile pills, digestion pills". We then constructed measures of the number of different prescription drugs and the number of different over the counter drugs, both of which were taken over the last 2 days.

The nature of the NPHS drug use data affected our study objectives. First, the NPHS recorded information on the number and type of drugs used. We can therefore model how drug charges affect the probability of some drug use, and the total number of different drugs taken over the last two days, but we were unable to detect changes in the dosage of each drug taken (unless of course the respondent discontinues or initiates use of a drug in response to a change in drug charges). One would therefore expect our price elasticity estimates to be smaller (in absolute value) than estimates which use a continuous measure of prescription drug use. Second, because information on drug manufacturer was not given we were also unable to detect the impact of drug charges affect the choice of use of a brandname or (where they existed) "generic" versions of the same active ingredient. Third, the relatively short survey recall window (two days) means that most of the drugs reported would likely be taken on a daily basis. Drugs taken daily are more likely to be prescribed for the management of chronic health conditions, whereas drugs taken intermittently are more likely to be prescribed for acute conditions, or conditions for which medication is taken on an "as needed" basis. Given that the financial burden of drug fees depends on the prescribed duration of use, we categorized the prescription drugs as being used primarily for acute or for chronic use and estimated separate models for each type of prescription drug. Some drugs are used for both chronic and acute conditions – these drugs were treated as missing.

2.3 Measurement of physician services use

We constructed a variable indicating the total number of consultations with primary care physicians (both general practitioners and family physicians) over the 12-month period prior to the survey. There were two observations of over 300 visits reported in the 1996 NPHS. We truncated the number of visits at 300.

2.4 Categorization of NPHS respondents into target groups.

We elected to estimate separate models of prescription drug use for seniors, social assistance recipients and the general population for several reasons: first, as we discuss below, our ability to measure the prescription drug insurance coverage of these groups differed considerably. Second, it is possible that the structure of the models differs between the three groups. For example, the effects of socio-economic and demographic characteristics on drug use by seniors might be different than the effects for non-seniors.

Seniors. Seniors were identified as being 65 to 84 years, inclusive, at the time of the survey. All of the provincial programs that offer separate benefits for the elderly begin to provide such benefits at age 65. We elected to exclude those 85 years and older for several reasons: first recall problems may be especially acute for this group. Second, to be eligible for inclusion in the NPHS, these respondents must be healthy enough to institutionalization (and death) and might be atypical of other elderly persons. The figures below (**Figure 1** and **Figure 2**) confirm this for the case of prescription drug use – rates of use begin to drop off dramatically at age 85 for both males and females.

Figure 1 Mean number of different prescription drugs taken last 2 days, by 5-year age groups – Males

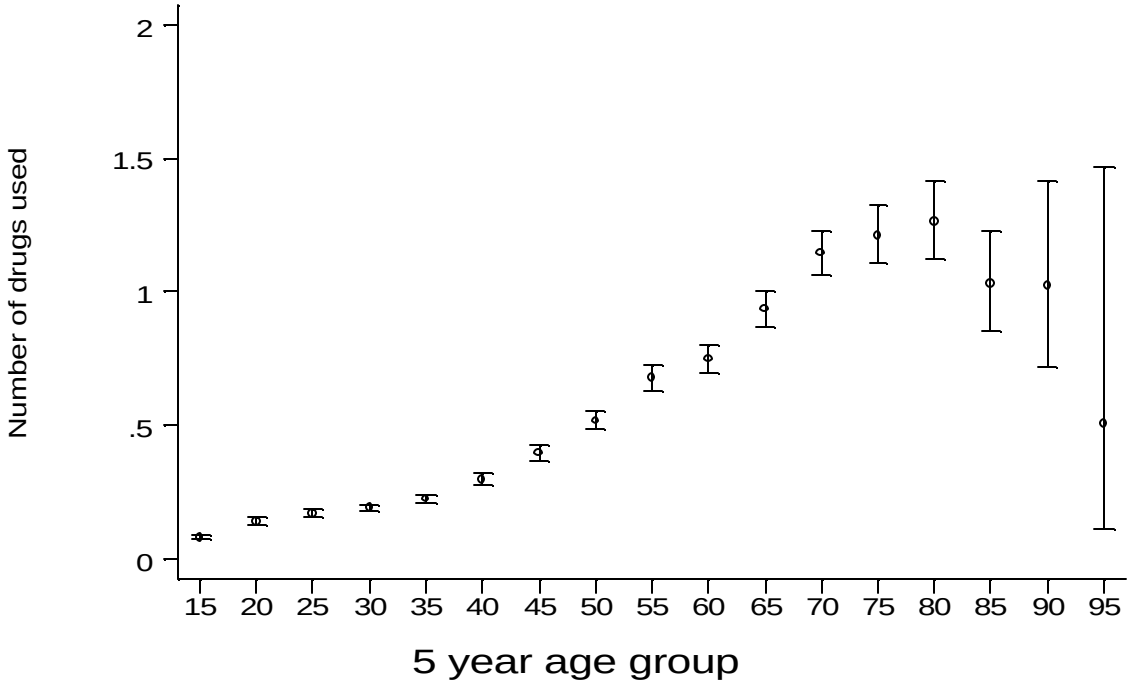
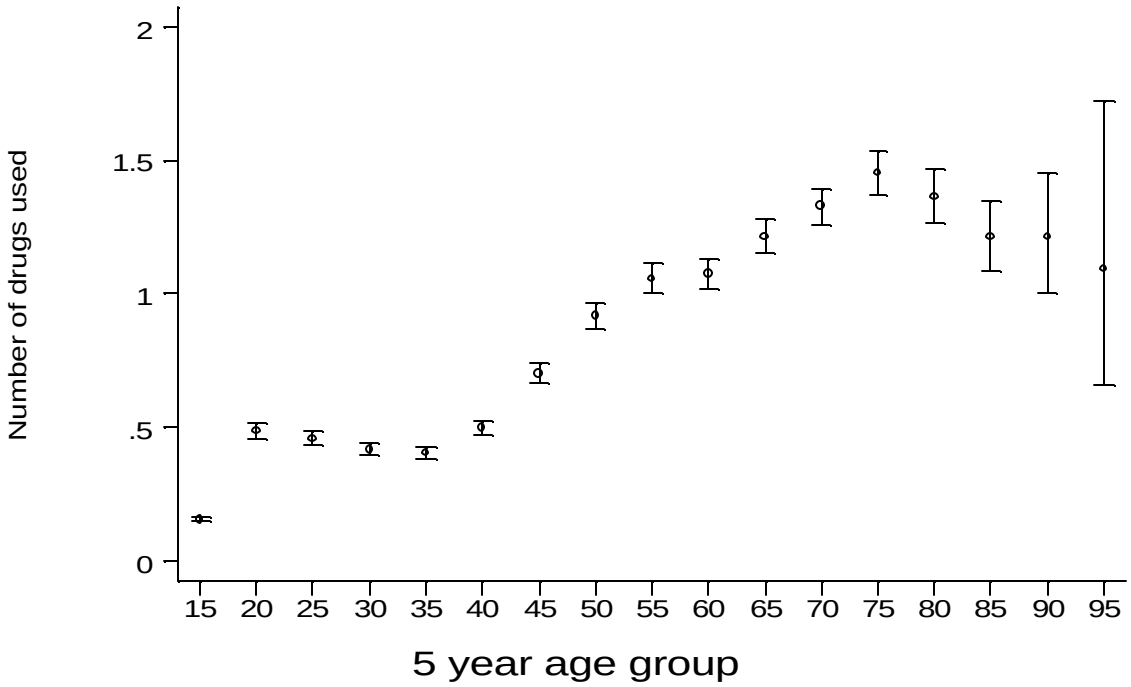


Figure 2 Mean number of different prescription drugs taken last 2 days, by 5-year age groups – Females



Social assistance recipients. Social assistance recipiency status was identified by the questions: "Thinking about the total income for all household members, from which of the following sources did your household receive any income in the past 12 months?" and "What was the main source of income?" In both questions, a list of income sources was read to the respondent; one response option was "provincial or municipal social assistance or welfare". Those who identified this as their main income source[1] and were 19-64 years of age, inclusive, were classified as social assistance recipients. (In all provinces, with the exception of Newfoundland, social assistance recipients who turn 65 years and become eligible for the seniors only program are no longer eligible for the social assistance drug benefits but become eligible for the seniors drug benefits.)

General population. This category excludes those identified as seniors and social assistance recipients. Further, individuals were between 19-64 years, inclusive, and to minimize drug insurance status measurement error, did not receive any provincial or municipal social assistance or welfare income over the last 12 months.

[1] The eligibility for provincial social assistance drug benefits among those who received some provincial or municipal social assistance or welfare over the last 12 months, but who did not identify this as their main source of income did not receive was unclear. It is possible that they were eligible for such benefits for only a portion of the year and were therefore excluded.

2.5 Measurement of the level of drug charges

The NPHS contained only limited information on prescription drug insurance coverage. The 1996 (but not the 1994) NPHS posed the direct question: "Do you have insurance that covers all or part of the cost of your prescription medications? (Include any private, government or employer-paid plans.)" It is possible, however, to infer both the eligibility of public drug insurance and also the amount of public subsidy given to seniors, social assistance recipients and general population respondents on the basis of respondent characteristics (e.g. age, province of residence, income) reported in the surveys and provincial drug plan eligibility rules, independently of the direct question. Next, we describe how this information was used to estimate the level of prescription drug insurance coverage for all 3 groups.

2.5.1 Measurement of drug insurance coverage for the general population

The drug insurance coverage status of this group was ascertained by their response to the direct question, providing a binary indicator of drug insurance coverage for the 1996 NPHS only. All of the non-Atlantic provinces offer drug subsidies to the general population and we potentially could have exploited information on both the eligibility and the generosity of drug insurance for this group. We decided against this, however, because we could not tell which respondents were in receipt of public subsidies. In any event, it is likely that only a small fraction of the general population in BC, Saskatchewan, Manitoba and Ontario receive public subsidies as they are targeted at households with high drug costs relative to income with no other source of drug insurance; further, residents of Manitoba and Ontario have to explicitly enroll in the program. The rates of participation in the Alberta and Quebec general population drug plans, on the other hand, might be higher due to the more attractive benefits. Alberta currently charges enrolled households a monthly premium (currently between $14.35 to $41.00, depending on household size and income) and a 30% copayment (up to a $25 per prescription maximum) with no deductibles. Note that the Alberta program insures not only drugs, but also hospital room upgrades, ambulance services and other ancillary services. In Quebec, annual premiums are currently between $0 - $175 (depending on household size and income), there is a 25% copayment after a $8.33 monthly deductible and a monthly copayment ceiling of $62.50. Further, the Quebec government requires that those without access to sufficiently generous private insurance (with a minimum benefit package regulated by the government) enroll in the public plan.

Estimation of the effect of prescription drug insurance coverage on drug use requires the use of specialized statistical techniques. Suppose that individuals who expect to use lots of medications are more likely to find insurance coverage worthwhile than those who expect to use fewer drugs. For high expected users, insurance subsidizes their potentially large expected drug bill (and also provides some risk insulation) and it might be worth the cost, especially if the premium is based on the average drug expenses of both high and low drug users. Consider what happens when we naïvely compare the drug use of those with and without prescription drug insurance. We find that those with insurance use more drugs than those without, and conclude that drug insurance "causes" more drug use, when in fact the correlation is due to individuals with differing levels of expected drug use sorting themselves into and out of drug insurance coverage. Hence we could not conclude from our naïve analysis that insurance coverage will change drug use behaviour, for example by inducing those with low expected drug use to consume more drugs. A common

solution to similar problems is to use the "instrumental variable" estimator – implementation of this estimator requires auxiliary variables which are at once *a*) correlated with individuals choice to hold drug insurance coverage and *b*) uncorrelated with unobserved differences in individuals' need for drugs. The coin toss to decide who gets insured in the context of a hypothetical randomized controlled trial of the impact of insurance coverage on drug use is an example of a valid instrumental variable: it is highly correlated with who receives insurance but is independent of drug use. In the present study, individuals were clearly not randomized in and out of insurance coverage. Insurance coverage is, however, highly correlated with one's type of occupation and enrollment in post-secondary educational institutions, but after controlling for respondent health status, occupation and educational group membership is also plausibly uncorrelated with expected drug use. Private insurance coverage is typically provided as a benefit of occupational or student group membership, and members are given little opportunity to opt out of drug coverage entirely, unless they have drug insurance coverage from some other source. One could argue that individuals with high drug needs would migrate into occupations which afford coverage and those with low drug needs would migrate to occupations with no coverage. We would argue that, given our classification of occupations, between occupation migration is quite costly and likely to be uncommon. For individuals who reported working for pay or profit and not a full time student in the last 12 months, we categorized their sector of occupation using the Pineo classification(3); these categories are: self-employed professionals, employed professionals, high level management, semi-professionals, technicians, middle management, supervisors, foremen and forewomen, skilled clerical/sales/service, skilled crafts and trades, farmers, semi-skilled clerical/sales, semi-skilled manual, unskilled clerical/sales/service, unskilled manual, and farm labourers. Separate categories were created for full time students and for those who were not full time students and who did not work for pay or profit in the last 12 months. An individual deciding to migrate between these occupational groups to take advantage of improved drug insurance coverage would first face the search costs of finding new employment (if going to a new job) and would also perhaps need to upgrade their skills to move into a different field (consider, for example, the costs incurred by a farm labourer wishing to apply for a high level management position so as to take advantage of the better drug coverage available). Hence we argue that variations in respondents' educational and labour market activity status induce *pseudo* randomization(4) into insurance coverage, in much the same way as the coin toss would explicitly randomize individuals into insurance coverage.

2.5.2 Measurement of drug insurance coverage for seniors

As we explain in detail below, we ascertained the level of public prescription drug insurance coverage for seniors and social assistance recipients on the basis of their reported characteristics (e.g. age, province of residence, income) in conjunction with the provincial drug plan eligibility rules. Senior and social assistance recipient respondents who hold private drug insurance would also likely respond in the affirmative to the question, but it is difficult to distinguish holders of private drug insurance from those who respond positively because they use the public system and recognize these public subsidies as prescription drug "insurance". Hence there will be some over-estimation of drug charges for those who hold private insurance, especially for those programs in which patients pay a large percentage of drug costs. By the same token, this will likely not be problematic for social assistance recipients, because they receive reasonably comprehensive drug insurance (most paying between $0 - $2 per prescription during the periods

covered by the 1994-95 and 1996-97 NPHS) and only a small minority would likely find the purchase of private drug insurance worthwhile.

Each provincial government operates its own drug plan for seniors and social assistance recipients; each with its own terms and conditions. The history of these terms and conditions, from the program inception dates to August 1999, are described in the companion document "Beneficiary cost sharing under Canadian provincial prescription drug benefit programs: History and assessment". The NPHS contains data with which to assign senior respondents into the public drug insurance programs, including respondent age (65 years and older), province of residence and date of survey administration (for respondents residing in provinces where the plan eligibility and/or cost sharing requirements changed over a survey period). In addition to these criteria, some plans provided more generous benefits to lower income seniors. The province of Saskatchewan offered different benefits to seniors with full, partial and no Guaranteed Income Supplement (GIS) benefits, as did Quebec after August 1 1996. Prior to this, Quebec differentiated coverage to seniors on the basis of the receipt of full versus less-than-full GIS. The provinces of New Brunswick and Newfoundland, and during the 1994-95 NPHS survey period, the province of Nova Scotia differentiated coverage to seniors on the basis of the receipt of some versus no GIS. During the 1996-97 NPHS survey period, Manitoba instituted a drug insurance system targeted at seniors and the general population which covered all drug costs in excess of an household income specific deductible; this deductible was 2% (3%) of adjusted household income for households with adjusted household income of $15,000 or less (more than $15,000). Finally, in July 1996 Ontario introduced an income-contingent copayment for seniors. Seniors faced a $100 deductible, and paid a $6.11 per prescription copayment thereafter; seniors with low income, defined as household income of less than $16,018 if single and less than $24,175 if married or common-law, paid $2 per prescription.

Both household income and GIS recipiency status are recorded in the NPHS, although the information provided may in some cases lead to some classification error, for several reasons. First, there are the usual problems with recall and respondents' tendency to strategically under-report income. Second, income information in the NPHS is reported in $5,000 intervals for household income between $0 - $19,999 and in $10,000 intervals for household income between $20,000 - $59,999. The final 2 intervals are $60,000-$79,999 and $80,000+. These categories did not match the program eligibility criterion for Ontario. Senior Ontarians eligible for the lower copayment plan were identified by reported gross household income of $19,999 or less if single, widowed, separated or divorced, (the threshold level is an adjusted income of $16,018) and by gross household income of $29,999 or less if married, common-law or living with a partner (the threshold level is an adjusted income of $24,175). Manitobans eligible for the lower deductible plan were identified by reported gross household income of $14,999 or less. GIS recipiency status was identified by the questions: "Thinking about the total income for all household members, from which of the following sources did your household receive any income in the past 12 months?" and "What was the main source of income?" For both questions, a list of income sources was read to the respondent; one response option was "Old Age Security and Guaranteed Income Supplement". If the respondent identified OAS and GIS as the main income source, individuals were assumed to have received the maximum GIS benefit. Individuals who identified OAS and GIS as an income source, but not their main income source, were assumed to have received a partial GIS benefit. Finally, individuals for whom OAS and

GIS was not an income source were assumed to have not received any GIS benefits. (No respondents identified OAS and GIS as their main income source, but did not identify OAS and GIS as an income source.) Although respondents are likely to be more candid in their responses to GIS status than to their household income, it is possible that some respondents may have misinterpreted the response category "Old Age Security and GIS" as "Old Age Security or GIS".

Having identified seniors program eligibility, we next turn to the identification of the level of cost sharing within each program. The structure of the cost sharing arrangements can be characterized along 2 dimensions: 1) does the beneficiary pay the same amount for each prescription, or does the price paid vary with the number of prescriptions filled? and 2) does the amount paid per prescription depend on the cost of the prescription or is it independent of drug cost; if the former is true, does the cost depend on the dispensing fee component, the drug ingredient cost, or both? Each of these dimensions has implications for our methodology.

First, if the drug plan invokes a deductible or payment ceiling, the amount paid for each prescription will (eventually) decline with the number of prescriptions dispensed. For example, BC seniors currently pay their dispensing fee up to a $200 annual maximum. If the dispensing fee is $8, then the first 25 prescriptions carry an $8 charge, but any additional prescriptions are free of charge. Consider what happens when we attempt to use this price variation ($0 or $8 per prescription) to estimate the effect of drug price on drug use. Suppose that there is no correlation between drug use and price: individuals are completely insensitive to the price of drugs and will pay virtually any price (up to their incomes). If this is the case, it seems plausible that individuals who have a large medical need for drugs will pay $0 for their next drug, whereas those with low needs will pay $8 per prescription. But this will generate a negative correlation between drug price and use, leading to the erroneous conclusion that drug use *is* price sensitive. There are several potential solutions to this problem. The first is to add health status and other variables to the model to explain whether the individual is a high or low drug user. But if this is not adequately modeled, there will be residual correlation between the drug price and unexplained drug needs which will contaminate estimates. Second, adopt the "instrumental variable" estimator – implementation of this estimator requires variables which are at once a) correlated with individuals choice to consume above or below the threshold at which the price of drugs changes (25 prescriptions in the example above) and b) uncorrelated with unobserved differences in individuals' need for drugs. Unfortunately, we could find no variables with these properties in the NPHS.

The measurement of marginal drug cost (MDC) – the cost of the next drug dispensed – for respondents who face deductibles or payment ceilings creates another difficulty. The NPHS records the number of different prescription drugs taken over the last 2 days, whereas in order to determine if the patient has exceeded the threshold number of prescriptions, we require data on the number of prescriptions filled from the start of the deductible accounting period to the survey date. For example, we need to infer whether a senior respondent from BC has filled at least 25 prescriptions and would therefore receive drugs free of charge solely on the basis of 2 day drug use. We attempted to measure this by dividing estimates of BC seniors respondents' number of drugs taken per day (*add*) by average number of days supply per prescription (*ads*)(5), to arrive at an estimate of the average number of prescriptions filled daily. For example, a senior taking 2 drugs per day where each prescription lasts 1 month will fill an average of 2/30 prescriptions per

day and will fill an average of 2/30*365 or about 24 prescriptions per year. We multiplied the average daily prescription fill rate times the number of days that had elapsed between the start of the deductible accounting period (*deddate*) and the survey interview date (*intdate*) to estimate the number of prescriptions filled at the time of the survey (1+*intdate-deddate*) and then multiplied this by the average dispensing fee (*adf*) to determine if the respondent had exceeded the $200 threshold. Hence the MDC for a BC senior was $0 if (*adf*)*(*add*/*ads*)*(1+*intdate-deddate*)>$200 and $*adf* otherwise. In order to estimate the number of drugs taken per day (*add*), we could have used respondents' reports of 2 day prescription drug use, but in other to avoid using responses which were temporarily large or small, we first estimated the average number of prescription drugs taken for each level of health status (measured by the number of different chronic health problems) among Canadian seniors and used the average corresponding to each respondent's health status. The same general approach was used to estimate drug charges for seniors enrolled in programs with other forms of non-linear drug prices.

Another problem arises when the drug charge is not known with certainty. The simplest case is when the charge is the same amount for all seniors and is known with certainty. Such was the case when Ontario provided drugs free of charge to all seniors, or when Quebec charged a $2 per prescription to those seniors not receiving the maximum GIS benefit. The next simplest case is when the copayment is some fraction of the dispensing fee, as is currently the case for BC seniors. Although there are some variations in dispensing fees charged, competitive pressures in retail pharmacy typically minimize the variance in dispensing fees charged seniors in a province. We used province-specific average dispensing fees charged for seniors; these data are collected and assembled by the Canadian Pharmacists Association(6). The most complex case is when the drug charge includes some fraction of the drug ingredient cost – there is great heterogeneity in the per-unit prices and quantities of prescription drugs dispensed which translates into large differences in drug charges. Such is the case for drug charges in Manitoba – seniors whose cumulative expenditures are below the deductible amount face the full cost of the prescription. We used province-specific average total drug cost(6) to estimate MDC for those provinces.

Clearly, the precision of the estimates of drug charges for seniors varies widely depending on the terms and conditions of the provincial drug insurance plan. Measurement error in the drug charges can adversely affect the statistical properties of our estimators. Moreover, as we have explained, our price elasticity estimates using data from those plans in which the MDC varied with the number of prescriptions dispensed are likely to be misleading. In recognition of this, we categorized senior respondents into levels reflecting the reliability of both the assignment of seniors into provincial drug insurance plans and the estimation of the level of cost sharing within each plan, and then restricted our sample to those observations for which we had a reasonable degree of confidence in our estimate of drug charges. Drug charge estimation reliability was determined by 1) whether eligibility depends on reported income or GIS status; 2) whether MDC depended on cumulative drug use and 3) whether the drug charge is known, some fraction of dispensing fee, or some fraction of the cost of the drug. This created $2\times2\times3=12$ different categories which were assigned into 4 levels of overall reliability; these are illustrated in **Table 1**, below. For the purposes of estimating models of the effect of prescription drug charges on drug use for seniors, we elected to restrict the sample of observations to those for which the overall reliability was either "very good" or "good". These observations had a MDC which was either known with certainty or a fraction of dispensing fee, and which did not vary with

cumulative (deductible year-to-date) drug consumption. One exception was made for the drug plan in Quebec. Prior to August 1996, seniors not receiving the maximum GIS subsidy faced a $2 per prescription charge subject to a $100 annual ceiling. We assumed that most Quebec seniors would have filled less than 50 prescriptions between the start of the deductible period and the interview date and hence assigned a MDC of $2 for these subjects, categorized their overall MDC reliability as "good" and included these observations in the estimation sample.

Table 1 Assignment of respondents into categories of overall marginal drug cost estimate reliability

		Does marginal drug cost (MDC) depend on cumulative drug use?					
		No			Yes		
		MDC known	MDC = dispensing fee	MDC = % of drug cost	MDC known	MDC = dispensing fee	MDC = % of drug cost
Does drug plan eligibility depend on income?	No	Very Good	Very Good	Fair	Poor	Poor	Poor
	Yes	Good	Good	Fair	Poor	Poor	Poor

2.5.3 Measurement of drug insurance coverage for social assistance recipients

Fortunately, many of the problems that hamper estimation of drug charges for seniors are generally not present for social assistance recipients. First, as was mentioned, social assistance recipients are less likely to have private drug coverage, thereby reducing the potential for measurement error. Second, in most cases, drug cost is some fixed amount per prescription, and does not vary with the number of prescriptions. There were some exceptions. First, starting in November 1997, Alberta charged social assistance recipients $2 for the first three prescriptions per month, and $0 thereafter. We assumed that all prescriptions attracted the $2 charge. Second, between August to December 1996, the province of Quebec required social assistance recipients to pay a 25% copayment to a maximum of $83.33 for the 5-month period. (Previously drugs were provided free of charge.) In addition to the 25% copayment, a $25 quarterly deductible was imposed and a quarterly maximum of $50 added between January to June 1997. Starting in July 1997, the quarterly deductible and maximum were replaced by a monthly $8.33 deductible and $16.67 maximum. We ignored the issues associated with the introduction of deductibles and assumed that a drug charge of $6.18 (25% of the average Quebec drug program drug cost of $24.72) applied to all prescriptions. Third, beginning in April 1996, New Brunswick imposed a maximum beneficiary contribution of $250 per household. The per-prescription charge was $4 for adults and $2 for children under 18; a household had to fill over 62 prescriptions for adults or 125 prescriptions for children to exceed their maximum. Given these very high rates of drug use, we assumed that no households exceeded the payment maximum. Fourth, in Nova Scotia responsibility for the drug benefits program for social assistance recipients was transferred from the municipal government to the provincial government in April 1996. The several municipal governments that we contacted did not charge for prescription drugs and we assumed that this applied to all municipal governments. It is possible that this introduced some measurement error.

2.5.4 The effects of drug formularies on drug cost estimates.

Drug charges can be applied to all drugs generally, or can be applied to specific drugs. For example, most provinces restrict reimbursement to a list of drugs contained in a formulary. This amounts to a 100% co-insurance on off-formulary drugs and is another source of inter-provincial variation in drug coverage. We do not exploit between provincial and intertemporal variations in drug formularies and it is important to consider what impact this will have on our research questions. If these non-reimbursed drugs are not commonly prescribed then the effect on the number of drugs taken should be negligible (subsumed in the random disturbance of the estimating equations). Even if the drugs are commonly prescribed, however, the impact on number of drugs taken might be small. Formularies typically do not exclude entire classes of drugs with similar therapeutic effect; they might, however, selectively exclude particular dosage forms of drugs. If there are other drugs available with similar therapeutic effect, then these restrictions should not change the number of drugs taken - just the mix.

2.6 Measurement of health status

Health status is typically an important predictor in empirical models of health care utilization. As Manning et al(7) note in their review of the literature, health status often explains most of the variance in regression models of medical care utilization. More importantly, controlling for it can affect the magnitude of other estimated coefficients because of the correlations between health status and other regressors such as education, income and age.

We used two measures of overall health status, one based on self-perception of overall health status, the other based on medical diagnoses of chronic conditions. The level of self-assessed overall health status was ascertained with the following question: "In general, how would you describe your health: excellent, very good, good, fair, or poor?" This measure of overall health has been shown to correlate well with physician assessments, measures of functional ability/disability, number and/or type of self-reported health problems, diagnoses or chronic diseases, acute symptoms and composite measures of health status based on either self reports or a combination of physician and self-reported conditions and health service utilization data(8-10).

In addition, we constructed a variable indicating the number of different chronic health problems which had been diagnosed by a medical professional. The 1994 NPHS identified the following 20 conditions: food allergies, other allergies, asthma, arthritis/rheumatism, non-arthritis back problems, high blood pressure, migraine headaches, chronic bronchitis/emphysema, sinusitis, diabetes, epilepsy, heart disease, cancer, stomach/intestinal ulcers, effects of stroke, urinary incontinence, Alzheimer's disease, cataracts, glaucoma, or other long term condition. In addition to these conditions, the 1996 NPHS identified those with thyroid conditions and those with a "bowel disorder such as Crohn's Disease or colitis".

2.7 Measurement of socio-economic and demographic characteristics

Six indicator variables of gross household income earned in the 12 months prior to the survey were constructed and used in models for seniors and the general population: $0-$9,999 (the reference category); $10,000-$19,999; $20,000-$29,999; $30,000-$39,999; $40,000-$59,999; $60,000 and over. Models for social assistance recipients used just 4 categories: $0-$9,999; $10,000-$19,999; $20,000-$29,999; $30,000 and over. In every model, the logarithm of household size was included to deflate income into per capita terms. One of the study objectives is to assess if the effects of drug charges vary by individuals' household income level. This was accomplished by interacting the drug charge variable with the income indicator variables. We also included an indicator of whether or not the respondent's dwelling was owned by a household member to measure wealth. In a previous study of prescription drug use using the 1994 NPHS(11), we merged community-level socio-economic status from the 1991 Statistics Canada census to the federal electoral district (FED) in which the respondent resided. These included information on FED-level unemployment rate (among those 15 years and older); the FED-level median household income and the FED-level mean home ownership rate. These variables were found to have negligible effects on drug use and hence were not used here.

A variety of additional variables were included in the statistical models to reduce the likelihood of confounding. The effects of changes in these variables on drug utilization are not of primary interest here because the modelling technique used can only identify the "overall" effect. For

example, higher levels of educational attainment might be associated with lower drug use due to "healthy" lifestyle choices not controlled for by the health status variables. On the other hand, individuals with higher levels of education might consume more drugs due to a heightened awareness of advances in pharmacotherapy.

The effect of gender on drug use was captured using an indicator variable equal to one if the respondent is male. For models of social assistance recipients and the general population, 6 age categories were included: 19-24 years inclusive (the reference category), 25-29, 30-39, 40-49, 50-59, and 60-64. **Figure 1** and **Figure 2** suggest that the lifecycle patterns of drug use differ by sex, especially for individuals under age 65. To accommodate this, we added sex-age group interaction variables to the models. For models of seniors' drug use, 4 five-year age categories were constructed: 65-69 (the reference category), 70-74, 75-79, and 80-84. We did not include sex-age group interaction variables for seniors. Three marital status indicator variables were constructed: never married (the reference category); married, common-law, or living with a partner; and widowed, separated, or divorced. Four indicator variables denoting the highest level of educational attainment were constructed: less than secondary level education (the reference category); secondary level education; beyond secondary level education; and college or university degree.

2.8 Measurement of access to drug prescribers

One factor possibly influencing prescription drug use is access to drug prescribers. In a previous study of prescription drug use using the 1994 NPHS (11), we controlled for variations in prescriber access by merging FED-level 1994 physician full time equivalents (FTEs) for both general practitioners/family physicians and specialists to the FED of the respondent. (Physician supply data were obtained from the Southam Medical Database administered by the Canadian Institute for Health Information (12).) Then, using population estimates from the 1991 Statistics Canada census, we computed physician FTEs per 1,000 population in the FED. These variables were found to have virtually no impact on drug use and hence were not used here.

2.9 Estimation Methods

Table 2 lists the 10 outcome variables under investigation. Our choice of estimation technique depended on the nature of these variables. Outcome variables 2-7 are non-negative integers (count data), and the remainder are binary (0,1). We elected to use negative binomial regression for the count variables and logit regression for the binary outcomes for the models of seniors and social assistance recipients. Negative binomial regression is preferable to the more commonly used linear regression estimator on statistical grounds because linear regression is less efficient, admits the possibility of *negative* predicted drug use, and will almost certainly face the problem of heteroskedastic errors, invalidating conventional inferential procedures.

Table 2 Outcome variables to be modeled

	Outcome variable	Target Groups
1	Number of prescription drugs taken during the last 2 days	Seniors, social assistance, general population
2	Probability of at least 1 prescription drug taken during the last 2 days	Seniors, social assistance
3	Number of prescription drugs taken during the last 2 days, in subsample of those taking at least 1 prescription drug	Seniors, social assistance
4	Number of prescription drugs taken for acute conditions during the last 2 days	Seniors, social assistance, general population
5	Number of prescription drugs taken for chronic conditions during the last 2 days	Seniors, social assistance, general population
6	Number of over the counter drugs taken during the last 2 days	Seniors, social assistance, general population
7	Number of physician visits during the last 12 months	Seniors, social assistance, general population
8	Probability of use of "insulin" or "pills for diabetes" during the last month	Seniors, social assistance, general population diagnosed with diabetes
9	Probability of use of "asthma medications" during the last month	Seniors, social assistance, general population diagnosed with asthma
10	Probability of use of "medicine for blood pressure" during the last month	Seniors, social assistance, general population diagnosed with hypertension

We estimated models of the number of prescription drugs taken during the last 2 days in two ways. First, we used the conventional negative binomial estimator using the entire sample of drug users and non-users (model 1). The parameter estimates from this model indicate the effect of changes in drug charges (or drug insurance coverage for the general population sample) on average drug use over the population. Note, however, that the equation for average drug use in the population conditional on drug charges and other variables, $E(y_i \mid x_i)$ (where y_i is the number of drugs taken by the *i*th respondent, and x_i are the values of the drug charge and other variables for the *i*th respondent), can be decomposed into the product of the probability of use being greater than zero, $Pr(y_i>0 \mid xi)$, and the expected number of drugs used in the subsample of drug users, $E(y_i \mid y_i>0, x_i)$, that is:

$$E(y_i \mid x_i) = Pr(y_i>0 \mid x_i)\, E(y_i \mid y_i>0, x_i)$$

Examining the separate effect of drug charges on the probability of some drug use (vs. no use) (model 2) and the number of drugs taken by drug users (model 3) offers some additional insights into the effects of cost sharing. If drug use is price sensitive, these models shed some light on whether the primary effect of drug charges is to encourage or discourage the use of drugs (vs. no drugs) or whether changes in drug use operate through changes in the number of drugs taken by users. If changes in drug use operate through the decision to use pharmaco-therapy or not, then

policies which lower drug prices might have implications for individuals' propensity to seek physician care, assuming that the decision to use drugs is associated with the individuals' propensity to seek physician care. We will directly examine the inter-sectoral implications of public drug subsidies using our models of primary care consultations, but the information gathered here might provide confirmatory evidence.

The regression estimators were modified to account for the cluster sampling frame of the NPHS using the robust covariance matrix estimators programmed in STATA version 6.0(13). In contrast to the conventional estimators that assume that all observations are independent within clusters, the robust estimators take into account the loss of effective sample size owing to the correlation between latent differences in drug and physicians' services use of survey respondents residing within the same clusters. The greater the degree of correlation, the less information gained per cluster and the lower is the precision of the estimates. Upon preliminary testing, however, the robust and conventional standard error estimates were very close. This perhaps reflects the distribution of respondents across clusters; the average number of observations per cluster in the seniors, social assistance recipients and general population samples was 1.6, 1.2 and 1.4, respectively. Hence there is not a large loss in effective observations within clusters owing to the fact that there were only a few in each to begin with. In what follows, we use the conventional maximum likelihood estimators of the standard errors in the models for seniors and social assistance recipients.

After model estimation, we had to transform our estimated coefficients to produce quantities of interest. In the models of the number of different drugs or number of general practitioner consultations by seniors and social assistance recipients, we estimated price elasticities, defined as the percentage change in use associated with a 1% increase in drug prices. In the case of the general population, we observed only the difference in drug use between those with and those without some prescription drug insurance, and estimated the percentage increase in drug use or general practitioner visits associated with some versus no drug insurance. For models of binary outcomes, for example, the models of insulin or oral glyceamics use, we estimated the *absolute* change in the probability of drug use associated with either a percentage increase in MDC (seniors and social assistance recipients) or between those with and those without some prescription drug insurance (general population). Some of the calculations required that we quantify the values of the model covariates (such as age, sex, marital status, etc.); in these cases, we set the covariate values at their estimation sample means.

Once models were estimated, we used a simulation technique developed by King et al (14;15) to convey the precision of our estimates. The approach uses conventional 95% confidence intervals around the estimated effects, but builds in uncertainty regarding both parameter estimation (which is what most analysts do), but it also reflects "fundamental uncertainty" – that is randomness in drug use that cannot be explained by our statistical models. For this reason, our confidence intervals are slightly larger than would be the case had we only considered the former type of uncertainty.

We used a different procedure to quantify precision in the models of the impact of drug insurance coverage on the drug and physician service use among the general population. Recall that general population respondents who decided to hold drug insurance might also be the ones

who have a greater need for drugs in the first place; this created statistical problems that are potentially ameliorated by the use of the instrumental variables (IV) estimator. Because of difficulties in operationalizing the IV estimator using count data, we opted to use the standard IV estimator for continuous data. We were reluctant to use the standard IV estimator of the standard errors, however, because we suspected the error distribution to be heteroskedastic. We therefore created estimates of the standard errors using the empirical distribution of 1,000 bootstrap replications from each of the models.

3. Detailed Results

3.1 Descriptive Statistics

Tables of descriptive statistics for each of the three target groups, and for the entire sample (including those in the NPHS who were excluded from the target groups) are presented in Appendices 6-9. Below (**Figure 3 - Figure 8**) we present histograms of the primary outcome variables for each of the three target groups.

Figure 3 Histogram of number of different *drugs* taken in the last 2 days: seniors, social assistance recipients and the general population

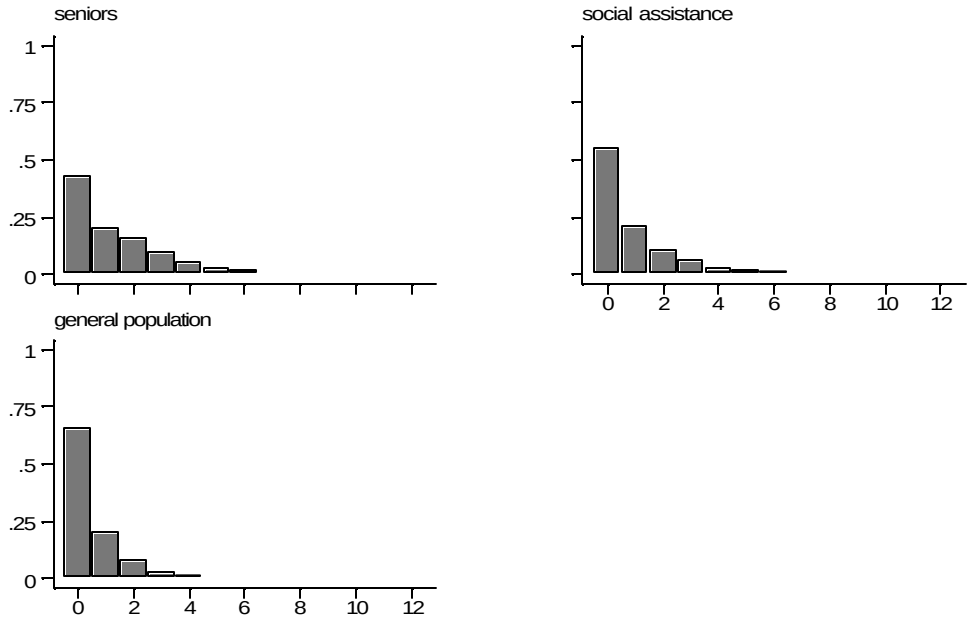


Figure 4 Histogram of number of different *prescription drugs* taken in the last 2 days: seniors, social assistance recipients and the general population

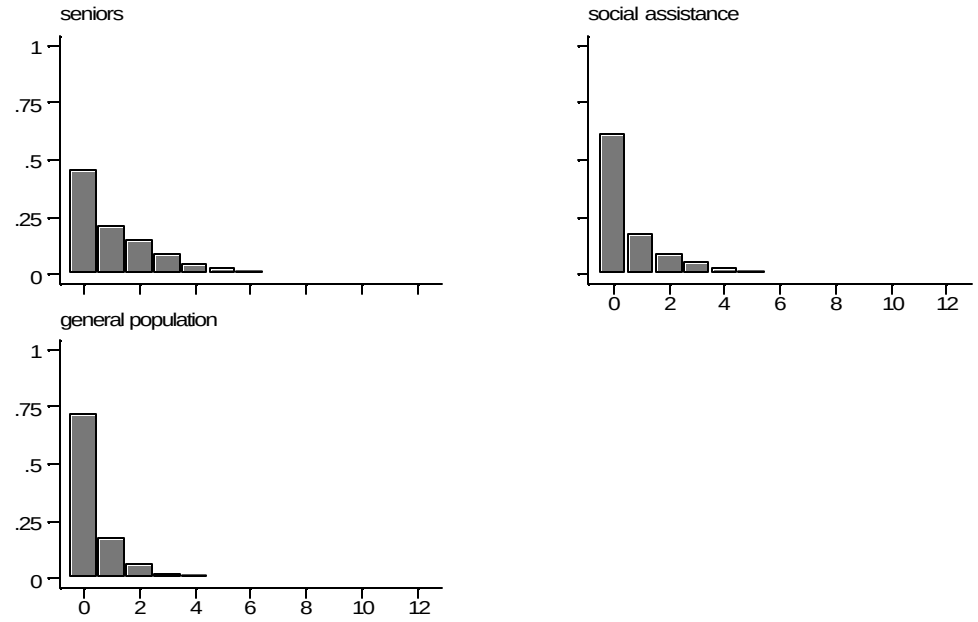


Figure 5 Histogram of number of different *prescription drugs for acute conditions* taken in the last 2 days: seniors, social assistance recipients and the general population

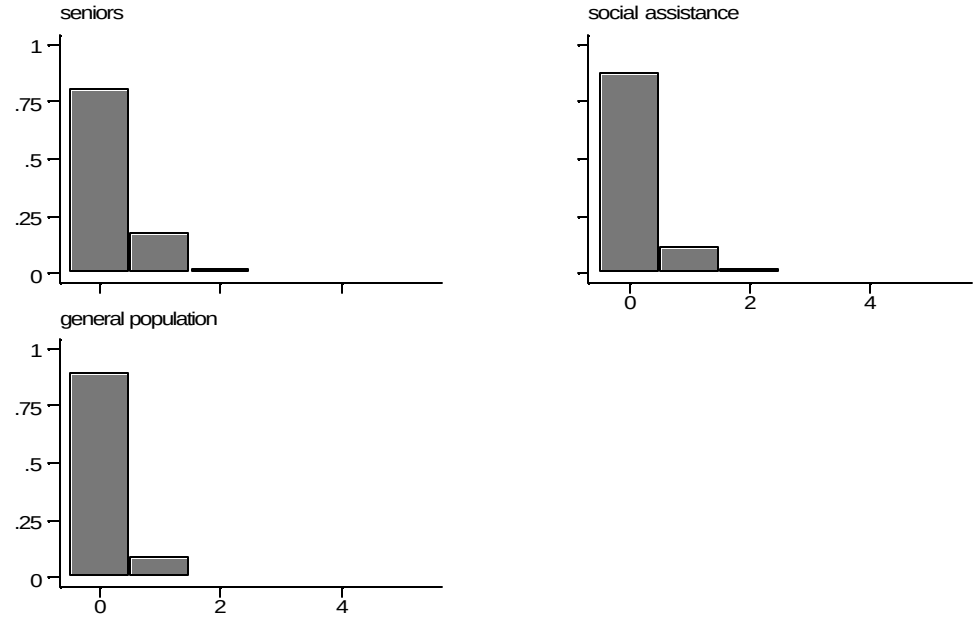


Figure 6 Histogram of number of different *prescription drugs for chronic conditions* taken in the last 2 days: seniors, social assistance recipients and the general population

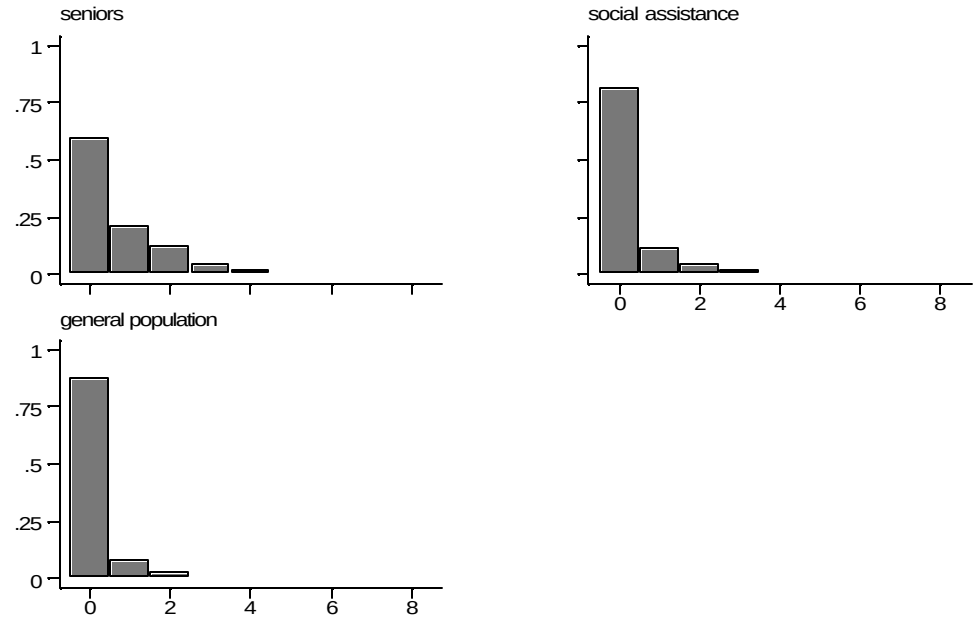


Figure 7 Histogram of number of different *over the counter drugs* taken in the last 2 days: seniors, social assistance recipients and the general population

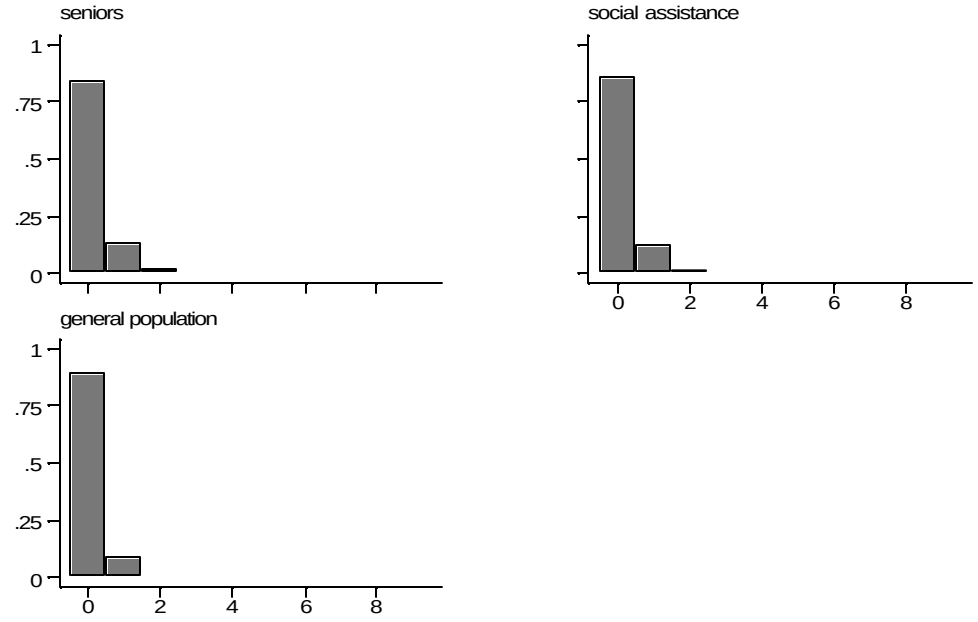
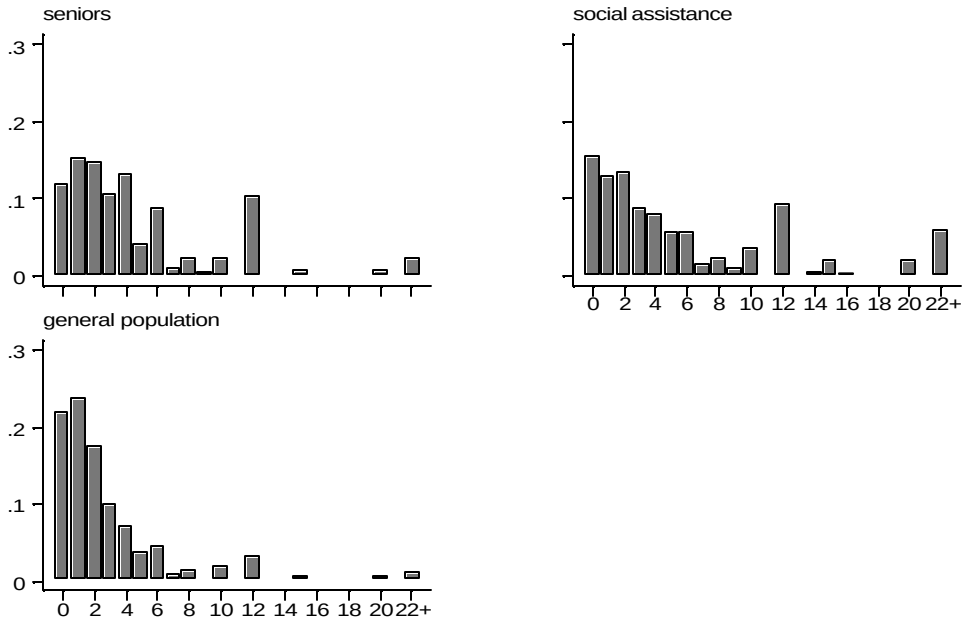


Figure 8 Histogram of number of *general practitioner consultations* in the last 12 months: seniors, social assistance recipients and the general population



3.2 Probability and comprehensiveness of prescription drug insurance coverage

3.2.1 Distribution of marginal drug charges for seniors and social assistance recipients

There was substantial inter-provincial variation in average drug charges for seniors (**Table 3**). The highest mean drug charges during the 1994-95 and 1996-97 NPHS sample periods were observed in Saskatchewan ($26.62 per prescription in 1996-97), Manitoba and Prince Edward Island; the lowest were observed in Ontario ($0 in 1994-95), Quebec and BC. Drug charges for seniors in Ontario, Quebec and to a lesser extent, Newfoundland, increased between the 2 survey periods. The reader is reminded that these charges are what a senior would pay for an additional prescription drug. In those provinces with deductibles and payment ceilings, the average drug charge includes those who (we estimated had) exceeded their deductible or ceiling and would be paying a price lower than what they were charged for "below deductible" prescriptions. The frequency distribution of drug charges, which displays the range of drug charges observed during each survey period, is presented in Appendix 3. The reader is also reminded that some provinces changed cost sharing rules within a survey period so that drug charges within a province can vary depending on the dates respondents were surveyed.

Drug charges for social assistance recipients were generally lower than those charged seniors. During the 1994-95 NPHS survey period only 2 provinces – Saskatchewan and New Brunswick –charged social assistance recipients for prescription drugs, but during the following survey 3 other provinces began to charge. The largest increase was observed in Quebec; prior to the reform of its drug insurance system, social assistance recipients received drugs free of charge. After the reforms which commenced in August 1996, average drug charges were $6.18. (Note

that the 1996-97 average charge of $4.81 includes drug charges of respondents interviewed prior to the introduction of cost sharing.)

Table 3 Estimates of mean marginal drug costs (MDC), standard deviation, and population by provinces

Province	Seniors					
	1994-95 NPHS			1996-97 NPHS		
	Mean MDC	Std Dev.	Population	Mean MDC	Std Dev.	Population
NF	7.32	3.98	53,119	11.43	4.44	51,663
PEI	14.85	0.00	15,066	14.45	0.00	14,735
NS	5.95	1.52	103,188	6.18	1.86	107,067
NB	6.55	1.81	82,537	8.77	1.56	84,844
PQ	1.24	0.97	706,784	4.65	2.48	713,264
ON	0.00	0.00	1,162,881	4.50	7.68	836,849
MB	24.85	8.15	130,644	25.56	11.20	107,624
SK	25.65	2.74	124,531	26.62	2.68	124,612
AB	9.68	1.50	233,419	10.05	0.20	239,672
BC	6.07	0.71	399,865	5.99	0.00	423,583
Total	4.57	7.36	3,012,034	7.51	7.89	2,703,913
Province	**Social assistance recipients**					
	1994-95 NPHS			1996-97 NPHS		
	Mean MDC	Std Dev.	Population	Mean MDC	Std Dev.	Population
NF	0.00	0.00	23,166	0.00	0.00	29,837
PEI	0.00	0.00	2,648	0.00	0.00	1,729
NS	0.00	0.00	33,800	3.00	0.00	31,654
NB	2.00	0.00	20,427	4.00	0.00	26,006
PQ	0.00	0.00	319,209	4.81	2.57	273,278
ON	0.00	0.00	367,599	1.95	0.31	221,202
MB	0.00	0.00	26,435	0.00	0.00	21,467
SK	2.00	0.00	30,808	2.00	0.00	23,193
AB	0.00	0.00	31,003	0.00	0.00	23,731
BC	0.00	0.00	91,822	0.00	0.00	80,418
Total	0.11	0.45	946,917	2.72	2.44	732,515

Note: sampling weights used to make averages representative of population.

3.3 Probability of drug insurance in general population

There were substantial socio-economic and demographic differences in the probability of drug insurance coverage among the general population 19-64 years not receiving social assistance (**Table 4** and **Figure 9**); estimates from the logit model are presented in Appendix 5. Our estimates suggest that gross annual household income is the strongest predictor of the probability of drug insurance coverage among the different factors considered. The likelihood of insurance

increases monotonically from 40% for those with incomes of $10,000-$19,999 to 80% for those with incomes of $60,000 or more.[2] After conditioning on income, household wealth (as measured by home ownership) increased the probability of drug insurance by only 3%. Occupational categories also had strong effects on insurance coverage probabilities: 77% of technicians, high level management and full time students reported insurance, whereas only 30% of farmers, 43% of farm labourers and 44% of self-employed professionals did. After controlling for income and occupational categories, the only discernable effect of education was observed between those who had and had not graduated from highschool, the former having about a 5% higher probability of insurance coverage. Males and females had very similar probabilities of coverage, as did individuals between 30-64 years. Individuals between 19-29 years were about 3% less likely to report coverage compared to those 30 and older. The strength of marital/partnership bonds impacted on the probability of drug insurance coverage. Sixty percent of those who never married have coverage, compared to 67% of those widowed, separated or divorced and 72% of those married, common-law or living with a partner. Coverage rates were quite similar between individuals with different levels of self-assessed overall health status. Larger differences were observed between those with varying numbers of diagnosed chronic health problems: 65% of those with no chronic health problems had coverage whereas 92% of those with 11 or more problems had coverage. It is possible that individuals with several chronic health problems are more likely to be eligible for drug or disease-specific coverage offered by their provincial government drug plan. Note, however, that the confidence interval around the estimates are larger as the number of health conditions increases, owing to the small number of individuals in these groups. The interprovincial differences in drug insurance coverage were surprising, given the many socio-economic and demographic factors that had been controlled for. Coverage rates were highest in 2 of Canada's richest provinces, Alberta and Ontario (73%) and lowest in Saskatchewan (44%), Manitoba (53%) and BC (60%).

Table 4 Estimated probability (with standard errors and 95% confidence intervals) of drug insurance coverage by subject age, sex, marital status, household income, homeownership status, education, occupation, health status and province of residence.

Age Group	Mean Probability	Standard Error	95% Conf. Interval	
19-24	0.665	0.010	0.646	0.683
25-29	0.656	0.008	0.640	0.671
30-39	0.700	0.005	0.691	0.709
40-49	0.692	0.005	0.681	0.702
50-59	0.691	0.007	0.678	0.704
60-64	0.691	0.010	0.671	0.711
Sex	Mean Probability	Standard Error	95% Conf. Interval	
Male	0.683	0.004	0.675	0.691
Female	0.692	0.004	0.684	0.699
Marital Status	Mean Probability	Standard Error	95% Conf. Interval	
Married/Commonlaw	0.718	0.003	0.711	0.725

[2] To calculate probabilities of drug insurance coverage by income, we compared the model predictions by level of household income, in each case setting the values of the remaining covariates such as age, sex, etc at their sample means. We used the same approach for all of the comparisons reported here.

Widowed/Separated/Divorced	0.668	0.008	0.652	0.684
Never Married	0.604	0.007	0.590	0.617
Household Income	Mean Probability	Standard Error	95% Conf. Interval	
$0-9,999	0.410	0.016	0.381	0.441
$10,000-19,999	0.399	0.009	0.382	0.416
$20,000-29,999	0.527	0.008	0.513	0.542
$30,000-39,999	0.650	0.006	0.638	0.663
$40,000-59,999	0.760	0.004	0.752	0.768
$60,000+	0.803	0.004	0.795	0.812
Homeownership status	Mean Probability	Standard Error	95% Conf. Interval	
Homeowner	0.695	0.003	0.689	0.701
Non-Homeowner	0.665	0.006	0.654	0.676
Education	Mean Probability	Standard Error	95% Conf. Interval	
College/Univ.Degree	0.694	0.004	0.686	0.703
Some Post Secondary	0.691	0.005	0.680	0.701
Highschool Grad	0.700	0.006	0.688	0.711
Less than Highschool	0.650	0.007	0.637	0.663
Occupation	Mean Probability	Standard Error	95% Conf. Interval	
full time student	0.768	0.010	0.747	0.788
not working for pay or profit	0.656	0.007	0.641	0.669
self-employed professional	0.441	0.030	0.383	0.502
employed professional	0.764	0.009	0.745	0.782
high level management	0.766	0.015	0.735	0.795
semi-professional	0.713	0.010	0.694	0.732
technician	0.770	0.018	0.733	0.803
middle management	0.711	0.009	0.693	0.729
supervisor	0.618	0.019	0.581	0.655
foreman	0.660	0.018	0.623	0.695
skilled clerical/sales/service	0.707	0.011	0.685	0.727
skilled crafts/trades	0.693	0.010	0.674	0.711
farmer	0.300	0.019	0.264	0.337
semi-skilled clerical/sales/service	0.670	0.008	0.653	0.686
semi-skilled manual	0.695	0.010	0.676	0.714
un-skilled clerical/sales/service	0.714	0.010	0.693	0.734
unskilled manual	0.661	0.009	0.643	0.680
farm labourer	0.432	0.025	0.384	0.482
Self assessed health status	Mean Probability	Standard Error	95% Conf. Interval	
excellent	0.678	0.005	0.668	0.688
very good	0.690	0.004	0.682	0.698
good	0.687	0.005	0.677	0.697
fair	0.699	0.010	0.679	0.719
poor	0.717	0.018	0.680	0.751
# chronic health problems	Mean Probability	Standard Error	95% Conf. Interval	

0	0.658	0.004	0.650	0.666
1	0.692	0.005	0.682	0.701
2	0.712	0.007	0.699	0.724
3	0.718	0.009	0.700	0.736
4	0.726	0.012	0.701	0.750
5	0.765	0.017	0.731	0.796
6-10	0.786	0.017	0.752	0.818
11+	0.915	0.086	0.668	0.993
Province of residence	Mean Probability	Standard Error	95% Conf. Interval	
BC	0.594	0.018	0.559	0.629
Alberta	0.725	0.005	0.714	0.735
Saskatchewan	0.440	0.024	0.395	0.487
Manitoba	0.532	0.007	0.519	0.545
Ontario	0.730	0.003	0.723	0.736
Quebec	0.668	0.013	0.643	0.693
New Brunswick	0.684	0.020	0.644	0.722
Nova Scotia	0.707	0.020	0.665	0.745
Prince Edward Island	0.698	0.021	0.656	0.738
Newfoundland	0.646	0.022	0.601	0.688

Data source: 1996-97 NPHS

Figure 9 Estimated probability of drug insurance coverage among the general population, by *age groups*

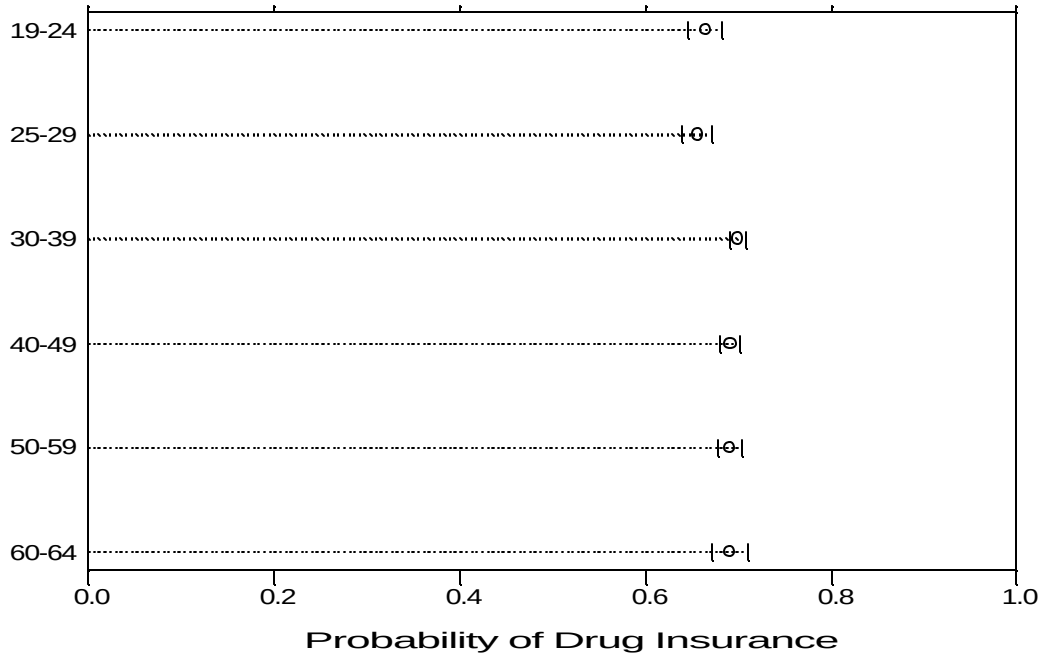


Figure 10 Estimated probability of drug insurance coverage among the general population, by *sex*.

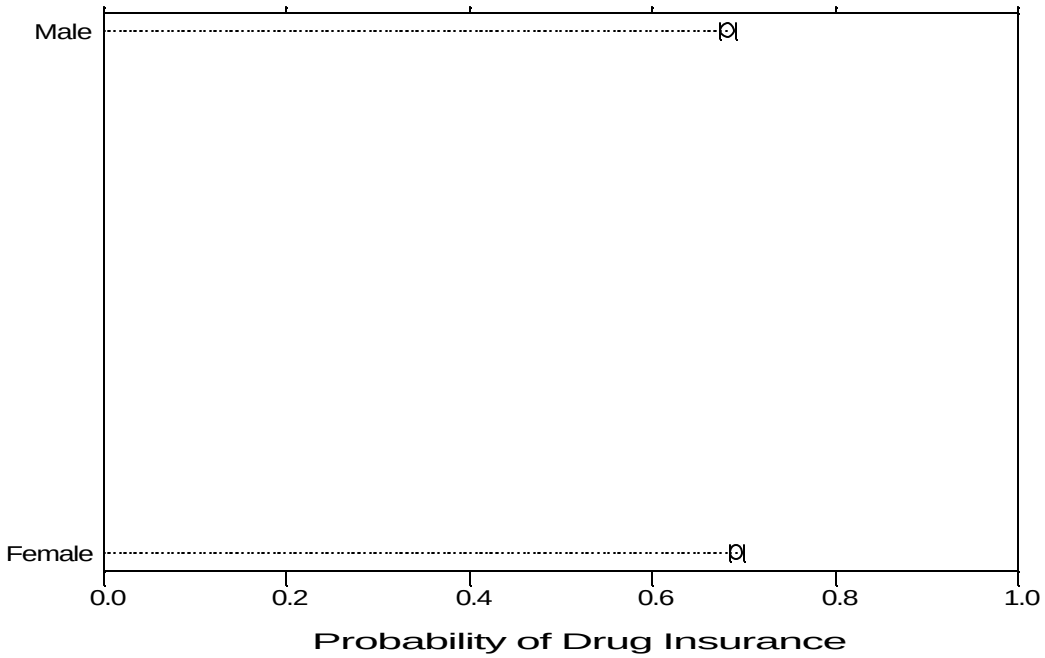


Figure 11 Estimated probability of drug insurance coverage among the general population, by *marital status*

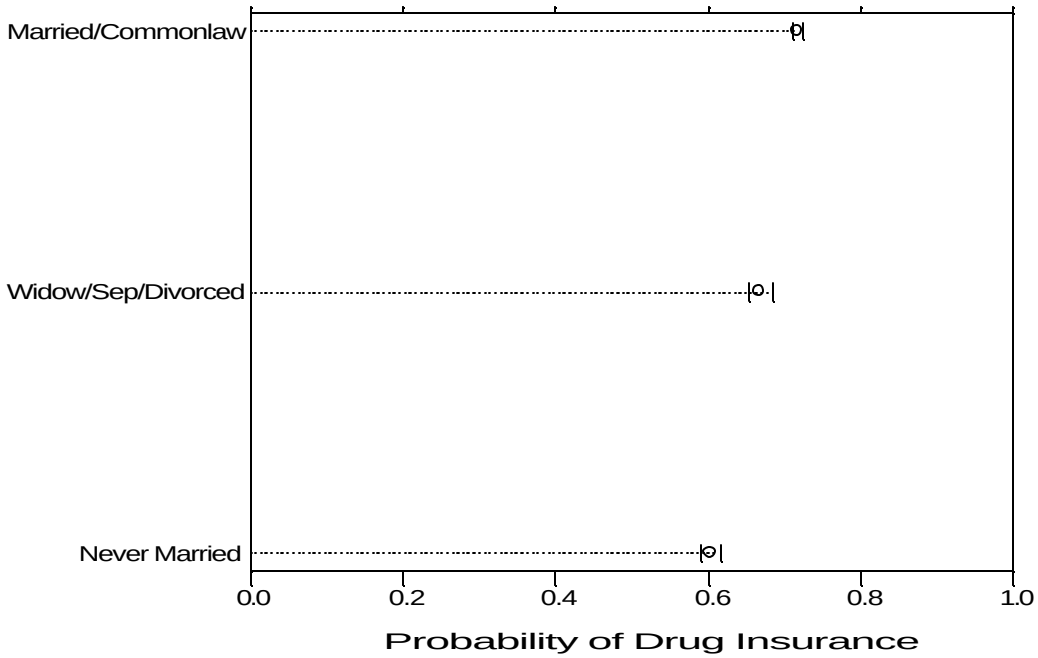


Figure 12 Estimated probability of drug insurance coverage among the general population, by *gross annual household income over previous year*

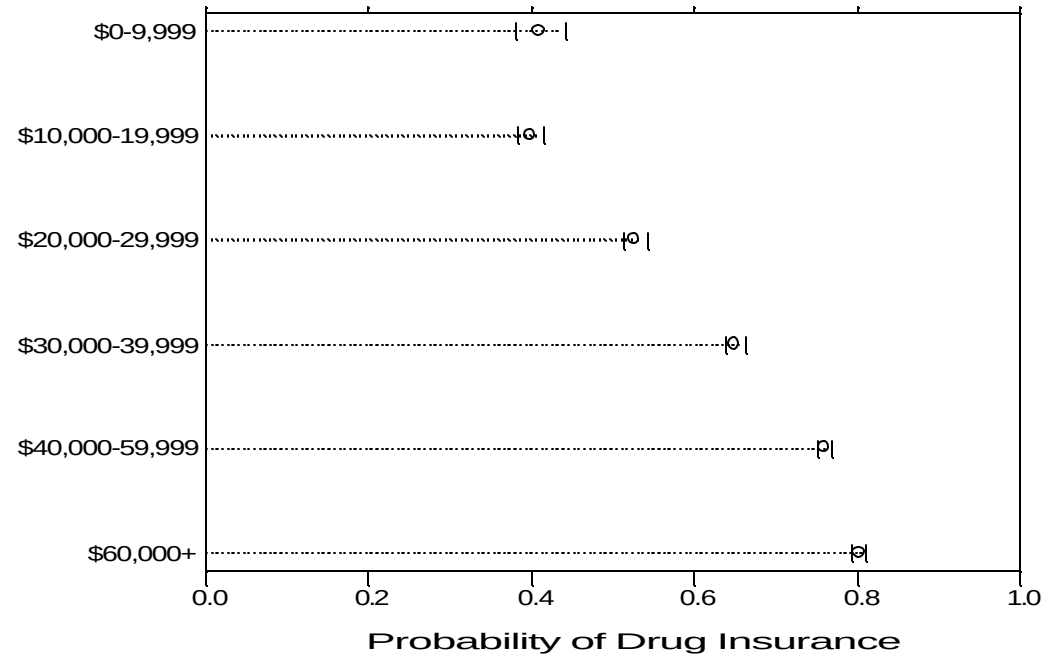


Figure 13 Estimated probability of drug insurance coverage among the general population, by *homeownership status*.

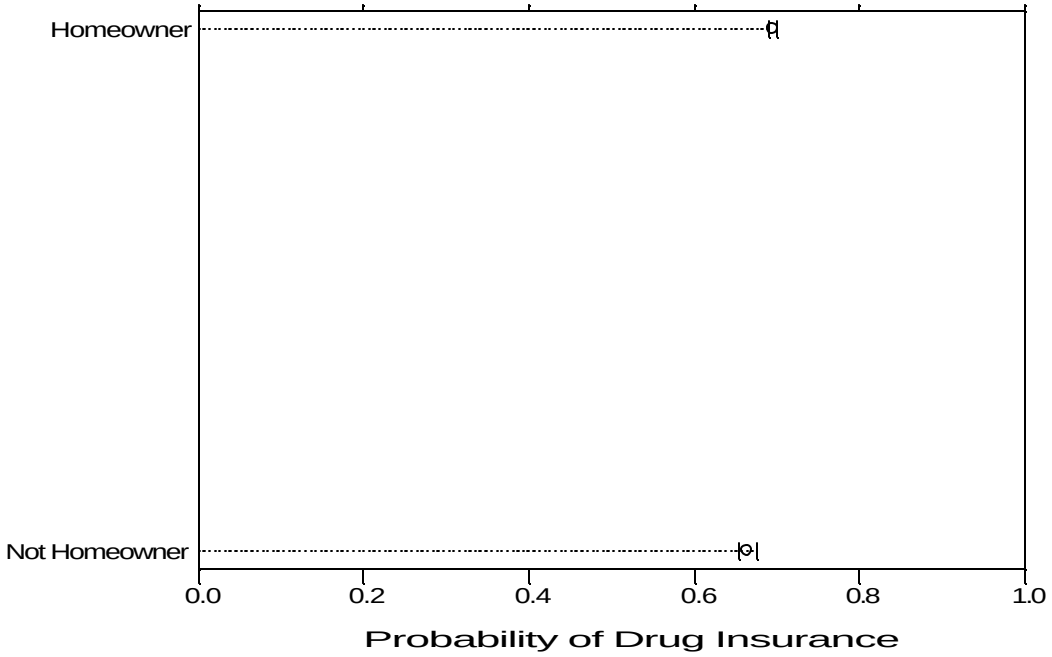


Figure 14 Estimated probability of drug insurance coverage among the general population, by *highest level of education*.

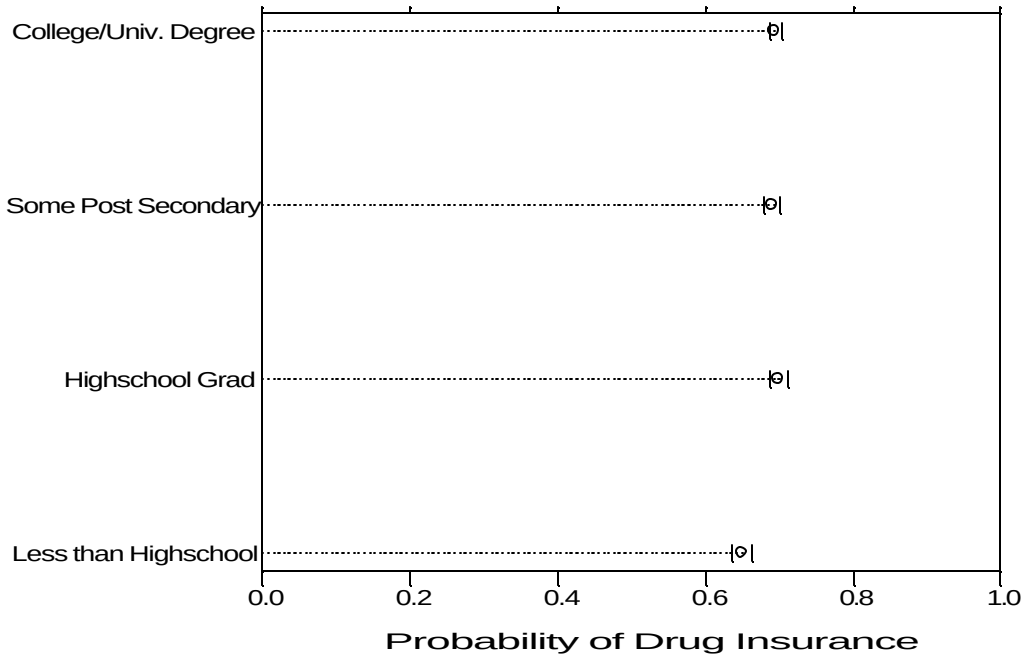
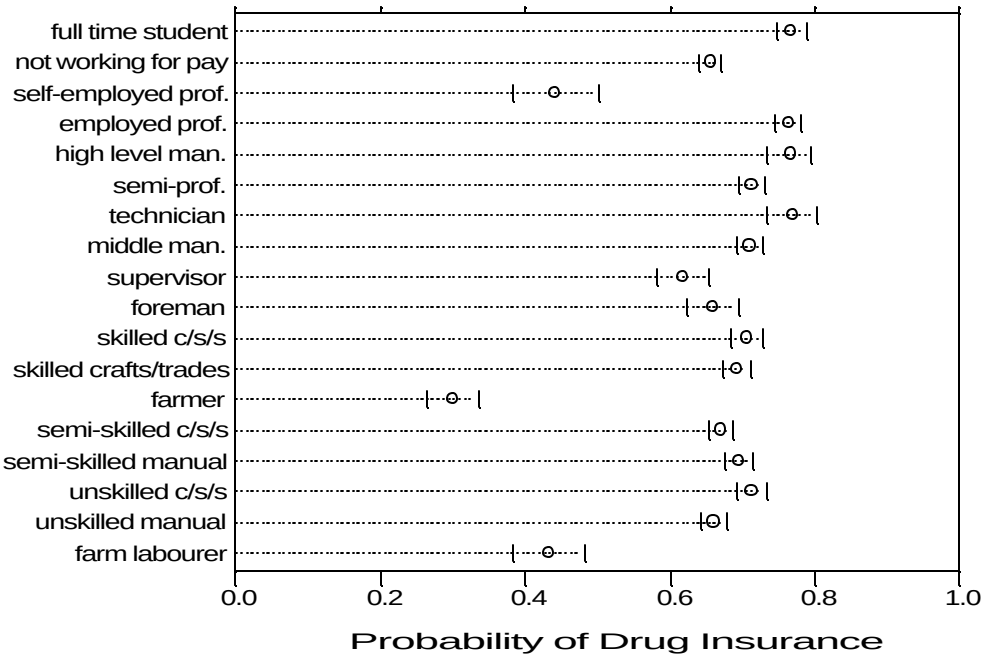


Figure 15 Estimated probability of drug insurance coverage among the general population, by *occupation*.



Note: c/s/s = clerical, sales or service.

Figure 16 Estimated probability of drug insurance coverage among the general population, by *self-assessed health status*.

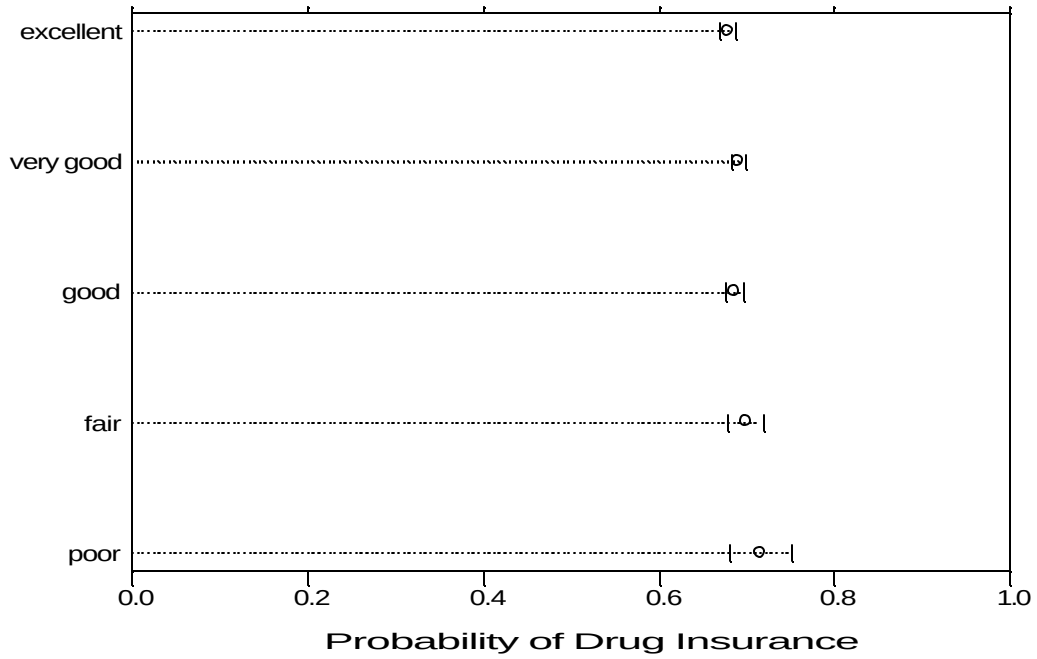


Figure 17 Estimated probability of drug insurance coverage among the general population, by *number of chronic health problems.*

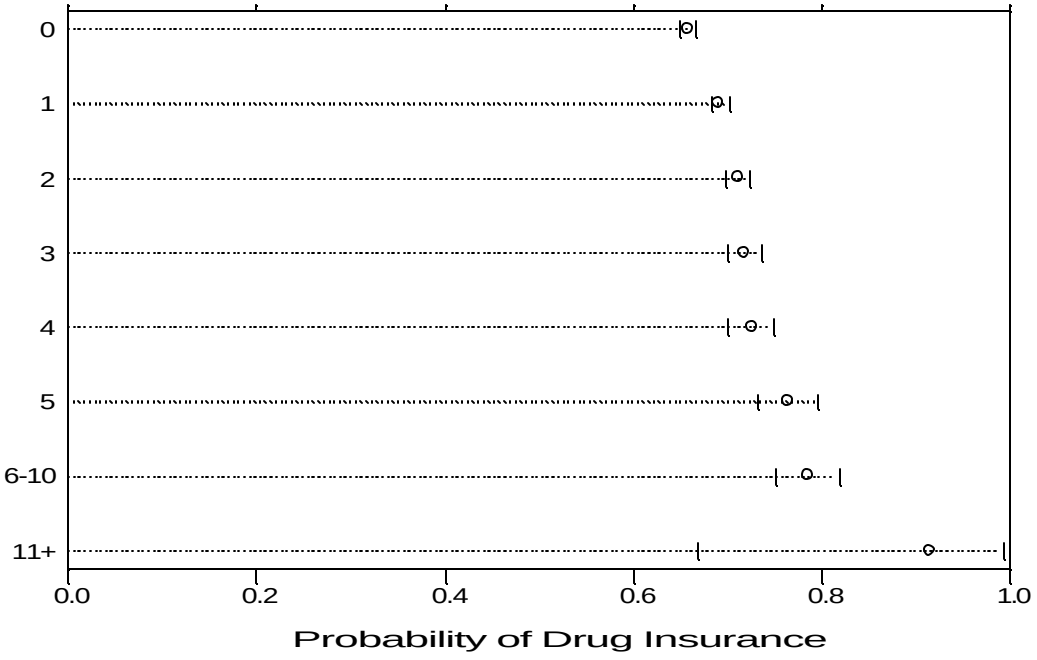
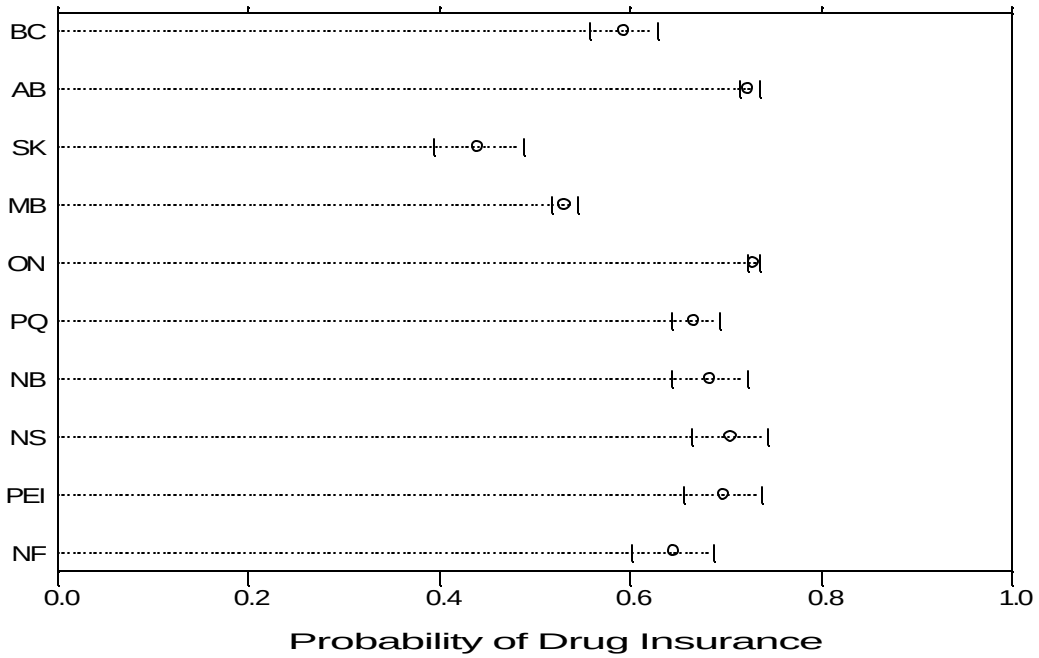


Figure 18 Estimated probability of drug insurance coverage among the general population, by *province of residence*

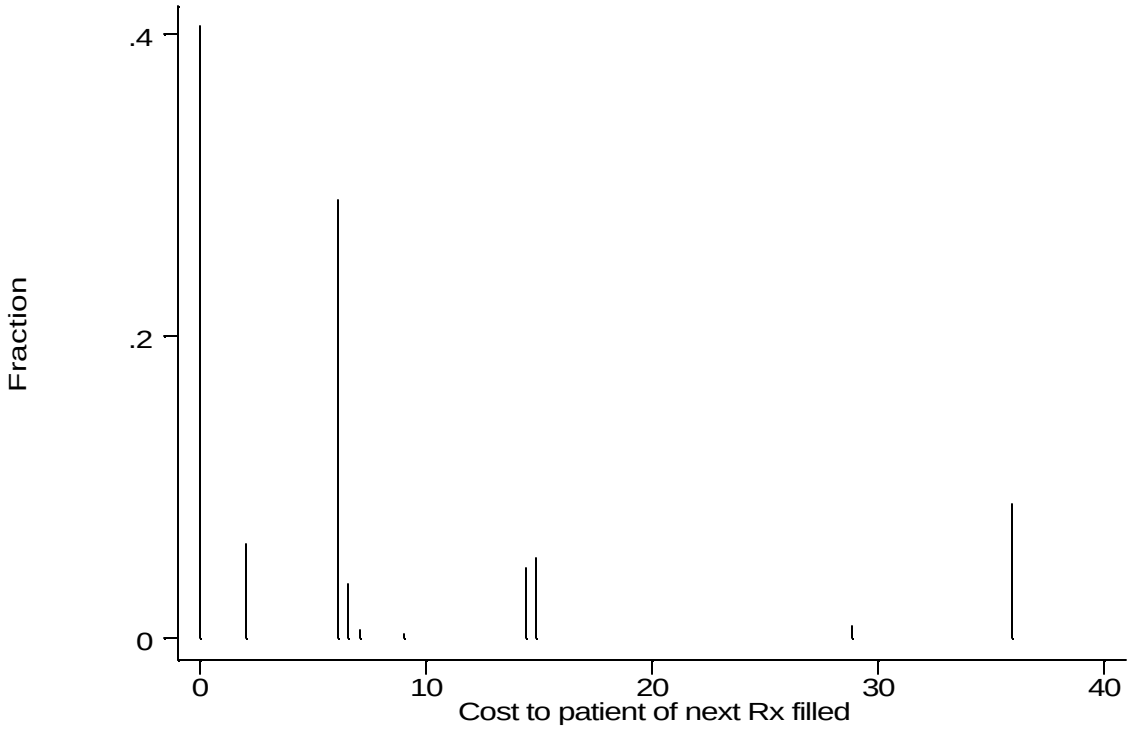


3.4 Effects of drug charges on drug use and physician services use

3.4.1 Effects of drug charges and income on seniors' use of drugs and physician services

After restricting the seniors sample to those subjects for whom the overall MDC reliability was either "very good" or "good", we were left with 3,195 or 25% of the 12,680 observations on seniors in the two NPHS surveys. These included observations on seniors residing in the provinces of Ontario, Quebec, New Brunswick, Prince Edward Island and Newfoundland; the distribution of senior's drug plans into levels of overall MDC estimation reliability are presented in Appendix 3. The average MDC in our estimating sample was $7.11 with a range of $0 to $35.89. Most of the subjects faced a MDC of under $10.00; the most frequently observed MDC was $0 (**Figure 19**). This corresponds to the observations in Ontario prior to the introduction of cost sharing there in July 1996.

Figure 19 Frequency distribution of marginal drug cost for seniors in the estimation sample.



Our results indicate that, in general, seniors' drug use is rather price insensitive. Indeed, our estimates detect a small *positive* elasticity of 0.043, meaning that a 1% increase in MDC *increases* the number of different prescription drugs taken in the last 2 days by 0.043% (95% CI: 0.011% to 0.073%). Decomposing the change in drug use, we see that the increase is primarily due to increases in the probability of using some (vs. no) drugs: a 1% increase in MDC increases the probability of some drug use by about 3 percentage points (95% CI: 1.2% to 4.1%), while there were virtually no changes observed in the number of different drugs taken by existing drug users. The overall elasticity of 0.043 could mask difference in the price sensitivity of seniors with differing levels of gross annual household income. But, after accommodating this possibility in our models, we did not find any differences in elasticities by income. Our models did reveal, however, differences in the elasticity estimates of models of the number of drugs taken for chronic conditions vis-à-vis the models of drug use for acute conditions. In neither case did the results conform with our prior hypotheses – both elasticities were positive, not negative, and the absolute size of the elasticity was higher in the models of acute drug use. There was virtually no impact of drug charges on the use of over the counter medicines, nor on the number of primary care physician visits made over the previous year. After decomposing the impact of price changes on the number of physician visits, we found that a 1% increase in MDC was associated with a very small (1%) increase in the probability of consulting a primary care physician but that there was virtually no impact on the number of visits made by those who had already consulted with physicians in the previous year.

Table 5 Estimates of means elasticity by outcome variables, with 95% confidence interval, subsample of seniors.

Outcome Variable	Mean Elasticity	95% Confidence Interval	
number of different prescription drugs taken in the last 2 days	0.043	0.011	0.073
probability of prescription drug use last 2 days	0.027	0.012	0.041
number of different prescription drugs taken in the last 2 days, in subsample of those who took at least 1 drug	-0.002	-0.024	0.020
number of different prescription drugs taken in the last 2 days, in subsample of household income *$0-9,999*	0.025	-0.047	0.097
number of different prescription drugs taken in the last 2 days in subsample of household income *$10-19,999*	0.030	-0.006	0.067
number of different prescription drugs taken in the last 2 days in subsample of household income *$20-29,999*	0.216	0.103	0.333
number of different prescription drugs taken in the last 2 days in subsample of household income *$30-39,999*	0.095	-0.105	0.298
number of different prescription drugs taken in the last 2 days in subsample of household income *$40-59,999*	0.102	-0.136	0.342
number of different prescription drugs taken in the last 2 days in subsample of household income *$60,000+*	-0.014	-0.384	0.364
number of different prescription drugs used for acute conditions taken in the last 2 days	0.094	0.033	0.155
number of different prescription drugs used for chronic conditions taken in the last 2 days	0.034	-0.004	0.071
number of different over the counter drugs taken in the last 2 days	-0.012	-0.077	0.057
number of consultations with general practitioners in the last 12 months	0.009	-0.017	0.038
probability of at least one consultation with a general practitioner in the last 12 months	0.010	0.001	0.019
number of consultations with general practitioners in the last 12 months, by those with at least 1 visit	-0.004	-0.030	0.020

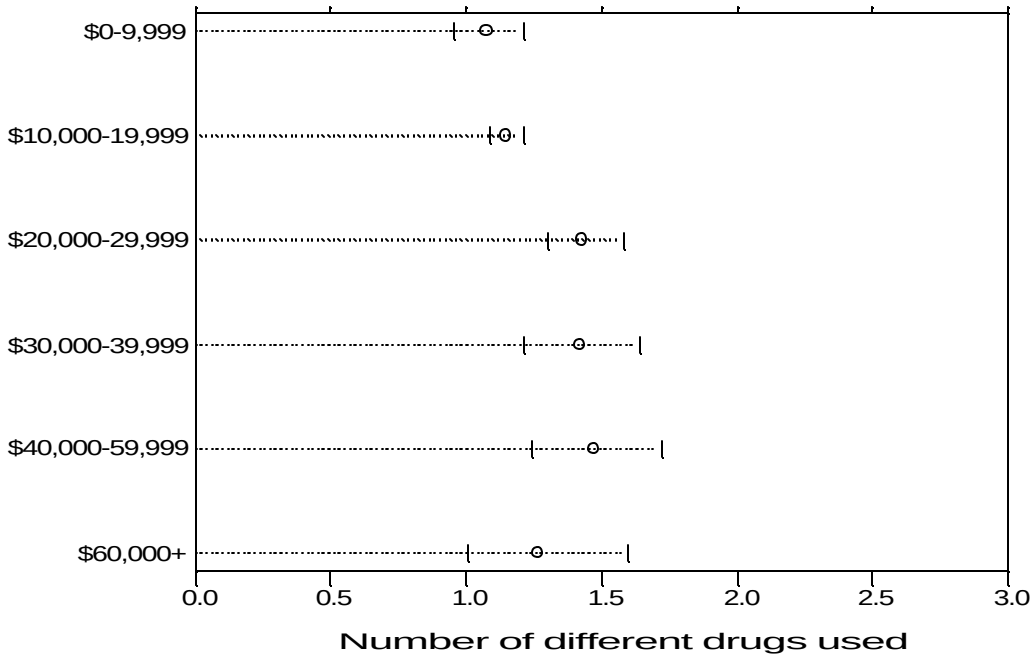
Note: for models of number of drugs use or physician visits, elasticity defined as % change in outcome variable associated with 1% increase in drug charge. For probability models, elasticity defined as absolute change in probability associated with 1% increase in drug charge.

There is some evidence that seniors' drug use is sensitive to household income. Mean number of different drugs taken in the last 2 days increased from 1.08 for subjects with household income under $10,000 to 1.47 for subjects with household income between $40,000-$59,999, a relative increase of 36% (**Table 6** and **Figure 20**). The largest increase in drug use occurred when income increased above $10,000-$19,999. Drug use tapered off slightly for those in the highest income bracket $60,000 and over.

Table 6 Estimated mean number of different prescription drugs used by seniors in the last 2 days, by levels of gross household income, with 95% confidence intervals

Household income	Mean	Std. Err	95% Conf. Interval	
$0-9,999	1.077	0.066	0.952	1.213
$10,000-19,999	1.146	0.032	1.087	1.208
$20,000-29,999	1.427	0.070	1.299	1.578
$30,000-39,999	1.417	0.108	1.215	1.643
$40,000-59,999	1.470	0.122	1.245	1.724
$60,000+	1.263	0.150	1.007	1.598

Figure 20 Mean number of different prescription drugs used by seniors in the last 2 days, by levels of gross household income, with 95% confidence intervals



3.4.2 Effects of drug charges and income on use of drugs and physician services by social assistance recipients

Social assistance recipients appear to be somewhat more price sensitive than seniors (**Table 7**). The price elasticity of drug use for this group is –0.10 (95% CI: -0.15% to -0.05%), meaning that a 1% increase in MDC is associated with a –0.10% decrease in the number of different prescription drugs taken during the last 2 days. Furthermore, the effects of cost sharing appear to operate though both the probability of any use and the number of different drugs taken by users.

There was some heterogeneity in the drug price sensitivity among individuals with different levels of household income. Individuals with household income of $10,000-$19,999 were the most price responsive, with an elasticity estimate of –0.18. The elasticity for the highest income group – those with incomes of $30,000 or more – had a larger elasticity, but this was not statistically different from zero. The other income groups also had elasticity estimates that were not statistically different from zero at conventional levels. Just as was the case for seniors, the price elasticity estimates for models of acute and chronic drug use differed; acute drug use seemed to be much more price responsive than chronic drug use. Over the counter drug use was also price sensitive – the elasticity estimate was –0.16% (95% CI: -0.25% to -0.06%). Drug price had only negligible impact on the number of primary care physician visits among social assistance recipients. Finally, in contrast to what was observed among seniors, the mean drug use by social assistance recipients does not seem to vary with gross household income (**Table 8** and **Figure 21**).

Table 7 Summary of estimated drug price elasticities for social assistance recipients by outcome variable, with 95% confidence intervals

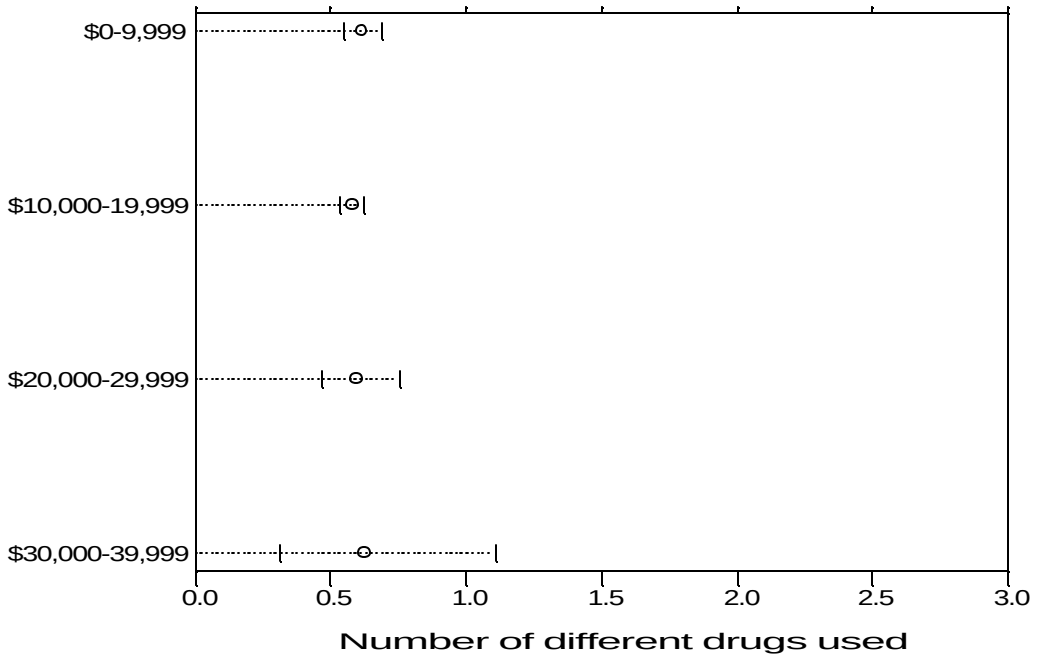
Outcome Variable	Mean Elasticity	95% Confidence Interval	
number of different prescription drugs taken in the last 2 days	-0.097	-0.146	-0.049
probability of prescription drug use last 2 days	-0.027	-0.047	-0.009
number of different prescription drugs taken in the last 2 days, in subsample of those who took at least 1 drug	-0.032	-0.063	0.000
number of different prescription drugs taken in the last 2 days, in subsample of household income *$0-9,999*	-0.032	-0.098	0.036
number of different prescription drugs taken in the last 2 days in subsample of household income *$10-19,999*	-0.179	-0.254	-0.102
number of different prescription drugs taken in the last 2 days in subsample of household income *$20-29,999*	-0.079	-0.314	0.151
number of different prescription drugs taken in the last 2 days in subsample of household income *$30,000+*	-0.419	-1.144	0.302
number of different prescription drugs used for acute conditions taken in the last 2 days	-0.161	-0.265	-0.062
number of different prescription drugs used for chronic conditions taken in the last 2 days	-0.056	-0.130	0.019
number of different over the counter drugs taken in the last 2 days	-0.155	-0.249	-0.063
number of consultations with general practitioners in the last 12 months	-0.033	-0.071	0.009
probability of at least one consultation with a general practitioner in the last 12 months	0.007	-0.004	0.019
number of consultations with general practitioners in the last 12 months, by those with at least 1 visit	-0.035	-0.071	0.000

Note: for models of number of drugs use or physician visits, elasticity defined as % change in outcome variable associated with 1% increase in drug charge. For probability models, elasticity defined as absolute change in probability associated with 1% increase in drug charge.

Table 8 Estimated mean number of different prescription drugs used by social assistance recipients in the last 2 days, by levels of gross household income, with 95% confidence intervals

Household Income	Mean	Std. Error	Conf. Interval	
$0-9,999	0.615	0.034	0.551	0.687
$10,000-19,999	0.581	0.024	0.536	0.623
$20,000-29,999	0.596	0.074	0.465	0.756
$30,000-39,999	0.626	0.210	0.311	1.109

Figure 21 Estimated mean number of different prescription drugs used by social assistance recipients in the last 2 days, by levels of gross household income, with 95% confidence intervals



3.4.3 Effects of drug insurance coverage and income on use of drugs and physician services by general population

Among the general population, our instrumental variables estimates suggest that the effect of holding drug insurance has virtually no effect on the number of different drugs taken in the last 2 days. Holding constant socio-economic, demographic and health status variables, those with

drug insurance coverage use about only 4% more drugs than those without insurance; moreover the confidence interval around this estimate includes zero. There were differences observed in the effect of insurance coverage on acute versus chronic drug use – the insured used 46% more drugs for acute conditions than did the uninsured, but the estimate was somewhat imprecise. On the other hand, the insured used 14% fewer drugs for chronic conditions than did the uninsured, but the confidence interval around this mean ranged from –59% to 25%, reflecting imprecision of the estimates. The insured used about 66% more over the counter medications than did the uninsured, (this affect appeared to be estimated with some precision) but there was virtually no difference in the rates of primary care physician consults between the 2 groups.

Table 9 Estimated percentage change in drug use and primary care physician visits between those with some versus no drug insurance coverage, general population, with 95% confidence intervals

Outcome Variable	Mean Elasticity	95% Confidence Interval	
number of different prescription drugs taken in the last 2 days	3.6	-23.4	32.1
number of different prescription drugs used for acute conditions taken in the last 2 days	46.0	-0.60	95.1
number of different prescription drugs used for chronic conditions taken in the last 2 days	-14.3	-58.7	25.0
number of different over the counter drugs taken in the last 2 days	66.4	23.4	112.0
number of consultations with general practitioners in the last 12 months	3.7	-19.5	23.8

Note: elasticity defined as % difference in outcome variable between those with some drug insurance versus those with no drug insurance.

We turn next to the effect of household income on the prescription drug use. In contrast to earlier analyses, here we compare the difference in drug use of individuals with incomes $10,000 and higher to those with income below this amount. **Table 10** below reveals that the drug use of those with income between $10,000-19,999 was virtually the same as those with less than $10,000 household income. Very small differences in mean drug use were observed, however, between with $30,000-39,999 income relative to those with less than $10,000 (0.001 different drug difference). The difference was only slightly larger for those with incomes $40,000-$59,999 (0.016 difference) and those with $60,000 or higher income (0.037 difference).

Table 10 Estimated mean number of different prescription drugs used by general population last 2 days, by levels of gross household income, with 95% confidence intervals

Household income	Estimated difference in drug use compared to those with less than $10,000 household income	95% Confidence Interval	
$10,000-19,999	0.000	-0.074	0.066
$20,000-29,999	-0.020	-0.101	0.049
$30,000-39,999	0.001	-0.084	0.062
$40,000-59,999	0.016	-0.076	0.087
$60,000+	0.037	-0.053	0.111

3.5 Effects of drug cost and income on use of specific medicines

The focus in this section is on the effects of drug insurance on the use of so-called "essential" medications in the last month among individuals diagnosed with specific health conditions. Specifically we examine variation in the use versus non-use of insulin and pills for diabetes among diagnosed diabetics, use of high blood pressure medications among those with hypertension and use of "asthma medications" among those diagnosed with asthma. It should be noted that this analysis does not identify variations in medications non-compliance associated with drug charges, beyond the simple use versus non-use of these drugs.

Overall, our estimates indicate that use of specific "essential" medications is rather insensitive to the variations in drug charges observed in our data. A 1% increase in MDC lowered the probability that a senior diagnosed with asthma would use an asthma medications in the last month by only 0.014 or by 1.4%. The corresponding figure for social assistance recipients was 1.9%, suggesting that social assistance recipients are slightly more price sensitive than seniors. In both cases, however, the confidence interval around the estimates included zero. For general population respondents diagnosed with asthma, our results suggest that those with prescription drug insurance coverage are 8% less likely to have taken an asthma medication in the last month – a somewhat counterintuitive finding – but again the estimates are sufficiently imprecise that we could not reject the hypothesis that general population asthmatics are, in fact, completely price insensitive.

Turning to the use of insulin or "pills for diabetes" among those diagnosed with diabetes, we see that again the effects of drug price on drug use are very negligible for seniors and social assistance recipients. Diabetics in the general population with some drug coverage were 16% more likely to take insulin or "pills for diabetes" in the last month compared to those without insurance, but again the estimate was quite noisy. The models of the probability of use of "medicine for blood pressure" among those diagnosed with hypertension paints a similar picture – seniors and social assistance recipients were virtually unresponsive to variations in drug price, whereas hypertensives in the general population with some drug insurance were about 14% less likely to use anti-hypertensives than those with no insurance, but this estimate could not be distinguished from zero.

Table 11 Summary of the estimated effects of drug insurance on the use of "essential" drugs among individuals diagnosed with specific chronic health problems, by target group

Health Condition	Target Drugs	Target Group	No. of obs.	Elasticity Estimate	95% Confidence Interval	
Asthma	"asthma medications"	Seniors	189	-0.014	-0.091	0.001
		Social Assistance	359	-0.019	-0.073	0.033
		General population	3,124	-0.082	-0.245	0.142
Diabetes	"Insulin" or "pills to control diabetes"	Seniors	329	0.009	-0.037	0.056
		Social Assistance	121	0.012	-0.001	0.103
		General population	1,123	0.155	-0.148	0.481
Hypertension	"medicine for blood pressure"	Seniors	1,000	-0.002	-0.019	0.015
		Social assistance	232	0.002	-0.043	0.053
		General population	3,690	-0.135	-0.279	0.004

Note: elasticity estimate for seniors and social assistance recipients represents the change in probability of use of target drug associated with 1% increase in MDC. Elasticity estimate for general population represents difference in probability of target drug use between those with and without some prescription drug insurance.

Next we turn to the effects of gross household income on the probability of use of drugs for asthma, diabetes and hypertension. Higher amounts of household income lead to a higher probability of drug use, at least over certain ranges of income. The probability of asthma medications use among elderly and general population asthmatics increases from $0 - $40,000 then appears to drop off with higher levels of income. Among social assistance recipients diagnosed with asthma, the probability of use of asthma drugs increases monotonically as income increases upwards from $10,000-$19,999.

Among elderly diabetics, the probability of use of insulin or "pills for diabetes" appeared to increase from $0 to $39,999 then tapered off thereafter. In contrast, rates of drug use among social assistance recipients and the general population diagnosed with diabetes were relatively invariant to income. Rates of use of anti-hypertensives were also relatively invariant to income for all three target groups.

Table 12 Estimated probability of use of asthma medications by seniors diagnosed with asthma, by levels of gross household income, with 95% confidence intervals

Household Income	Estimated probability of drug use	Std. Error	Conf. Interval	
$0-9,999	0.381	0.426	0.000	1.000
$10,000-19,999	0.394	0.427	0.000	1.000
$20,000-29,999	0.417	0.432	0.000	1.000
$30,000-39,999	0.461	0.439	0.000	1.000
$40,000-59,999	0.360	0.421	0.000	1.000
$60,000+	0.397	0.429	0.000	1.000

Figure 22 Estimated probability of use of asthma medications by seniors diagnosed with asthma, by levels of gross household income, with 95% confidence intervals

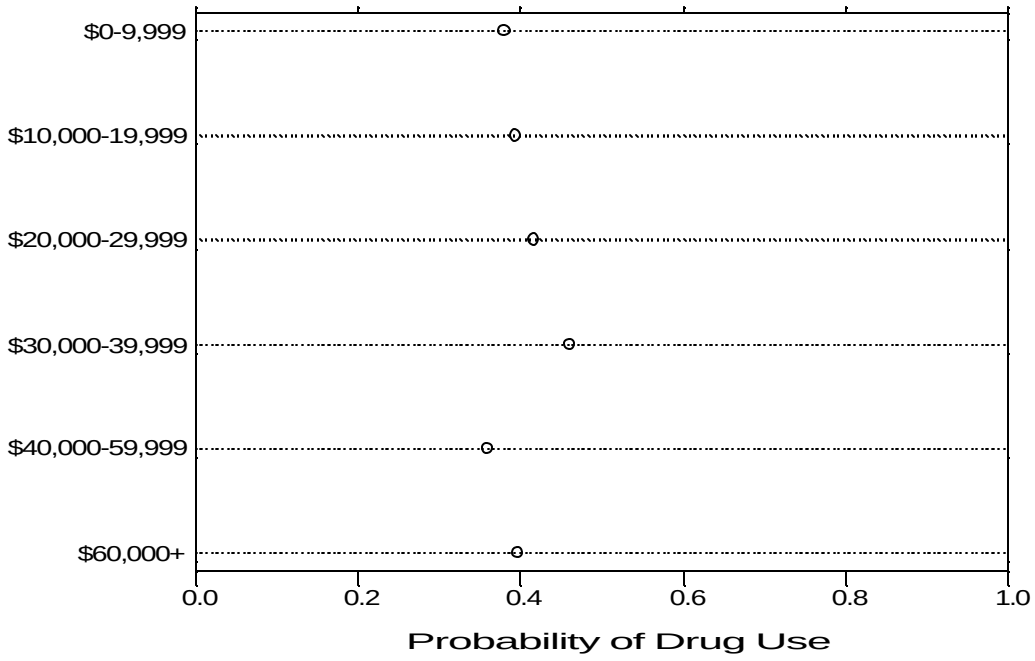


Table 13 Estimated probability of use of asthma medications last month by social assistance recipients diagnosed with asthma, by levels of gross household income, with 95% confidence intervals

Household Income	Estimated probability of drug use	Std. Error	Conf. Interval	
$0-9,999	0.757	0.041	0.672	0.833
$10,000-19,999	0.617	0.042	0.535	0.697
$20,000-29,999	0.717	0.102	0.475	0.878
$30,000+	0.773	0.202	0.260	0.988

Figure 23 Estimated probability of use of asthma medications last month by social assistance recipients diagnosed with asthma, by levels of gross household income, with 95% confidence intervals

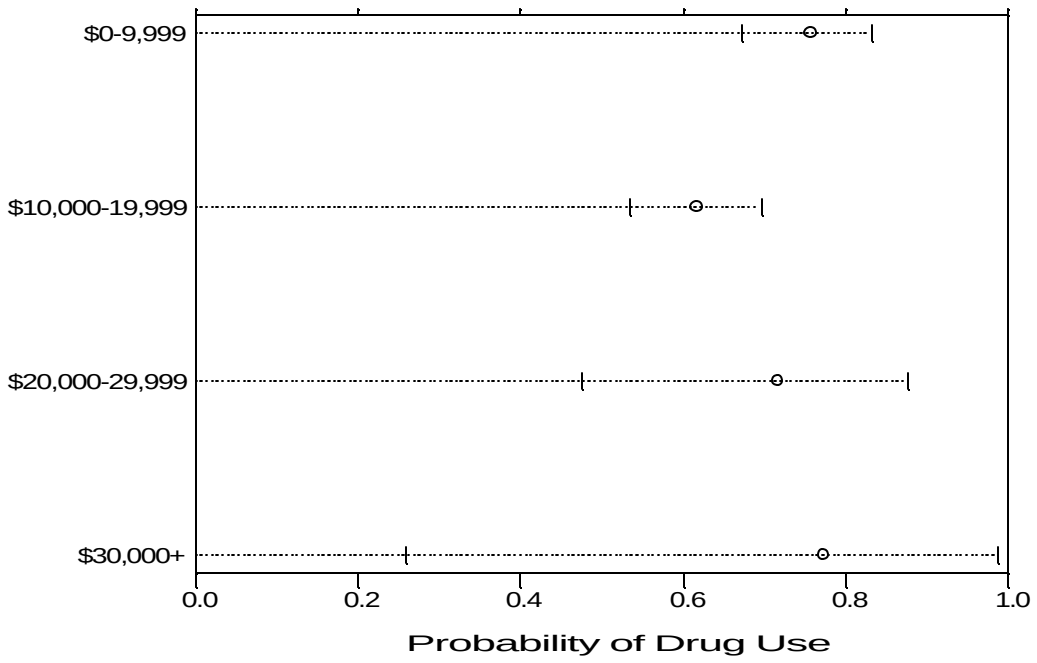


Table 14 Estimated probability of use of asthma medications last month by general population diagnosed with asthma, by levels of gross household income, with 95% confidence intervals

Household Income	Estimated probability of drug use	Conf. Interval	
$0-9,999	0.548	0.446	0.644

$10,000-19,999	0.588	0.519	0.654
$20,000-29,999	0.580	0.523	0.630
$30,000-39,999	0.610	0.564	0.654
$40,000-59,999	0.554	0.514	0.590
$60,000+	0.576	0.529	0.621

Table 15 Estimated probability of use insulin or "pills for diabetes" by seniors diagnosed with diabetes, by levels of gross household income, with 95% confidence intervals

Household Income	Estimated probability of drug use	Std. Error	Conf. Interval	
$0-9,999	0.664	0.092	0.460	0.822
$10,000-19,999	0.733	0.034	0.663	0.796
$20,000-29,999	0.721	0.063	0.584	0.829
$30,000-39,999	0.800	0.095	0.573	0.942
$40,000-59,999	0.329	0.132	0.110	0.618
$60,000+	0.749	0.190	0.289	0.976

Figure 24 Estimated probability of use insulin or "pills for diabetes" by seniors diagnosed with diabetes, by levels of gross household income, with 95% confidence intervals

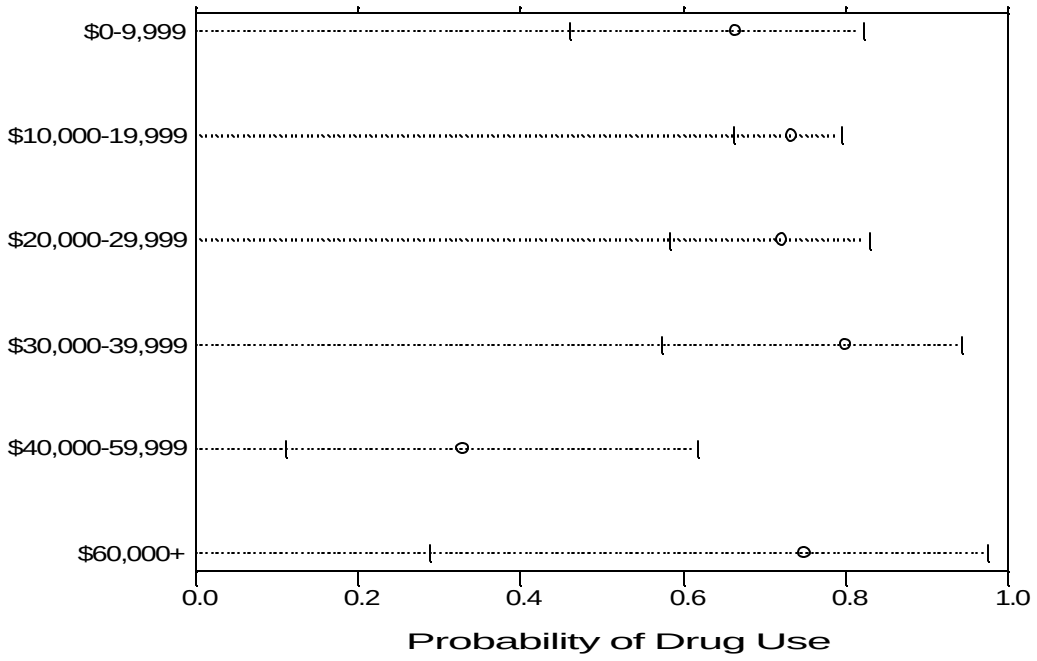


Table 16 Estimated probability of use insulin or "pills for diabetes" last month by social assistance recipients diagnosed with diabetes, by levels of gross household income, with 95% confidence intervals

Household Income	Estimated probability of drug use	Std. Error	Conf. Interval	
$0-9,999	0.387	0.442	0.000	1.000
$10,000-19,999	0.421	0.449	0.000	1.000
$20,000-29,999	0.379	0.440	0.000	1.000
$30,000+	0.406	0.447	0.000	1.000

Figure 25 Estimated probability of use of insulin or "pills for diabetes" last month by social assistance recipients diagnosed with diabetes, by levels of gross household income, with 95% confidence intervals

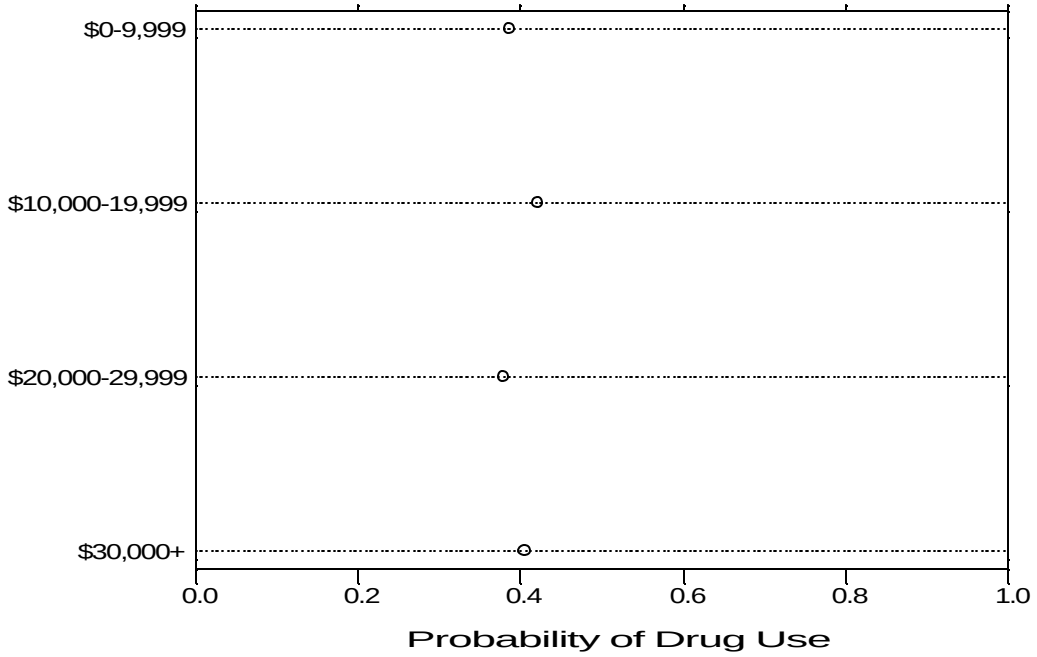


Table 17 Estimated change in the probability of use of insulin or "pills for diabetes" by general population 19-64 years diagnosed with diabetes, by level of household income, with 95% confidence intervals

Household Income	Estimated probability of drug use	Conf. Interval	
$0-9,999	0.724	0.556	0.846
$10,000-19,999	0.682	0.564	0.777
$20,000-29,999	0.625	0.535	0.704

$30,000-39,999	0.668	0.595	0.728
$40,000-59,999	0.675	0.596	0.734
$60,000+	0.637	0.543	0.721

Table 18 Estimated probability of use "medicine for blood pressure" by seniors diagnosed with high blood pressure, by levels of gross household income, with 95% confidence intervals

Household Income	Estimated probability of drug use	Std. Error	Conf. Interval	
$0-9,999	0.810	0.037	0.730	0.875
$10,000-19,999	0.877	0.014	0.848	0.903
$20,000-29,999	0.819	0.034	0.746	0.879
$30,000-39,999	0.861	0.046	0.758	0.933
$40,000-59,999	0.896	0.050	0.768	0.967
$60,000+	0.835	0.078	0.639	0.949

Figure 26 Estimated probability of use of 'medicine for blood pressure' by seniors diagnosed with high blood pressure, by levels of gross household income, with 95% confidence intervals

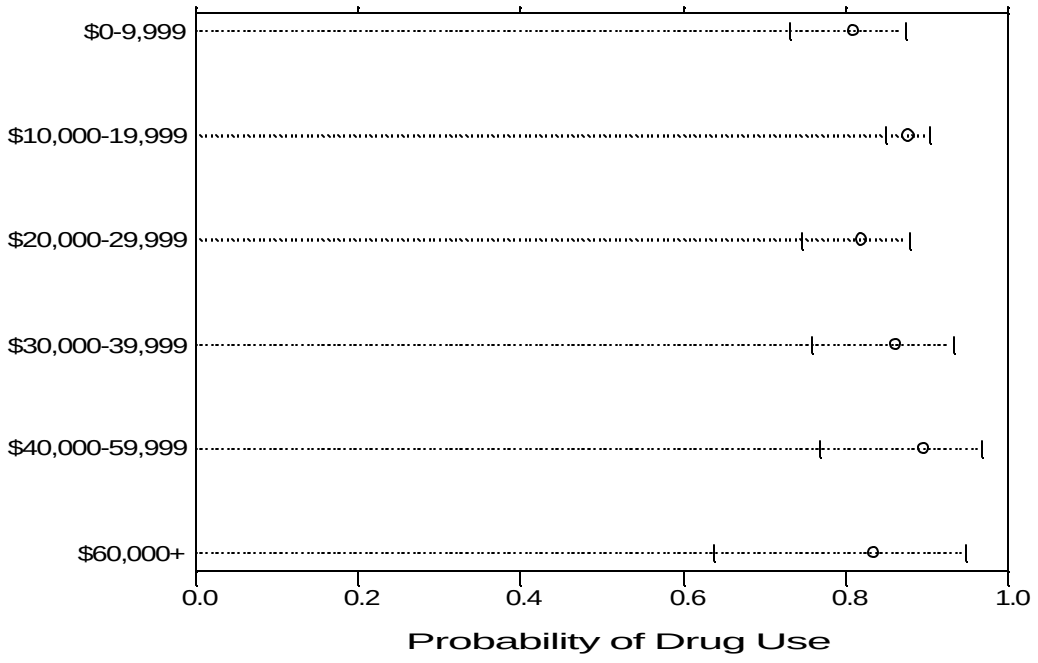


Table 19 Estimated probability of use of 'medicine for blood pressure' last month by social assistance recipients diagnosed with high blood pressure, by levels of gross household income, with 95% confidence intervals

Household Income	Estimated probability of drug use	Std. Error	Conf. Interval	
$0-9,999	0.637	0.272	0.081	0.982
$10,000-19,999	0.596	0.279	0.071	0.977
$20,000-29,999	0.672	0.269	0.096	0.989
$30,000+	0.623	0.271	0.070	0.980

Figure 27 Estimated probability of use of 'medicine for blood pressure' last month by social assistance recipients diagnosed with high blood pressure, by levels of gross household income, with 95% confidence intervals

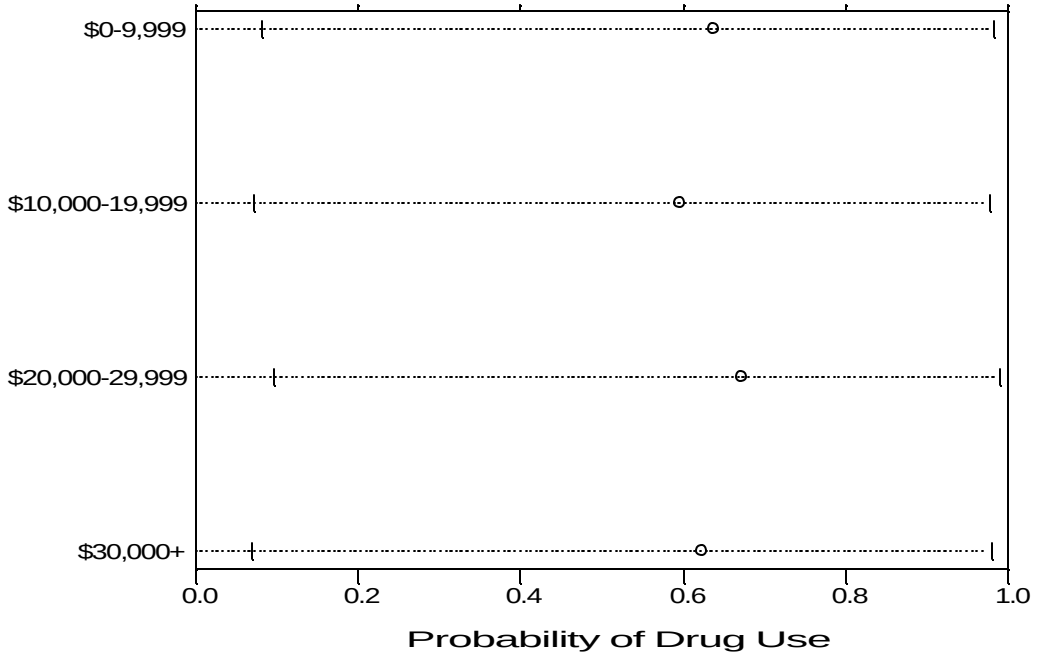


Table 20 Estimated change in the probability of use of 'medicine for blood pressure' by general population 19-64 years diagnosed with high blood pressure, by levels of gross household income, with 95% confidence intervals

Household Income	Estimated probability of drug use	Conf. Interval	
$0-9,999	0.710	0.620	0.793
$10,000-19,999	0.659	0.592	0.724
$20,000-29,999	0.686	0.636	0.731

$30,000-39,999	0.713	0.672	0.749
$40,000-59,999	0.720	0.688	0.753
$60,000+	0.708	0.663	0.748

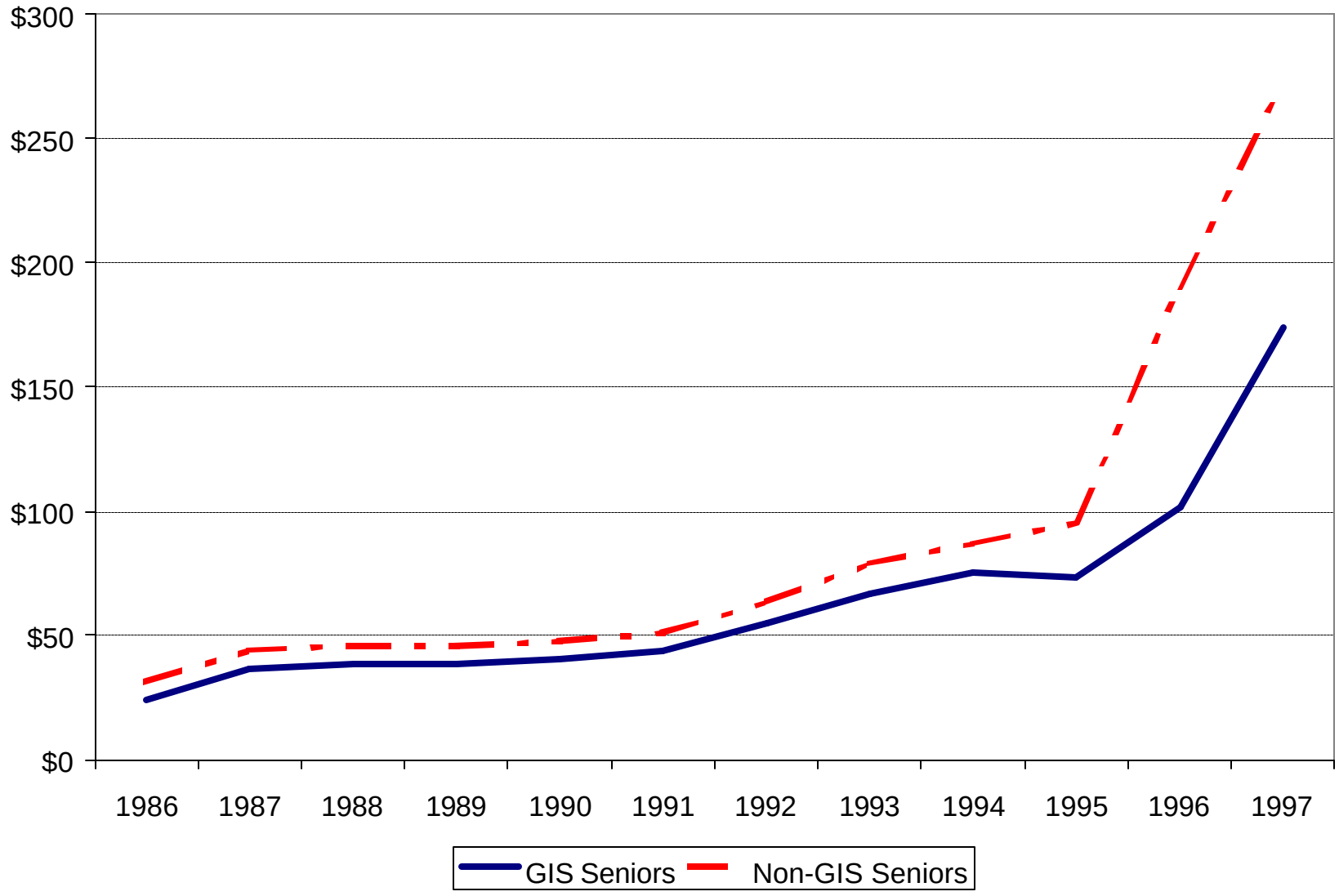
4. Discussion

Drug charges in Canada, or "Do we need national pharmacare?" Although there are several different reasons why governments might be interested in expanding subsidies for prescription drugs, a primary reason is to reduce financial barriers to drugs. What financial barriers to drugs do Canadians currently face? We distinguish between the financial barriers to drugs faced by seniors and social assistance recipients – those for whom provincial drug plans are a primary source of drug insurance coverage(16) and the remainder of the population – henceforth the "general population". Although all the non-Atlantic provincial governments offer some drug subsidies to the general population, benefits are typically far less generous than for seniors and social assistance recipients. For, example, in all provinces except Alberta, benefits are paid only after household-level out of pocket spending exceeds a substantial deductible; deductibles in Saskatchewan, for example, are $850 semi-annually. In Alberta, members of the general population must pay premiums to be eligible for government subsidized drug insurance. Private, not public, drug insurance is therefore the primary source of insurance among most members of the general population(2).

Expenditures on provincial drug programs have been the fastest growing component of public health care expenditures in Canada(17), and total expenditures on drugs is now equal to the expenditure on physician services(18). One of the primary responses of provincial governments drug plans to rising drug expenditures has been to introduce or increase beneficiary user fees(16), most typically for their senior beneficiaries. Figure 28, below, simulates the annual provincial weighted average[3] out of pocket drug cost facing a single senior with $540 annual drug expenditures (18 prescriptions per year, each costing $30) over the period 1986 – 1997. Because low income seniors typically receive more comprehensive public drug insurance coverage than do higher income seniors, separate cost schedules are presented by seniors' income status. Low income seniors are assumed to have household income of $15,000 and receive the federal Guaranteed Income Supplement (GIS); high income seniors are assumed to have household income of $25,000 and not receive GIS. As is clear from the figure, copayment rates have increased substantially over the 12 year period. In 1986, a low income senior was required to pay $24 of the $540 drug cost; in 1997 this figure was $174, an increase of 625%. Cost sharing increases were higher for higher income seniors. Out of pocket drug expenses for higher income seniors grew from $31 in 1986 to $272 in 1997, an increase of 777%.

[3] Provincial weights were the proportion of the total Canadian population of individuals 65 and older residing in the respective provinces. Population data are from the 1996 Census of Canada (Statistics Canada, 1997).

Figure 28 Canadian average out-of-pocket expenses for a senior (65 and older) incurring $540 annual drug expenses: 1986 – 1997, by GIS recipiency status.



Recent studies have estimated the number of Canadians by level of drug insurance coverage (full, partial or none) and by various socio-economic and demographic characteristics (such as age, sex and employment status). Less attention has been paid, however, to the distribution of direct charges for prescription drugs paid by senior and social assistance beneficiaries of the provincial drug plans and how these charges vary by province. We used the NPHS data to address this question.

We found considerable inter-provincial variation in direct charges for senior beneficiaries of the provincial drug plans. Mean charges ranged from $0 (Ontario 1994-95) to $26.62 (Saskatchewan 1996-97). Consistent with the graph above, drug charges for seniors were increasing, especially for residents of 2 of Canada's most populous provinces – Ontario and Quebec. Charges for social assistance recipients were much lower – most provinces charged nothing, and those that did charge, typically charged $2 per prescription. A notable except was the province of Quebec, which introduced deductibles and coinsurance rates exceeding $6 per prescription in 1996-1997.

There is considerable variation in the rates of insurance coverage among the general population. It has been estimated that 10% of Canadians do not have any drug insurance coverage, and a further 10% are under-insured (paying 35 percent or more of their costs out of pocket)(2). The 10% of the population who are uninsured are likely non-elderly not receiving social assistance benefits who are not members of an employment-related, professional association or student group drug plan(2); individuals not enrolled in such plans wishing to purchase drug insurance often face substantial direct charges well in excess of their expected drug costs. It also appears that a substantial proportion of the 10% of the under-insured are those with labour force attachments but either work in occupations without comprehensive coverage or work on a part time basis (2).[4]

There already has been some research on the association between the socio-economic and demographic characteristics of those in the general population and their level of drug insurance coverage. These studies, however, have examined univariate associations between drug insurance coverage and individual characteristics and are unable to disentangle whether it is the individual characteristic itself, or other factors associated with the individual characteristic that are responsible for the correlation. For example, while other studies(2;19) have found that those with higher levels of household income have a higher probability of drug insurance coverage, it is unclear if the "causal" factor is income, or factors associated with income, such as education and labour force activity (labour force participation, and if in the labour force, ones sector of employment). In the absence of direct public provision of prescription drug insurance (through, for example, a national pharmacare plan), one policy option to increase the uptake of prescription drug insurance among the general population is to change those individual characteristics (such as income, education and labour force activity) which are associated with it. Which factor to change, e.g. increasing income among the working poor by tax reform; providing tuition subsidies and income contingent loans to encourage additional training; encouraging female labour force participation by subsidizing day care; depends on knowledge of the determining factors. Hence, our focus is on the effects of specific characteristics on the probability of some

[4] There is little evidence that rates of beneficiary cost sharing have recently increased among the private insurance plans. Instead, it appears that the private plans have reacted to expenditure growth by restricting access to specific high cost medications through the use of drug formularies(80).

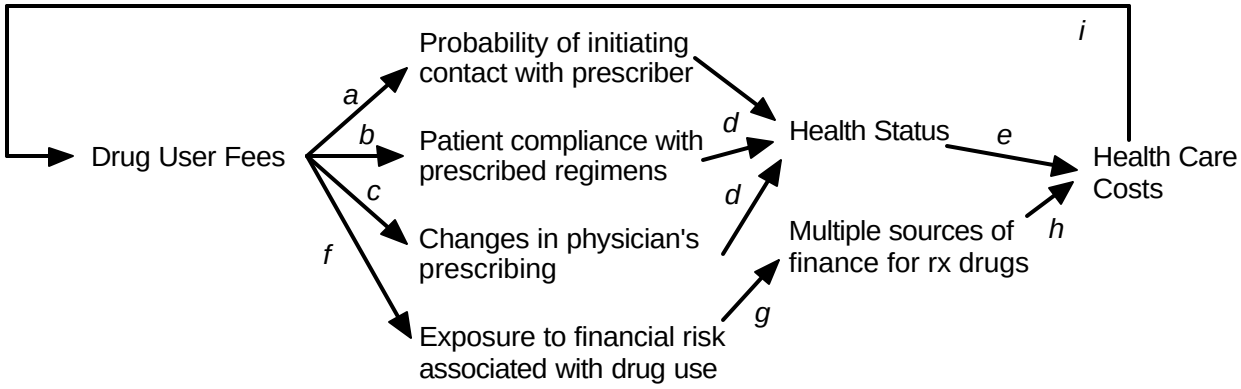
(versus no) drug insurance coverage among the general population, holding all other factors constant.

Our results point to three important determinants of drug insurance coverage among the general population 19-64 years of age. The first is household income, which is not entirely surprising – those with higher levels of household income are better able to pay for drug insurance coverage or perhaps those in higher paying jobs have more comprehensive drug insurance employee benefits. The likelihood of insurance increases monotonically from 40% for those with incomes of $10,000-$19,999 to 80% for those with incomes of $60,000 or more. After controlling for income, however, we discovered interesting differences in coverage by occupational categories: 77% of technicians, high level management and full time students reported insurance, whereas only 30% of farmers, 43% of farm labourers and 44% of self-employed professionals did. After controlling for income and occupational categories, the only discernable effect of education was observed between those who had and had not graduated from highschool, the former having about a 5% higher probability of insurance coverage. The interprovincial differences in drug insurance coverage were surprising, given the many socio-economic and demographic factors that had been controlled for. Coverage rates were highest in 2 of Canada's richest provinces, Alberta and Ontario (73%) and lowest in Saskatchewan (44%), Manitoba (53%) and BC (60%).

Potential effects of drug fees on health and health care costs. In the short-term, drug user fees reduce drug benefit program expenditures through 2 separate effects. First, user fees reduce program expenditures by the share of costs assumed by the user. Second, if health care use is price-sensitive, overall use declines. If one thinks of the total drug expenditures as represented by a pie, by introducing or increasing drug charges, the insurance agency becomes responsible for a smaller share of a potentially smaller expenditure pie.

Drug cost sharing may have additional consequences. While some claim that user fees will selectively deter "frivolous" health care use, (which can be interpreted as health care which has negligible or even harmful effects on health) others argue that the opposite is true. It is well established that consumers typically lack the information required to assess the expected effect of health care on health status (20). Hence, when faced with user fees, uninformed consumers may relinquish health care that might have deleterious effects on their health – choices that would not have been made had they been better informed. Referring to the diagram below, in the face of increases in drug user fees, patients might either (*a*) reduce the probability of visiting a prescribing physician or (*b*) be less compliant with prescribed drug regimens, both of which might adversely affect health status – process (*d*). It is plausible that physicians' prescribing choices are affected by their patients' drug insurance status. A physician might substitute lower cost prescription drugs, over the counter drugs, additional counseling (his/her own time), and, in rare cases, surgery for specific prescription drugs if the patient has inadequate prescription drug insurance coverage – process (*c*). In principle, because the physician typically has better knowledge than the patient of the effects of health care on patient health, physician-initiated therapeutic substitutions should have a smaller adverse effect on patient health than treatment decisions made solely by the patient. Distinguishing physician from patient-initiated changes in drug use following changes in drug user fees might therefore predict the likely effects on patient health status.

Figure 29 Path diagram of the effects of drug user fees on patient health status and health care costs



The impact of user fees differs by beneficiary characteristics. Fees do not affect those with no medical need for drugs – such individuals would not take drugs even if they were free of charge. Conversely, the financial burden of user fees increases with one's use for drugs. Because income and other measures of ability to pay are strongly positively correlated with health status(21), low income individuals potentially face the highest financial burden from user fees. Further, standard economic theory predicts that one's price sensitivity of demand for a good or service is inversely related to one's ability to pay: in the face of an increase in drug charges, the poor are likely to curtail drug use by a greater amount than the rich. Hence those with the largest need for health services might be those who are most deterred from consuming health services by user fees.

While user fees might reduce drug benefit program expenditures in the short run, the long-term effect on overall health care expenses is unclear. If higher drug user fees adversely affect patient health, then physician visits, hospitalizations and even additional prescribing might ensue – process (*e*) – thereby offsetting some of the cost savings to the drug program. Moreover, user fees, as well as exclusions of large segments of the population from public drug coverage, expose individuals to the risk of incurring drug expenses (process (*f*)), motivating risk averse individuals to purchase private drug coverage. Hence user fees generate multiple sources of finance for prescription drugs – process (*g*). But as Evans, Barer and Stoddart(22) argue: "The key to cost control is, or at least has been to date, the containment of overall budgets, either through a single payer system as in Canada, or a large number of closely co-ordinated payment agencies as in Germany. But the more independent sources of funding there are, the more difficult is cost control." Hence, although public programs have been able to shift costs to others, the introduction of multiple sources of finance may have increased overall pharmaceutical costs – process (*g*). To the extent that user fees increase publicly funded expenditures on health care, drug user fees might increase – process (*i*) – thereby propagating further increases in health care costs.

How do our results conform with the existing evidence on these issues? Appendix 1 provides a comprehensive review of the existing research evidence, a summary of which is provided here. The literature indicates that higher drug user fees are associated lower rates of drug use. For most individuals, however, a 1% increase in drug prices lowers drug use by less than 1%. Hence

the "price elasticity" of drug use – defined as the percentage change in drug use due to a 1% increase in drug price – is less than 1 in absolute value. Most estimates are clustered between -0.1% and -0.3%. Drug benefit programs which use direct charges to reduce program expenditures will therefore do so primarily by shifting the financial burden of drugs to consumers – overall drug use will not decline by a large extent. There are 2 corollaries to this. First, the converse to the previous statement holds as well – if drug use is largely price insensitive, then a national pharmacare program (i.e. increased public subsidization of prescription drugs) will simply redistribute income from government to drug consumers, where the size of the income transfer is greater, the larger is drug use. Because our results suggest that drug use increases with income, holding constant health status, additional public drug subsidies applied equally to rich and poor alike may very well provide a bigger benefit to those who are better off. The second corollary is that, because the drug use of the average individual is not very price sensitive, it is unlikely that their health status will be adversely affected by changes in drug charges.

Our results for seniors and the general population are supportive of this view. The drug use of seniors with average characteristics (income, age, etc) (where drug use is measured by the number of different prescription drugs taken in the last 2 days) is largely unresponsive to the price charged for drugs and, those in the general population with better access to drug insurance appear to use about the same number of drugs as those without good access to drug insurance.

There are a number of reasons why prescription drug use is rather price insensitive in the general population. First, when drug fees include a component which is invariant to drug ingredient cost, such as when the beneficiary pays some fraction of the dispensing fee, or when there is a flat per-prescription charge, physicians tend to reduce the expenditure burden on their patients by increasing prescription sizes and issuing fewer prescriptions. This is consistent with the effects of a prescription dispensing fee copayment introduced by the BC Ministry of Health Pharmacare seniors drug plan in 1987 and the introduction of fixed copayments and deductibles by the Ontario Drug Benefit program in 1996 – prescription sizes increased and the number of prescriptions decreased such that the overall volume of units of prescription drugs dispensed did not change much. Second, when the charge is some proportion of drug ingredient cost, there is some external evidence that physicians mitigate the effects of charges on their patients by substituting lower cost for higher drugs; for example substituting generic for brandname or substituting low for high cost drugs with similar therapeutic effect. Evidence of the impact of drug fees on the substitution of over the counter for prescription drugs is weaker – some studies have found such an effect to exist, while others have not. Our study investigated this issue and did not find any evidence that individuals facing higher prescription drug costs tended to substitute over the counter for prescription drugs.

The overall finding – that drug use by most individuals is typically not very price sensitive – is subject to three important caveats. The first is that these results are conditional upon the extent of variation in cost sharing observed in empirical analyses. Most of these studies have exploited only rather modest changes in cost sharing in the context of public drug benefit programs. Price elasticity estimates over higher levels of cost sharing may very well demonstrate greater price sensitivity (as standard economic theory predicts), hence drug programs which introduce substantial cost sharing might find unexpected changes in drug use, patient health and associated health care costs. Only the RAND Health Insurance Experiment considered the effects of large

variations in drug insurance – from 100% coverage to 5% coverage – yet even in this study, subjects faced a maximum out of pocket limit and were compensated for expenses so that they would not be made worse off by entering the study. (Furthermore, the study excluded the elderly, and drug cost sharing was fully confounded by changes in cost sharing for physicians' services.)

Alas, our study was hampered by the same issues. We could not use about 75% of the observations on seniors owing to problems of measuring prescription drug coverage – this reduced the usable variation in interprovincial drug prices and as a consequence most of the seniors faced charges under $10 – the single most common charge was $0.

The second caveat is that the nature of our drug utilization measures only 1 dimension of drug use – the number of different drugs taken. While this variable is sensitive to discontinuations of drugs and additions to the number of drugs taken, it is insensitive to changes in the *dosage* of each drug taken, assuming that the individual did not stop taking the drug all together. One would therefore expect our price elasticity estimates to be smaller (in absolute value) than estimates that use a continuous measure of prescription drug use. Moreover, our elasticity estimates for those in the general population were particularly noisy, possibly owing to the fact that we needed to use the "instrumental variables" estimator, instead of the more efficient linear regression estimator. Hence our results based on the samples of individuals in the general population should be interpreted with some caution.

The third caveat is that while it is likely true that drug elasticities are small for most individuals, there is some evidence to suggest that individuals with lower income and health status are more price sensitive. Hence an increase in drug fees will result in proportionately larger reductions in drug use among the sick poor relative to the rest of the population. It also appears that drug fees applied to such groups have adverse effects on health status and increase subsequent health care costs (physicians' services and hospitalizations) – such effects are typically not observed among higher income individuals. Hence, while modest increases in drug fees are innocuous for the majority of the population, this is not necessarily the case for the sick poor. The implications for a national pharmacare program are clear – if one of its goals is to promote health, then drug subsidies should be targeted at those for whom drug prices are a large barrier to access.

To examine this, we estimated separate price elasticities by beneficiary income and health status. First, we estimated separate models for social assistance recipients, who by definition have relatively low incomes; this facilitates comparison to elasticity estimates for seniors and the general population. Second, for seniors and social assistance recipients we estimated separate elasticities for those with varying levels of gross household income. Third, we determined the effects of drug charges on the use of potentially needed medications by those with specific chronic disorders. The NPHS identifies respondents' chronic health problems as well as the names of prescription drugs taken over the previous two days. Using these data we estimated the effect of interprovincial variations in the use of insulin and oral glyceamics among individuals diagnosed with diabetes, anti-hypertensives use among those diagnosed with high blood pressure, and asthma medications among individuals with asthma.

What can be inferred from such an analysis? Because we used cross-sectional data, we cannot explore the dynamic effects of drug fees on drug use and changes in drug use on health. We can, however, still make some limited inferences on the effects of drug fees on health. On the face of it, if medicines are always used in a clinically appropriate manner, then a policy which removes financial barriers to care will increase the health of those most in need of care. But our data cannot speak directly to the question of whether the drug use being induced or deterred by user charges is essential or appropriate because the appropriateness of a drug therapy is specific to each clinical situation and we had no information on the clinical indications for their use. It seems plausible, however, that a positive fraction of the services induced or deterred by co-payments satisfy the criteria of appropriateness. If the rate of inappropriate drug use is similar for individuals in each health status level, then such an analysis can indicate if the use of "appropriate" drugs varies by levels of health care need.

Our study provides evidence that social assistance recipients are indeed substantially more price responsive than seniors and those in the general population. What's more interesting is that social assistance recipients' drug use was sensitive to price variations in the range of $0 - $6. Hence individuals with low income do not necessarily need to face substantial drug charges for them to relinquish prescription medicines. Analysis of the differences in price elasticities by income level of social assistance recipients produced qualitatively similar but weaker evidence. We found that social assistance recipients with incomes of $10,000-$19,999 had statistically significant price elasticities, whereas those with higher incomes did not. On the other hand, those with incomes between $0-$9,999 had insignificant elasticities as well, which is somewhat counterintuitive. One plausible explanation for this difference is that respondents claiming household incomes below $10,000 might be under-representing income for strategic reasons. Indeed a substantial number of social assistance recipients reported having no income – which seems implausible as the NPHS was a residential survey. Moreover, other analysis of drug utilization suggest that those with reported incomes of under $10,000 have drug use similar to those with incomes over $20,000. In contrast to social assistance recipients, we found no evidence that seniors' price elasticity varies with income. It is possible however that current household income is a less useful measure of ability to pay for seniors than other measures, such as accumulated assets.

Analysis of the effects of drug charges on the use (vs. non-use) of potentially needed medications – insulin and "pills for diabetes" use among those diagnosed with diabetes for example – generally showed that the probability of drug use was generally independent of drug charges, even among the social assistance recipients. Again, an interpretive word of caution is in order – the drug use question pertains to whether or not the drug was used at any time during the last 4 weeks. Hence, our analysis does not identify variations in medications non-compliance associated with drug charges, beyond the simple use versus non-use of these drugs during at least 1 point in the last 4 weeks. Future analysis will measure use of specific medicines using information on detailed two day drug use.

Another objective of our study was to estimate separate models to determine the differential effects of drug fees for chronic and acute prescription drugs. The NPHS lists the names of the drugs taken during the 2 days prior to the survey, which we categorized as being those prescription drugs taken on a chronic basis and those taken on an acute basis. Prescription drug

fees will impose different financial burdens on patients depending on whether drugs are taken on a chronic basis (i.e. for an indefinite period of time) or are used primarily for acute conditions. Hence it is of some interest to estimate prescription drug elasticities for each type of drug.

We found that for seniors, higher prescription drug prices lead to a small *increase* in the use of drugs for acute conditions (the elasticity was 0.09%), but had no impact on the use of drugs for chronic conditions. It is unclear if this is a statistical artefact or a novel discovery. For social assistance recipients, higher drug prices translated into lower use of acute drugs (elasticity -0.16%), but only a minor and statistically insignificant decrease in the use of drugs for chronic conditions. The insured general population respondents used 46% more drugs for acute conditions than did the uninsured, but the estimate was somewhat imprecise. On the other hand, the insured used 14% fewer drugs for chronic conditions than did the uninsured, but the confidence interval around this mean ranged from –59% to 25%, reflecting significant imprecision of the estimates. Our models therefore provide some consensus that drug charges do not seem to effect the use of drugs for chronically taken medications but have some impacts on the use of drugs for acute conditions.

We also sought to assess how variations in household income affect the use of prescription medicines, holding constant health status and other socio-economic and demographic characteristics. One common interpretation of the association between income and prescription drug use begins with the proposition that everyone should have unfettered access to needed health services, including those prescription medicines which are health improving. Holding health status constant, a positive association between income and use of health services is undesirable because those with limited means are consuming less needed drugs than are those who are better off. One policy prescription is to subsidize the prescription drug use of those with limited means, thereby reducing the financial barriers to access for this group and encouraging their use of drugs. On the other hand, it is possible that even the rich will choose to forgo the purchase of potentially health improving drugs, preferring instead to spend their incomes elsewhere. In this case, one policy prescription would be to provide prescription drug subsidies to everyone, regardless of income.

The validity of this policy prescription hinges on the proposition that health care is different from other goods and services, in that nobody should face financial barriers to the use of effective care. If, on the other hand, prescription drugs were treated like any other good or service, then a positive correlation between income and prescription drug use would not be grounds for public subsidy. There is likely a positive correlation between the purchase of luxury cars and income, for example: only rich people purchase Mercedes Benz automobiles. Hence a public subsidy of luxury cars would benefit only the rich.

The evidence regarding the effects of household income on drug use was mixed. For seniors, the mean number of different drugs taken in the last 2 days increased from 1.08 for subjects with household income under $10,000 to 1.47 for subjects with household income between $40,000-$59,999, a relative increase of 36%. The largest increase in drug use occurred when income increased above $10,000-$19,999. Drug use did, however, taper off slightly for those in the highest income bracket $60,000 and over, possibly reflecting the effects of higher health status not controlled for by the health status variables included in the model. For the general population

and social assistance recipients, drug use increased with income, but only by the smallest of margins.

Our final objective was to assess the extent to which differences in drug charges are associated with variations in the number of physician visits. There are several reasons why one might expect drug fees to affect visits: (a) individuals whose primary motivation for initiating visits is to receive a prescription may not do so if forced to pay a drug fee; and (b) individuals who do not seek care after an increase in fees might become sicker and subsequently consult with their physician more often. Hence expanding the public subsidies for prescription drugs (in the form of national pharmacare) might have spill-over effects on other sectors of the public health care system. Again limitations with cross sectional data prevent us from distinguishing the two sources of change to physician visits. We are able, however, to identify the net effect of changes in drug fees on contemporaneous physician visits.

For seniors and those in the general population, drug charges had virtually no effect on the number of physician visits. Among social assistance recipients, higher drug charges were a small deterrent to seeking primary care: a 1% increase in drug charges was associated with a –0.03% decrease in visits. Moreover this was found to be most evident among those who had already seen a physician at least once in the past year and were likely under physician supervision. The drug charges had little impact on the probability of consulting a physician at least once over the course of a year.

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Appendix 1 Literature review of the effects of prescription drug cost sharing

Effects of drug user fees on overall drug use. Most studies have been unable to distinguish patient- and physician-initiated changes in drug use following changes to drug user fees. Instead, analysts typically estimate drug price sensitivity which ostensibly reflect some combination of behavioural reactions on the part of both prescriber and patient. The price sensitivity of drug use is commonly expressed as an "elasticity", defined as the percentage change in drug use associated with a small (1%) increase in drug prices. This measure is useful because it is invariant to the measurement units of prices and drug consumption. The literature indicates that for most individuals, drug price elasticities are well under 1 in absolute value, meaning that a percentage increase in price reduces consumption by less than 1%. However, as expected, low income are more price sensitive (i.e. have larger price elasticities, in absolute value) than higher income. Moreover, as standard economic theory predicts, estimates are larger when the base line price is higher; it is therefore important to indicate the range in prices used to generate elasticity estimates.

The published evidence on the price sensitivity of drug use has been obtained from changes to drug benefit programs in the context of the UK National Health Service (23-27), US Medicaid (28-39), US state drug subsidy programs for seniors (40-42), US Health Maintenance Organizations (43;44), drug benefit plans offered by US employer groups (45;46), the RAND health insurance experiment (HIE) (47;48), Canadian provincial drug benefit programs (49-54), as well as drug benefit programs in Australia (55), Belgium (56), the Netherlands (57), and Russia (58).

The UK NHS studies exploited the 700% increase in the real per-prescription charges applied to the non-exempt UK population during various periods between 1969 – 1992. Pregnant women, mothers of infants, those in receipt of social security benefits and those with low income, and after 1974, children under 16 years, and women over 60 years were exempted from charges. Most of the elasticity estimates across the 5 studies are clustered between –0.10 to –0.30, meaning that a 10% increase in fees would reduce drug consumption of those *with middle to high income* between 1 – 3%. The RAND HIE randomized US households whose members were *neither elderly nor low income* into health care insurance plans with varying levels of cost sharing for both drugs and medical services. The experiment yielded price elasticities around –0.17 for ambulatory services with co-insurance rates of 0 to 25% and around –0.31 with coinsurance rates of 25-95%. The price elasticity for drugs were smaller: –0.1 with co-insurance rates of 0 to 25% and about –0.2 with coinsurance rates of 25-95%. Because these estimates also reflect the effects of cost sharing for physicians' services on drug use, elasticities estimated using variation in drug price alone would likely be smaller.

Analysis of the effects of cost sharing within the context of US employer groups produced very small price elasticity estimates. One would expect that the individuals in these groups would be non-elderly with above average health status. Motheral (45) found virtually no response in overall drug use to an increase in the copayment for brandname drugs from US$10-15, noting that differential charges on brandname drugs promoted substitutions to free generic drugs. Smith (46) reported a price elasticity of –0.10 for copayments in the range US$1-8. This elasticity estimate pertained to the number of prescriptions filled, not the quantity of units of drug

consumed. Because the effect of the copayment was to increase prescription sizes, Smith notes that the elasticity estimate is likely somewhat smaller than –0.1. Using data on non-elderly members of a large HMO in Washington state, Harris et al(43) estimated prescription price elasticities of –0.05 for copayments in the range US$0-1.50 and –0.16 for copayments in the range $US 1.50-3.00. Again these copays increased prescription sizes, so the drug units price elasticity estimates are likely to be smaller.

Medicare, the US health care subsidy program for seniors, does not provide prescription benefits, although seniors with very low income levels can qualify for drug benefits as part of the state Medicaid system. Still, many low income seniors earn too much to qualify for Medicaid. Eleven US states have, however, established drug benefit programs for low income seniors. Coulson et al(41;42) used health survey data to assess the effects of a prescription drug subsidy program for low income Medicare recipients in the state of Pennsylvania. Respondents enrolled in this program reported filling 0.3 more prescriptions in the 2 week recall period than did elderly patients with neither an employer-sponsored plan nor a Medicare supplement plan that covers prescriptions. The corresponding price elasticity estimate was relatively high at –0.34. Similar estimates have been obtained from analyses of drug charges applied to low income Medicaid recipients(28-39).

Grootendorst(53) used longitudinal administrative prescription claims data from the BC Ministry of Health Pharmacare program to assess the effects of an extension in drug benefits at age 65. Pharmacare currently insures 70% of drug costs in excess of a $800 deductible for those under 65, but provides 100% coverage of drug ingredient cost (with a dispensing fee copayment) at age 65. He found that for most seniors, the extension of drug benefits has little if any impact on real drug expenditures. The exception were low income males – their consumption increased dramatically at age 65. Grootendorst(49), using data from the 1990 Ontario Health Survey, found that the availability of publicly-funded prescription drug insurance at age 65 had differential effects on the number of different prescription drugs reported as being consumed in the 4 weeks prior to the survey. Increases in drug use were concentrated primarily among individuals with lower levels of health status (2 or more chronic health problems) without prior drug insurance coverage. Individuals with just 1 chronic health problem consumed an additional 0.15 drugs at age 65 (not statistically different from zero at conventional levels), whereas those with 4 health problems consumed 0.60 additional drugs and those with 5 health problems consumed 1.12 additional drugs. Maritime Medical Inc.(50) assessed the effects of a $3 per prescription copayment, subject to an $150 annual maximum, levied on senior beneficiaries of the Nova Scotia drug program in June, 1990. Prior to this, seniors faced no drug charges. The copayment was found to reduce the number of prescriptions by 5.6%, but increase prescription size so that the average quantity used per patient remained unchanged. The study did not estimate separate price elasticities by beneficiary income or health status.

Effects of drug user fees on probability of seeking physician care. Drug fees can affect patients' propensity to seek physician care for 2 offsetting reasons. On the one hand, patients whose primary motivation for initiating visits is to receive a prescription may not do so if forced to pay a drug fee. On the other hand, if individuals who do not seek care after an increase in fees become sicker, then visits might rise. One might therefore expect an increase in user fees to initially lower the patient's propensity to initiate care, but if health is adversely affected, visits

might eventually increase. The converse holds in the event of a decrease in drug fees. Longitudinal data on drug use, health status and physician visits are required to tease these effects apart, but no study has exploited these types of data.

The weight of the small body of evidence suggests that drug user fees do not have a large *net* effect on patient's propensity to seek physician care. Grootendorst(59), using data from the 1990 Ontario Health Survey, found that the availability of publicly-funded prescription drug insurance at age 65 had little effect on the propensity of those without prior private insurance coverage to seek physician care. Similarly, using longitudinal prescription drug claims data, Grootendorst found that the availability of full coverage of drug ingredient cost at age 65 by the BC Ministry of Health Pharmacare program had no discernable effects on subsequent physician visits(59). Lingle et al(60) found that New Jersey Medicare recipients, who in 1977 became eligible for the "Pharmaceutical Assistance to the Aged" program, did not make any more physician visits over the next 4 years than Medicare recipients in the neighboring state of Pennsylvania, who were ineligible for publicly funded drug benefits. Johnson et al(44) found that moderate increases of from $1 to $3, from $3 to $5 per prescription for Medicare beneficiaries enrolled in a health maintenance organization had no effect on their physician visits. On the other hand, Kozma et al(61) found that relaxation of restrictions on prescribing of 323 different drugs on the South Carolina Medicaid drug formulary had a modest one-time increase in the number of physician visits by Medicaid beneficiaries. The generalizability of this study of formulary restrictions on specific drugs to the effects of user fees – which apply to all drugs – is unclear.

Effects of drug fees on patient compliance with prescription regimens and physician prescribing. Patient compliance with prescription regimens can be defined both in terms of their propensity to fill prescriptions written by physicians and their propensity to take filled prescriptions as directed. The existing evidence on patient compliance has focused only on the former measure. Begg(62) and Beardon et al(63) audited prescriptions written by general practitioners practicing in the UK and USA, respectively, and found that the rate of non-redemption of the prescriptions was higher, the higher the level of patient cost sharing. Poirier et al(51) assessed the effects of a $2 per prescription copayment, subject to an $100 annual maximum, levied on middle to high income senior beneficiaries of the Quebec drug program in May, 1992. Prior to this, seniors faced no drug charges. Seniors receiving the maximum Guaranteed Income Supplement (GIS), a federal subsidy for low income seniors, were exempted from the copayment. In 1994, senior couples with an income of less than $14,352 and single seniors with an income of less than $11,016 were eligible for the maximum GIS benefit. The study focused on the effects of the copay on refill rates for 2 classes of drugs: anti-hypertensives and benzodiazepines and were also able to merge 1991 Census data on seniors' neighbourhood-level income levels. The authors found that refills for benzodiazepines were virtually unaffected by the copay; Refill rates declined for antihypertensives, but the estimated elasticities were very small: -0.011 for low income seniors and –0.017 for high income seniors. Other studies(64;65) have surveyed patients regarding reasons for non-compliance with drug prescriptions and have found that ability and/or willingness to pay to be an important factor.

There is also some information on how physicians prescribing choices are affected by knowledge of their patients' drug insurance coverage status. Hux and Naylor(66) mailed out surveys to Ontario physicians to assess this issue. Physicians were asked to select which of 6 antibiotics,

with varying prices, they would prescribe in a given clinical scenario. Information on antibiotic drug prices and the patient's drug insurance coverage status were randomly assigned to the scenarios. Rates of prescribing the more expensive antibiotics did not vary by patient drug plan status when no information on prices were given. However, when information on drug prices was presented, knowledge of their patient's drug insurance mattered: 18% of patients with drug insurance were prescribed expensive antibiotics versus just 8% of those without drug insurance.

There is also evidence that physicians attempt to mitigate the financial burden of certain types of drug user fees by altering prescription sizes. If the per prescription charge includes a component which does not vary with the drug ingredient cost – such as a fixed dollar amount per prescription or some percentage of a [fixed] drug dispensing fee – then beneficiaries can reduce their expenditures by filling fewer, but larger prescriptions, i.e. by having their physicians increase the number of units per prescription. Indeed, unpublished data held by the author corroborates this hypothesis. In April 1987, the BC Ministry of Health Pharmacare program required senior beneficiaries to assume 75% of the dispensing fee, up to an annual maximum of $125. In 1994, seniors paid the entire dispensing fee to $200 annually. Analyses of the total units of drug dispensed to seniors, as well as the number of prescriptions dispensed and the units per prescription before and after these copayments revealed that prescriptions dispensed dropped, but the units per prescription increased, so as to leave the total number of units dispensed to seniors virtually unchanged.

There is little evidence on the extent to which physicians substitute prescription drugs for other health care inputs when their patients face a change in their insurance coverage status. There is evidence that some physicians substitute prescribing for their time spent with patients(67;68), but no evidence exists on how this substitution varies with drug fees. Nor is there evidence on how drug fees affect rates of surgical and other procedures. There is mixed evidence that prescription drugs and over the counter are substitutes. It should be noted, however, that both physicians and patients can make decisions about such substitutions. O'Brien(23) found that each 1% increase the retail price of over the counter drug products in the UK increased the use of prescription drugs by 0.22%. Stuart et al(69), using survey data on elderly Medicare beneficiaries, assessed the extent to which variations in prescription drug fees affected the probability that respondents would use over the counter preparations vs. prescription drugs to treat their health problems. OTC drug use was found to be lower among those with more comprehensive prescription drug insurance coverage. Patients were asked to indicate the presence of 22 health problems; 10 of these problems were categorized as "minor", including minor stomach and intestinal pain, sleep problems, constipation and diarrhea, colds and allergies; 12 problems were "more serious", including depression, seizures, heart problems and diabetes. The authors found that prescription drug user fees affected over the counter substitution primarily for "minor" health problems, although there was some substitutions for "more serious" problems as well. Surprisingly, evidence from the RAND HIE found that increased cost sharing for prescription drugs resulted in lower use of over the counter products(70).

Effects of drug user fees on patient health status. All of the studies on this issue have examined the overall effect of changes in drug user fees on direct or indirect indicators of patient health. No studies have assessed the intermediate effects of drug user charges on compliance and the effects of compliance on health status.

In arguably the most compelling study to date, Tamblyn et al(52) assessed the effects of sweeping changes to the Quebec public drug benefit program. Beginning in 1996, seniors, social assistance recipients and other program beneficiaries faced large increases in drug user fees; user fee revenues were used to finance the extension of public drug coverage to the previously uninsured population. The imposition of copayments on social assistance recipients caused an increase in hospitalizations / institutionalizations, physician visits and emergency department visits of 194%, 22% and 106%, respectively. Among the elderly the increase in copayments caused increases in the same three categories of 35%, 13% and 50%, respectively. These changes were even more marked among those with psychiatric problems and those with asthma, diabetes, epilepsy and heart disease.

Several other studies are broadly consistent with Tamblyn's findings, but appear to be less convincing. Soumerai et al(71) exploited the natural experiment created by the imposition of a three prescription per month cap in the New Hampshire Medicaid program; this policy change did not occur in the neighbouring state of New Jersey. The cap was associated with an increase in rates of admission to nursing homes, but not to hospitals for Medicaid recipients aged 60 and older. When the cap was replaced by a $1 per prescription charge, the probabilities of nursing home admission declined but, in general, the patients who were admitted to these did not return to the community. It is difficult to assess if the nursing home admissions reflected increased morbidity associated with the 3 prescription cap. First, if patients were becoming ill, then one would expect hospitalizations to increase as well. Second, because the 3 prescription cap did not apply in nursing homes, it is plausible that patients were entering nursing homes to circumvent the prescription cap. Third, the authors' use of all-cause hospitalization may not be sensitive to specific adverse health events attributable to the prescription cap.

Soumerai et al(72) then assessed the effect of the same monthly cap on outcome measures in a more narrowly defined study population: the use of psychotropic drugs and acute mental health care by permanently disabled, noninstitutionalized patients with schizophrenia, 19 through 60 years of age, who were insured by New Hampshire Medicaid. Again matched controls from the New Jersey Medicaid program were used. The cap resulted in decreases in the order of 15 – 49% in the use of antipsychotic drugs, antidepressants and lithium, and anxiolytic and hypnotic drugs. The cap also produced an increase of 1-2 visits per patient per month to community mental health centres and sharp increases in the use of emergency mental health services and partial hospitalization but not in the frequency of psychiatric hospital admissions. Once again, when the cap was replaced by the $1 copay the use of most mental health services reverted to base-line levels. Emergent mental health service provision is presumably sensitive to adverse health outcomes associated with medication non-compliance in a psychiatric population. The increased visit rates to community mental health centers is, however, plausibly related to the fact that these centers provided free medications after the cap was imposed.

The RAND Health Insurance Experiment(48;73-75) tracked the health status of non-elderly individuals randomly assigned to different levels of drug charges, but drug charges were perfectly confounded with charges for physician services. The study found that for the 94% of the non-elderly population – those with no pre-existing health problems and who were not poor, the imposition of user charges on both drugs and medical services had little effect on health

status. But there were subgroups who were adversely affected by charges. As Keeler et al(74) note: "for clinically defined hypertensives, blood pressures with free care were significantly lower (1.9 mm Hg) than with cost-sharing plans, with a larger difference for low-income hypertensives than for high-income hypertensives (3.5 vs. 1.1 mm Hg), but similar differences for blacks and whites. The cause of the difference was the additional contact with physicians under free care; this led to better detection and treatment of hypertensives not under care at the start of the study. Free care also led to higher compliance by hypertensives with diet and smoking recommendations and higher use of medication by those who needed it." Brook et al(75) note that full health care insurance improved the vision for those with visual impairments (vision better by 0.2 Snellen lines). Newhouse et al(73) found that the provision of free dental care improved the oral health of those with low income.

Using monthly time series data over the period 1971-1982, Lavers(25) modeled the effects of rising charges for prescription drugs offered by the UK National Health Service on population level morbidity, defined as the average weekly number of new claims submitted each month by employed persons for sickness benefits. Lavers found a *negative* association between drug charges and contemporaneous illness claims: each 10% rise in the user fees for drugs lowered illness claims by 6%, although this estimate was not statistically different from zero at conventional levels. One cannot help but be skeptical of the statistical methodology. First, one would expect drug charges to affect health status only after a several month lag. Second, one questions whether important explanatory variables, such as unemployment rates and infectious disease rates, which were not included in the statistical model of explaining monthly sickness claims, could have rendered estimates inconsistent.

Other studies(29;34;38;43;51;52;55;76;77) have indirectly examined the effects of cost sharing on health status by monitoring the use of drugs whose withdrawal could have important effects on health status. Such drugs include anti-hypertensives, anti-coagulants, anti-psychotic, diabetic and thyroid agents. The consensus from these studies is that drug user fees reduce the use of such essential drugs, suggesting that health could be adversely affected. It should be noted, however, that for the decrease in the use of "essential" medications to have an adverse effect on health status, it must first be established that the pre-cost-sharing utilization of these drugs was medically warranted(78). But these studies do not have access to information on the clinical indications for their use. An exception is Foxman et al(47) who used clinical records to distinguish the effects of cost sharing on changes to both appropriate and inappropriate antibiotic prescribing.

Effects of drug user fees on health care costs. As mentioned previously, the short term impact of drug charges is to reduce drug program expenditures. The longer term impacts depend on the effect of charges on patient health and the attendant effects of use of prescription drugs as well as on hospitalizations, physician billings and related services. User fees are expected to have particularly adverse effects on the health of populations with compromised health and limited ability to pay – hence the one might expect that user fees might not necessarily decrease their total health care costs. This is consistent with the research evidence. Roemer et al(79) assessed the effects of a $US0.50 copayment on prescription drugs and a $US1 copayment on physicians' services for lower income patients, and found decreased drug and physician costs, but increased total costs because of higher hospital costs. Soumerai(72) estimated that when New Hampshire

imposed a cap of three reimbursable prescriptions per month on its Medicaid population that overall costs for psychiatric patients went up 17 times more than the resulting savings on psychiatric medications. Some part of these costs are attributable to factors other than reduced patient health status: visits to community mental health centre increased because these centers dispensed psychiatric medications without charge. Similarly, Lingle et al(60) provide evidence that low income seniors whose medications were subsidized by the New Jersey Pharmaceutical Assistance Program for the Aged had fewer hospitalizations compared to similar low income seniors in a neighbouring state without drug subsidies. Johnson et al(44) report that drug fees assessed to *higher income* seniors enrolled in a health maintenance organization was not associated with higher medical care (office visits, emergency department visits, home healthcare visits and hospitalizations) use and cost.

Appendix 2 Details of the sampling frame of the National Population Health Survey

For the purposes of sampling, the population of Canada's provinces, with the exception of Quebec, was stratified first into three geographic regions with differing population density (Major Urban Centres, Urban Towns and Rural Areas) and within these regions by "geographic and/or socio-economic strata". A total of 72 strata representing combinations of population density, geographic and/or socio-economic strata were sampled. Within each stratum, primary sampling units (PSUs) known as Census Enumeration Areas (EAs) were randomly selected for inclusion in the NPHS, where the inclusion probability was proportional to population size. In most strata, six EAs were selected. Dwellings within these EAs were then enumerated and occupied dwellings (households) were selected for inclusion into the survey. A total of 1,863 enumeration areas were selected from these strata.

In Quebec, the NPHS sample was selected from dwellings interviewed in the 1992-93 Santé Québec *Enquête sociale et de santé.* Sampling of the 16,010 dwellings proceeded using a two-stage design. Dwellings were stratified first into four geographic regions with differing population density (Montreal Census Metropolitan Area, regional capitals, small urban agglomerations and the rural sector) and within these regions by 15 Health Regions. A total of 72 strata representing combinations of population density, Health Region strata were sampled. Within each stratum, dwellings were further stratified into PSUs by socio-economic characteristics; PSUs were randomly selected with selection probability proportional to size. Selected PSUs were enumerated and random samples of their dwellings were drawn.

Several restrictions were placed on the inclusion of geographical strata, EAs within strata, and households within EAs. First, to ensure adequate representation from all of the ten provinces, a minimum of 1,200 households from each province were interviewed. Four of the provinces chose to increase their allotted sample size through the purchase of additional observations. Second, as is described below, the survey was administered to one household member, chosen at random, who will also respond to future rounds of the NPHS. This method under-represents persons from large households because they have less chance of being chosen; similarly persons from small households – often older single people or the elderly – are over-represented. To increase the representation of parents and youths in the sample, a proportion of households that have no member aged under 25 years were excluded.[5] In order to maintain the required sample sizes, the number of households visited in each province is increased by the anticipated number of households excluded in this way.

Once a household was selected for inclusion into the survey, the questionnaire was administered in two stages. The first stage was an in-person interview by a Statistics Canada employee with one respondent, aged 12 years and older (referred to as the index respondent) in which information on chronic health problems, activity limitation, health care services use and socio-demographic status of all household members was collected.[6] The index respondent responded

[5] In the 1994-95 NPHS, a total of 6443 households were eligible for exclusion from the sample on this basis. Of these, 3447 were actually rejected because no household member was under 25 years of age.

[6] Statistics Canada plans to re-interview 5/6 of the sample every 2 years. Should a household be re-

both on behalf of himself or herself (self-report) and on behalf of other household members (proxy-report). This information is contained in "General" section of the survey database. Detailed information on health status, disease risk factors, and drug use of just the index respondent was collected also using an in-person interview. This information is contained in the "Health" section of the survey database. Computer Assisted Interviewing was used in all stages of questionnaire administration to decrease the likelihood of transcription errors. The response rate for the General section of the survey was 89% and the response rate for the Health section of the survey was 96%.

There were several exceptions to these survey administration rules. First, the government of British Columbia purchased additional observations on residents living in specific areas of the province. Most of these additional units (788 of 849) were surveyed via telephone using the Random-Digit-Dialing (RDD) sample of telephone numbers. Second, the selected index respondent was sometimes not available due to illness or incapacity. In these cases, another household member was chosen to be the proxy respondent. In future interviews with the same household, however, the household member initially chosen as the index respondent will resume his or her role as index respondent, if able to do so. Third, the entire interview took an average of 1 hour to complete. In cases where time was limited, the in-person interview was completed via telephone.

interviewed, the same index respondent will be contacted.

Appendix 3: Population frequency distribution of marginal drug cost to seniors by province and NPHS survey year

MDC	BC		AB		SK		MB		ON	
	1994	1996	1994	1996	1994	1996	1994	1996	1994	1996
0.00	1.37%							16.09%	100.00%	3.97%
2.00										73.15%
5.93										
5.99		100.00%								
6.11										17.19%
6.15	98.63%									
6.18										
6.34										
6.50										
6.73										
6.92										
7.02			24.13%							
7.05										
8.69							20.28%			
8.88										
9.05										
9.14					2.69%					
9.46						2.39%				
10.01				95.31%						
10.48										
10.53			75.87%							
10.94				4.69%						
14.45										
14.85										
25.38										
26.11					97.31%					
27.04						97.25%				
27.34						0.37%				
28.83										0.72%
28.96							79.72%			
29.93										
30.18								53.05%		
30.96								30.86%		
35.89										4.96%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Appendix 3: Population frequency distribution of marginal drug cost to seniors by province and NPHS survey year (continued)

MDC	PQ		NB		NS		PE		NF	
	1994	1996	1994	1996	1994	1996	1994	1996	1994	1996
0.00	37.86%	21.11%	7.10%	3.06%	6.13%	8.32%			0.63%	0.63%
2.00	62.14%	2.33%								
5.93		51.39%								
5.99										
6.11										
6.15										
6.18		25.16%								
6.34					93.87%					
6.50									94.81%	
6.73						89.09%				
6.92						2.58%				
7.02										
7.05			92.90%							
8.69				0.00%						
8.88										0.26%
9.05				96.94%						
9.14										
9.46										
10.01										
10.48										93.84%
10.53										
10.94										
14.45								100.00%		
14.85							100.00%			
25.38									4.56%	
26.11										
27.04										
27.34										
28.83										
28.96										
29.93										5.27%
30.18										
30.96										
35.89										
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Appendix 4: Population frequency distribution of marginal drug cost to social assistance recipients by province and NPHS survey year

MDC	BC		AB		SK		MB		ON	
	1994	1996	1994	1996	1994	1996	1994	1996	1994	1996
0	100.00%	100.00%	100.00%	100.00%			100.00%	100.00%	100.00%	2.43%
2					100.00%	100.00%				97.57%
3										
4										
6.18										
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Population frequency distribution of marginal drug cost to social assistance recipients by province and NPHS survey year (continued)

MDC	PQ		NB		NS		PE		NF	
	1994	1996	1994	1996	1994	1996	1994	1996	1994	1996
0	100.00%	22.18%			100.00%		100.00%	100.00%	100.00%	100.00%
2			100.00%							
3						100.00%				
4				100.00%						
6.18		77.82%								
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Other appendices available from the author by request

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No. 371:	The Impact of Reference Pricing of Cardiovascular Drugs on Health Care Costs and Health Outcomes: Evidence from British Columbia – Volume III: ACE and CCB Literature Review	L.R. Dolovich A.M. Holbrook M. Woodruff

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