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**NATIONAL CATASTROPHIC DRUG INSURANCE REVISITED:
WHO WOULD BENEFIT FROM SENATOR KIRBY'S
RECOMMENDATIONS?**

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National catastrophic drug insurance revisited:
Who would benefit from Senator Kirby's
recommendations?*

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Abstract

The recent 'Romanow' and 'Kirby' inquiries into the Canadian health care system recommended a publicly funded catastrophic prescription drug insurance program to protect Canadians from potentially ruinous drug costs. While the Romanow commission was not specific about the nature of such a program, the Kirby commission recommended that household prescription drug expenses be capped at 3% of total household income, or \$1,500 per household member, whichever is lower, with government picking up the remainder. Using recent survey data on household spending, we estimate how the program would assist households of different means and ages, residing in different regions of the country. We find that, despite the fact that senior and low income non-senior households are the primary beneficiaries of provincial government drug plans, average subsidies would be over 4 times higher for these households than for all other (non-senior, non-indigent) households. A small percentage of other households would be among the largest beneficiaries of the program. Program benefits are typically larger in provinces with less generous public coverage and tend to benefit lower income households. Program costs are estimated to be at least \$461 million annually, although reductions in out of pocket drug spending will reduce medical tax credits and thereby increase tax revenues by at least \$80 million. Program costs appeared to be very sensitive to increased household drug spending that might result from the program introduction.

Introduction

Under the terms of the 1984 Canada Health Act, provincial governments that fail to fully subsidize the cost of 'medically necessary' physician and hospital-based services are subject to penalties, in the form of withheld federal transfer payments (Flood and Choudry 2002). The Canada Health Act does not mandate the public subsidy of prescription drugs and this has resulted in a relatively small public share of total drug spending - 35.2% in 2000 (Canadian Institute for Health Information 2002), compared with the public share of spending on physicians' services (98.6%) and hospital-based services (91.3%). Provincial government drug plans account for the majority (86%; CIHI 2002) of the public spending on prescription drugs used outside of hospitals.

The absence of national standards has resulted in substantial variation in several dimensions of the comprehensiveness of provincial government drug coverage: 1) the drugs listed on the provincial formulary - i.e. drugs that are reimbursed; 2) the time it takes a drug plan to list a new drug on its formulary (Rx&D 2003); 3) restrictions on the reimbursement of listed drugs, such as the common requirement that costly drugs will not be reimbursed unless therapy on a less costly drug is attempted first (Gregoire et al 2001); 4) the drug plans' share of the cost of listed drugs; and 5) the population eligible for subsidy (Grootendorst 2002).

With regard to dimensions 4) and 5), the provincial government plans provide uniformly comprehensive coverage for the indigent (recipients of social assistance benefits), and residents of long-term care facilities. Provincial subsidies for seniors (those 65 years and older) and especially the non-indigent, non-senior populations vary substantially. Grootendorst *et al* (2003) find up to a 12-fold variation among the provinces in the charges faced by seniors with similar income and drug use. There is no provincial subsidy for the prescription drug use by the non-indigent, non-senior population in the Atlantic provinces. BC, Saskatchewan, Manitoba, and Ontario offer 'catastrophic' drug coverage to this group, reimbursing drug costs in excess of an income-contingent deductible. Residents of Alberta and Quebec have the option of purchasing government-subsidized coverage with income-contingent premiums but with smaller deductibles than in the other provinces (Grootendorst

2002).¹ Although the federal government share of drug expenditures is small (subsidies are limited to aboriginals, active and retired military, and a few smaller groups), the federal government and several provincial governments provide income tax relief to households with large drug and other medical expenses.

Individuals with insufficient public coverage do have recourse to private insurance markets. Coverage available for individual subscribers, however, is not comprehensive²; this is likely due to information problems in this market. Data from the Final Report of the Standing Senate Committee on Social Affairs, Science and Technology chaired by Senator Michael Kirby (hereafter the 'Kirby report') indicates that approximately 600,000 Canadians, all based in the Atlantic region, had no drug coverage from either public or private sources (Table 7.5 of Kirby, 2002). A further 5% of Canadians (most from the Atlantic region) had coverage that would require that they pay at least 10% of total drug expenses of \$20,000.

Two recent inquiries into the state of the Canadian health care system have argued for additional publicly funded catastrophic drug coverage, in light of the increasingly important role of pharmaceuticals in the management of health problems, the fact that some of these drugs are very expensive, and the apparent lack of coverage against potentially ruinous drug costs. Both the Kirby report and the Final Report of the Commission on the Future of Health Care in Canada, chaired by Roy Romanow (Romanow 2002) called on the federal government to transfer funds to provincial governments that committed to expanding the level of drug insurance coverage to their residents. The two reports differ, however, in the recommended expansion of public coverage. Romanow proposed that this matter be resolved through negotiations between the federal and provincial governments, whereas Kirby's recommendations were specific: To be eligible for federal assistance, private and provincial drug plans would need to cap household prescription drug expenses at 3% of total

¹ Residents of Quebec who do not purchase government coverage must purchase private coverage with minimum coverage standards (maximum of \$750 out of pocket costs including premiums annually).

² For example, at time of writing the most comprehensive drug coverage offered by a major insurer, Liberty Health, to individual subscribers imposed a \$4,350 cap on total benefits payable annually. See: <http://www.benefitsonline.ca/individual/Secure/LibertyDetails.htm#DrugPlus>. To mitigate adverse selection, more comprehensive coverage is likely provided to those for whom coverage is required for membership in some organization, such as unions and student associations.

household income, or \$1,500 per household member, whichever is lower.

In this paper we present evidence to inform the likely effects of implementing a Kirby-style publicly funded catastrophic drug insurance scheme. First, using recent, nationally representative data on household-level prescription drug spending, we estimate the proportion of households with sufficiently large drug costs such that they would qualify for some financial assistance under the proposed scheme. We also estimate how much financial assistance such qualifying households would receive. We provide estimates for Canada as a whole, and within each province, for each of the three types of households that likely differ in both their source of drug coverage (provincial government coverage for seniors and the indigent, private insurance for the non-senior, non-indigent) and the comprehensiveness of such coverage. Existing studies have estimated the proportion of Canadians who lack insurance coverage against catastrophic drug costs, but there is little evidence on how existing public and private drug coverage arrangements affect households' catastrophic drug expenditure burdens. This study assesses the distributional impact of the proposed program between households currently given provincial drug benefits and those that are not.

Our second objective is to shed light on the effects of household characteristics, including household income, on the amount of assistance received under the proposed program. *A priori*, it is unclear whether the program would preferentially benefit low income households. While higher income households have more generous insurance coverage (Grootendorst and Levine, 2001) so that their out of pocket expenditures are lower, poorer households are more likely to qualify for provincial coverage for the indigent. And while higher income households are required to pay more out of pocket under the proposed program (3% of household income), the proposed subsidy formula includes a maximum household expenditure limit, irrespective of income, of \$1,500 per household member. Finally, even though higher-income households tend to be healthier, out of pocket drug spending tends to increase with income (Alan *et al* 2002). This is perhaps because of affordability but perhaps also because higher-income individuals with a particular health condition are better able to access prescribers or have heightened awareness of therapeutic options. To investigate this, we estimate models of the effect of household income on the probability that the household qualifies for some assistance, and among qualifying households, the effect of income on the amount of assistance

received. These models also control for household age, labour force participation, province of residence and other variables likely correlated with assistance and income. The estimates of the effect of province of residence on assistance obtained from this model provide information on how the comprehensiveness of public or private drug coverage in the province would affect assistance under the proposed program, while controlling for the factors that affect the uptake of such coverage and total drug expenditures (such as income and age).

Our third objective is to estimate the expected cost to government of implementing the Kirby proposal. We consider this estimate in the context of existing government tax credits on medical expenses. We also consider the sensitivity of the estimate to the possibility that households might increase drug consumption after receiving coverage for catastrophic drug costs.

Methods

We use data from the Statistics Canada 2000 Survey of Household Spending (SHS). The SHS collects information on annual household level income, spending on various goods and services, including prescription drugs, as well as information on household living arrangements (such as marital status, age and sex of children living in the household). The SHS data are intended to be representative of all persons living in private households, and therefore exclude those residing in long-term care facilities, hospitals, aboriginal reserves, and penal institutions. The survey is a stratified multi-stage sample, and lower population regions such as the Atlantic provinces are over-sampled. We use sampling weights provided by Statistics Canada to ensure descriptive statistics are nationally representative. Face-to-face interviews are conducted in January, February and March to collect expenditure and income information for the previous calendar year (the 2000 data were collected in the first quarter of 2001). Households which formed during 2000, for whom only partial year expenditure and income information were available, were excluded, leaving data on 14,250 households. To protect confidentiality, the province of residence of 163 households was masked. These masked observations were dropped for analyses requiring knowledge of province of residence, leaving a sample of 14,087 households.

For the purposes of delineating those who are routine beneficiaries of the provincial drug plans, we defined 3 household types: seniors, low income and others. Senior

households are those in which either the head or spouse is 65 years or older. The low income are defined as the non-senior households that receive at least 50% of their income from government transfers (such as welfare payments). The 'other' category includes all other non-senior, non-indigent households.

The assistance that the h^{th} household would receive under the proposed program, denoted as y_h , was calculated as:

$$y_h = \max(rxdrug_h - \min(0.03*grossy_h, 1500*nmemb_h), 0)$$

where $rxdrug_h$, $grossy_h$ and $nmemb_h$ are household h 's total spending on prescription drugs, total gross income and household size, respectively. Some of our analysis is done by calculating y_h with the year 2000 data and tabulating that against province of residence and household type. However to examine potential distribution effects across households while controlling for household characteristics (denoted by \mathbf{x}_h), a two-part model was used. This consists of a probit model of the probability that a household with characteristics \mathbf{x}_h would qualify for assistance:

$$\text{prob}[y_h > 0 | \mathbf{x}_h] \tag{1}$$

and a model of the average amount of assistance that would accrue to qualifying households with characteristics \mathbf{x}_h :

$$E[y_h | \mathbf{x}_h, y_h > 0] \tag{2}$$

The product of (1) and (2) produces the average assistance to all households with characteristics \mathbf{x}_h :

$$E[y_h | \mathbf{x}_h] = \text{prob}[y_h > 0 | \mathbf{x}_h] \times E[y_h | \mathbf{x}_h, y_h > 0] \tag{3}$$

To account for the strong possibility of right skewness in the distribution of assistance among qualifying households, we model y_h using a log-linear specification:

$$\ln y_h = \mathbf{x}_h^T \boldsymbol{\beta} + \varepsilon_h, \text{ for } y_h > 0 \tag{4}$$

where $\boldsymbol{\beta}$ is the set of parameters to be estimated and ε are the unobserved differences in assistance accruing to qualifying households that remain after conditioning on \mathbf{x}_h . Retrieving the average y 's (instead of $\ln y$) from (4) requires knowledge of the conditional distribution of each ε_h .

$$\begin{aligned} E[y_h | \mathbf{x}_h, y_h > 0] &= E[\exp(\mathbf{x}_h^T \boldsymbol{\beta} + \varepsilon_h) | \mathbf{x}_h, y_h > 0] \\ &= \exp(\mathbf{x}_h^T \boldsymbol{\beta}) \times E[\exp(\varepsilon_h | \mathbf{x}_h, y_h > 0)] \end{aligned}$$

To estimate this model, we use the year 2000 values for \mathbf{x}_h and y_h , assuming for the moment that these would be unchanged by the introduction of a federal catastrophic drug program. (We address the issue of behavioural responses later in the paper.) For $E[\exp(\varepsilon_h | \mathbf{x}_h, y_h > 0)]$, we assumed that the distribution of the ε varies systematically by province and used Duan's non-parametric estimator (Duan 1983), which in this case is the province-specific average exponentiated residual.

After estimating the equations (1)-(3), we predicted the assistance accruing to households with different levels of income, while holding all other characteristics fixed at population means. Confidence intervals were produced using the bootstrap method: Parameter estimates and predictions for all three equations were generated from each of 1,000 bootstrap samples (where each sample was randomly chosen with replacement from the original sample with number of observations set at the size of the original estimation sample), and the 2.5th and 97.5th percentiles of the prediction distribution for each equation formed the estimates of the 95% confidence interval.

The same methods were used to predict how assistance varied by province of residence. When making province-specific predictions, we used the province-specific estimate of the average exponentiated residual. When making income-specific predictions, we used the weighted average of the province-specific estimates of the average exponentiated residual, with province-specific weights set at the estimated proportion of households in the population residing in the province.

Turning to our choice of \mathbf{x}_h variables, to allow for non-linear effects of income on the probability or amount of assistance received, we created 5 variables indicating to which of the 5 quintiles of after tax household income the household belonged. Several other variables thought to affect both income and assistance were also included in the model. To account for the influence of existing drug coverage on out of pocket costs, we included indicators of the number of full time earners in the household (0, 1, 2 or more) and an indicator of whether the head was either married or living in a common law relationship. To account for the medical need for drugs, we included household demographic factors, including indicators of the age of the household head (under 30 years, 30-44, 45-64, 65-74, and 75 and older), number of children under 18 (0, 1-2, 3 or more) and the number of other household members, besides the head and his/her spouse if applicable (0, 1-2, 3 or more). Recall that

households can qualify for the proposed subsidy by virtue of what we call the 'income rule', i.e., spending more than 3% of household income on prescription drugs, or the 'per capita rule', spending more than \$1,500 per household member. The indicators of household size and marital status also control for the amount of assistance received via the per capita rule.

We estimated these models separately for senior and non-senior households. (We initially attempted to estimate separate models for each of the three household types identified earlier, but there were insufficient observations in the low income group to generate reliable estimates.) The variables indicating the number of full time income earners, the number of children and other household members were removed from the seniors' models as they were jointly insignificant.³

Results

Assistance by province of residence and household type

Before we use the two-part model described in the previous section, we estimate the assistance accruing to households under Senator Kirby's proposed catastrophic drug plan directly from the raw data. Overall, 5.8% of Canadian residential households would qualify for some assistance under the proposed program, but there is substantial variation by province of residence and household type (Table 1). Eligibility rates range from 3.4% in Ontario and 3.8% in BC to 13% in PEI and 15% in Saskatchewan. Similarly, eligibility rates are much higher for low income households (which comprise 8.2% of all households) and senior households (21.4% of all households), than for all other households (70.4% of all households). Inspection of eligibility rates among the individual cells reveals dramatic differences: 42.3% of Saskatchewan seniors qualify, compared to just 1.9% of other households residing in Ontario.

Most eligible households (87.9%), irrespective of province or household type, would qualify for coverage by virtue of the income rule, as opposed to the per capita rule (Table 2). The proportion qualifying via the income rule was highest for seniors (92.2%) and low income earners (89%) and lowest for other households (78.2%). There was modest inter-provincial

³The p-values associated with the likelihood ratio test statistics that these variables were jointly insignificant in the probit model of probability of assistance and the regression model of level of assistance were 0.56 and 0.86, respectively.

variation: 94.6% of eligible Quebec households would qualify via the income rule, whereas 81.6% of Saskatchewan residents would.

Table 1: Proportion of households qualifying for proposed catastrophic drug coverage, by province of residence and household type

province of residence	household type			Total
	senior	low income	other	
newfoundland	0.246	0.067	0.040	0.088
prince edward island	0.302	0.251	0.052	0.128
nova scotia	0.119	0.180	0.028	0.064
new brunswick	0.164	0.124	0.038	0.076
quebec	0.276	0.080	0.021	0.082
ontario	0.053	0.122	0.019	0.034
manitoba	0.286	0.049	0.033	0.097
saskatchewan	0.423	0.092	0.047	0.150
alberta	0.196	0.188	0.020	0.057
british columbia	0.052	0.121	0.024	0.038
Total	0.156	0.107	0.023	0.058

Source: 2000 Survey of Household Spending. Note: Households with unknown province of residence dropped. Sampling weights used.

Table 2: Proportion of households qualifying for proposed catastrophic drug coverage via the household income rule and not the per capita rule, by province of residence and household type

province of residence	household type			Total
	senior	low income	other	
newfoundland	0.861	0.898	0.930	0.886
prince edward island	0.905	0.832	1.000	0.919
nova scotia	0.896	0.888	0.852	0.881
new brunswick	0.920	0.891	0.939	0.921
quebec	0.975	0.960	0.818	0.946
ontario	0.839	0.809	0.699	0.774
manitoba	0.891	1.000	0.861	0.888
saskatchewan	0.819	0.833	0.801	0.816
alberta	0.945	1.000	0.624	0.861
british columbia	0.922	0.937	0.873	0.904
Total	0.922	0.890	0.782	0.879

Source: 2000 Survey of Household Spending. Note: Households with unknown province of residence dropped. Sampling weights used. Income rule: qualification for the subsidy by virtue of spending more than 3% of household income on prescription drugs. Per capita rule: qualification for the subsidy by virtue of spending more than \$1,500 per household member.

How much new money would the Kirby plan transfer annually to households that qualify for the proposed catastrophic drug coverage? The mean transfer is \$713, but most qualifying households would receive an amount less than this: half would receive \$330 or less and 75% would receive under \$821. A small fraction, however, would receive very large transfers: the top 1% would receive an amount in excess of \$5,450. These 'outlier' households clearly have a large influence on mean transfers. To analyze transfers to qualifying households by province and household type, we therefore present mean transfers (Table 3) and median transfers (Table 4), the latter statistic being a more robust measure of central tendency in this case.

There is substantial variation in transfers by household type. Whereas seniors had the highest eligibility rates of all three household types (16%), mean transfers to eligible households are the lowest: \$571 versus \$904 for low income and \$907 for other households. Median transfers to eligible households followed roughly the same pattern, although the influence of outlier households, approximated by the ratio of the mean to median

transfer, was highest for other households. Mean and median transfers varied by province as well.

Table 3: Mean catastrophic drug subsidies to qualifying households, by province of residence, and household type

province of residence	household type			Total
	senior	low income	other	
newfoundland	1,027	1,153	882	1,009
prince edward island	816	694	830	800
nova scotia	735	1,116	1,253	990
new brunswick	640	641	601	628
quebec	408	526	790	487
ontario	1,066	1,433	1,035	1,145
manitoba	495	488	698	541
saskatchewan	743	652	813	753
alberta	364	353	1,499	670
british columbia	593	364	549	523
Total	571	904	907	713

Source: 2000 Survey of Household Spending. Note: Households with unknown province of residence dropped. Sampling weights used.

Table 4: Median catastrophic drug plan subsidies to qualifying households, by province of residence, and household type

province of residence	household type			Total
	senior	low income	other	
newfoundland	610	556	820	660
prince edward island	540	168	400	510
nova scotia	420	470	550	470
new brunswick	282	324	390	300
quebec	270	310	280	270
ontario	278	525	672	444
manitoba	264	394	390	305
saskatchewan	480	673	650	510
alberta	260	194	950	290
british columbia	330	200	270	266
Total	300	430	410	330

Source: 2000 Survey of Household Spending. Note: Households with unknown province of residence dropped. Sampling weights used.

The mean new subsidy to all Canadian households from the proposed program would be \$39, but again there would be large differences in subsidies depending on province of residence and household type (Table 5). Households in the richer provinces, BC, Alberta and Ontario would receive below average subsidies, whereas Saskatchewan, PEI and Newfoundland would receive transfers well above the national average. Despite the fact that senior and low income non-senior households have traditionally been the primary beneficiaries of provincial government drug plans, average subsidies would be over 4 times higher for these households (\$85 and \$87 respectively) than for all other (non-senior, non-indigent) households (\$20). This difference is due largely to differences in eligibility rates: 16% of senior and 11% of low income households would be eligible for assistance, whereas only 2.3% of other households would be.

Table 5: Mean catastrophic drug plan subsidies to all households (qualifying and non-qualifying), by province of residence, and household type

province of residence	household type			Total
	senior	low income	other	
newfoundland	243	77	35	87
prince edward island	247	161	43	101
nova scotia	86	185	35	61
new brunswick	105	80	21	47
quebec	107	38	16	38
ontario	53	158	20	37
manitoba	140	24	22	52
saskatchewan	306	60	37	110
alberta	67	63	27	35
british columbia	29	33	12	18
Total	85	87	20	39

Source: 2000 Survey of Household Spending. Note: Households with unknown province of residence dropped. Sampling weights used.

Partial effects of household income and province of residence

We now use the two-part model of the subsidies a household would receive under the proposed catastrophic drug program. This allows us to 'control' for the \mathbf{x}_h variables age, marital status, family composition and province of residence as we examine the redistribution across income groups (and similarly to control for other \mathbf{x}_h influences as we examine redistribution across

households in different provinces.) Using this model, predicted probabilities of assistance, amount of assistance to both eligible households and to all households (irrespective of eligibility) by quintiles of household income and province of residence are provided in Tables 6 (seniors) and 7 (non-seniors). The regression estimates used to generate these predictions are presented in Appendices 1 and 2. The heterogeneity in levels of assistance to households residing in the different provinces remains after conditioning on income, household composition, marital status and the number of full time earners. Mean subsidies to seniors are highest in Saskatchewan, PEI and Newfoundland, and lowest in BC, Ontario and Alberta; the ratio of highest to lowest provincial mean subsidy is almost 15. This pattern of subsidy is consistent with relative generosity of the provincial plans - the largest subsidies would flow to seniors residing the provinces with the largest levels of cost sharing.

Although the mean subsidies to eligible senior households from the proposed catastrophic drug program increase with income quintile, the probability of eligibility decreases markedly with income so that on net the proposed program would benefit less well off seniors. This pattern emerges despite the element of low-income targeting present in most provincial programs for seniors.

Rates of assistance to non-senior households are typically less than one half rates received by comparable senior households. This appears to be due to relatively low eligibility rates among non-seniors; amounts of assistance accruing to eligible households tend to be the same or larger for non-senior households. Among Saskatchewan residents, for instance, 2% of non-senior households would qualify compared to 39% of senior households; subsidies to qualifying households are comparable (\$843 for seniors vs. \$873 for non-seniors). Again, rates of assistance to non-seniors vary by province with Nova Scotia, Ontario and PEI receiving the largest household subsidies and Quebec, BC and Manitoba receiving the lowest. With the exception of Ontario, these results can be explained by the availability of provincial drug coverage for this group.

The pattern of subsidies by income quintile for non-seniors resembles the pattern observed for seniors, although the income gradient in mean transfers appears to be steeper for non-seniors. This pattern is somewhat surprising given the element of low-income targeting present in most provincial programs.

Table 6: Predicted probability of assistance under the proposed catastrophic drug plan for senior households with 95% confidence intervals, by province of residence and quintile of household after-tax income.

Seniors sample									
Province of Residence	Prob. of Transfer (p)			Amount of Transfer (l)			Total Transfer (pxl)		
	Mean	Lower CI	Upper CI	Mean	Lower CI	Upper CI	Mean	Lower CI	Upper CI
Newfoundland	0.21	0.16	0.26	1,018	741	1,311	214	137	292
PEI	0.25	0.18	0.31	970	634	1,318	240	141	352
Nova Scotia	0.12	0.09	0.16	794	484	1,163	97	51	150
New Brunswick	0.13	0.09	0.17	712	472	1,038	92	50	144
Quebec	0.26	0.21	0.31	487	372	611	128	93	168
Ontario	0.06	0.04	0.09	1,168	338	2,396	75	20	154
Manitoba	0.26	0.22	0.31	546	405	696	143	100	192
Saskatchewan	0.39	0.34	0.44	843	677	1,004	329	255	405
Alberta	0.19	0.14	0.23	418	316	540	78	51	108
BC	0.05	0.03	0.07	484	269	702	22	10	37
Household Income	Prob. of Transfer (p)			Amount of Transfer (l)			Total Transfer (pxl)		
	Mean	Lower CI	Upper CI	Mean	Lower CI	Upper CI	Mean	Lower CI	Upper CI
Quintile 1	0.22	0.19	0.25	577	365	823	128	76	184
Quintile 2	0.15	0.12	0.17	702	462	1,015	103	62	151
Quintile 3	0.07	0.05	0.10	619	351	957	46	23	77
Quintile 4	0.04	0.02	0.07	1,279	621	2,423	58	20	130
Quintile 5	0.01	0.00	0.03	1,821	458	4,444	20	1	88

Note: The estimated regression models used to generate these predictions are presented in Appendix 1.

Table 7: Predicted probability of assistance under the proposed catastrophic drug plan for non-senior households, with 95% confidence intervals, by province of residence and quintile of household after-tax income.

Non-seniors sample

Province of Residence	Prob. of Transfer (p)			Amount of Transfer (l)			Total Transfer (pxl)		
	Mean	Lower CI	Upper CI	Mean	Lower CI	Upper CI	Mean	Lower CI	Upper CI
Newfoundland	0.02	0.01	0.02	1,069	656	1,658	18	9	31
PEI	0.04	0.02	0.05	890	484	1,369	31	13	53
Nova Scotia	0.03	0.02	0.04	1,285	820	1,862	33	17	51
New Brunswick	0.02	0.01	0.03	735	471	1,113	15	8	24
Quebec	0.01	0.01	0.01	918	448	1,482	9	4	16
Ontario	0.02	0.02	0.03	1,644	918	2,638	40	20	64
Manitoba	0.02	0.01	0.03	704	437	1,103	12	6	21
Saskatchewan	0.02	0.02	0.03	873	540	1,277	21	11	34
Alberta	0.02	0.01	0.03	1,527	731	2,342	32	12	54
BC	0.02	0.01	0.02	613	346	943	10	4	17

Household Income	Prob. of Transfer (p)			Amount of Transfer (l)			Total Transfer (pxl)		
	Mean	Lower CI	Upper CI	Mean	Lower CI	Upper CI	Mean	Lower CI	Upper CI
Quintile 1	0.11	0.08	0.13	1,044	703	1,412	111	69	159
Quintile 2	0.04	0.03	0.05	1,041	698	1,418	45	26	65
Quintile 3	0.03	0.02	0.03	1,121	700	1,571	30	16	44
Quintile 4	0.01	0.01	0.01	1,090	638	1,798	11	5	20
Quintile 5	0.00	0.00	0.01	1,323	562	2,636	5	2	11

Note: The estimated regression models used to generate these predictions are presented in Appendix 2.

Program cost estimates

Using tabulations from the raw data (as opposed to the two-part model) and assuming that total drug expenditures remain unchanged, we estimate the implementation of the proposed catastrophic drug insurance program to the estimated 11,362,290 households in Canada during the year 2000 would require the federal government to spend \$462 million (Table 8). This estimate is close to the \$500 million cost estimate produced in the Kirby report. Note this estimate assumes that the provincial governments do not adjust their programs to take advantage of the federal program. If they do, the cost to the federal government will be higher. However, provided total drug expenditures and private coverage do not change, the \$462 million is still a valid estimate of the total incremental cost of the proposal to all levels of government.

Table 8: Subsidies to all households (in \$ millions), by province of residence, and household type

province of residence	senior	low income	other	Total
masked records	9.2	1.6	7.6	18.4
newfoundland	9.3	3.1	3.8	16.2
prince edward island	2.8	0.7	1.4	5.0
nova scotia	6.8	6.1	8.0	20.9
new brunswick	6.7	2.3	3.8	12.8
quebec	66.8	11.6	31.4	109.9
ontario	46.4	48.3	59.0	153.7
manitoba	14.0	0.6	6.1	20.8
saskatchewan	29.6	1.7	8.9	40.2
alberta	12.6	2.0	22.4	37.0
british columbia	9.5	4.0	13.2	26.6
Total	213.7	82.0	165.8	461.5

Source: 2000 Survey of Household Spending. All households included, including those with masked province of residence. Sampling weights used.

A defect of this approach is that we have made no allowance for the federal tax credit program. In 2000 tax relief was 17% of the difference between total eligible medical expenses and the lesser of \$1678 and 3% of adjusted personal income. Hence if Kirby catastrophic drug coverage had existed in 2000, household

medical expenses would have been lower and there would have been a revenue offset to the federal government of up to 17% of \$462 million or approximately \$80 million.⁴ As part of this analysis, we have also estimated at \$180 million the federal tax revenue offset if, as part of the reform, pharmaceutical drugs were made ineligible for the tax credit program.⁵

Finally we estimated the sensitivity of the cost of a catastrophic drug program if households increased their drug consumption in response to the introduction of the program. We did this simply by increasing the expenditures in the raw data by the appropriate factor and redoing our cost calculation. There is uncertainty over both the increase in household drug consumption due to the new program and the baseline level of program expenditures, so that cost estimates are likely to be

⁴Virtually all of the expenses eligible for credit would be covered by the proposed program. However the revenue offset would unlikely be the full \$80 million because the credit is nonrefundable. Take up of the credit is also incomplete whereas we have assumed take up of the new program would be 100%. The reduction of eligible medical expenses would also provide a revenue windfall to the provincial governments. While an exact estimate would be complex, a common and reasonably accurate rule of thumb is to assume that the provincial offset would be about half the federal government revenue offset.

⁵ Because the SHS data is on a household basis yet the tax system is individually-based, we focus on households with only one adult age 18 or older. For such households we can estimate the tax credit with and without the inclusion of prescription drugs. (In this step we ignore the issue that the SHS data is on a calendar year basis while the tax credit can be claimed for any 12 month period. We also estimate the adjusted personal income for the tax credit calculation as gross income less registered pension plan deductions, childcare and moving expenses: some other possible deductions are not included because of lack of data.) Our resulting calculation is that for lone adult households, eliminating the tax credit for prescription drugs would increase federal tax revenues by \$60 million (and that this credit reduction would have a negligible effect on the cost of the Kirby plan). Given that the Kirby plan for lone adult households alone would cost \$150 million or about one-third of the complete Kirby plan, this suggests an estimate of about $3 \times \$60$ million or \$180 million for all households.

We verify this calculation by another method. Canada Customs and Revenue Agency data indicates that the allowable portion of medical expenses claimed was just over \$4 billion. Ignoring the nonrefundable aspect, this would indicate tax credits of $.17 \times \$4$ billion or \$680 million. Pharmaceutical drug expenditures are about 21% of medical expenses in the SHS data, suggesting an estimate of the tax credit for pharmaceutical drugs alone of about $.21 \times \$680$ million or \$143 million, roughly similar to our other estimate.

We also note again that these are federal government revenue offsets and that there would be an additional provincial government revenue offset of probably half the federal government figure.

imprecise.⁶ One finding, however, was remarkably robust: irrespective of the assumed percentage increase in drug consumption (1%, 5% or 10%), the resulting increase in program costs was approximately double. For example, if consumption increased by 10 per cent, we predict that program costs would increase by 20.6 percent. This appears to be due to disproportionate increases in the number of households that would become eligible for program benefits after an increase in their drug expenditures.

Discussion

In this paper we estimated how the introduction of the federally funded catastrophic drug insurance program advocated by the Standing Senate Committee on Social Affairs, Science and Technology would assist households of different means and ages, residing in different regions of the country. Our results provide evidence that assistance would vary along each of these dimensions, and sometimes in unexpected ways.

First, despite the fact that senior and low income non-senior households are the primary beneficiaries of provincial government drug plans, average subsidies would be over 4 times higher for these households than for all other (non-senior, non-indigent) households. The larger subsidies for seniors and low income are due primarily to differences in rates of eligibility for assistance under the program; mean subsidy per qualifying household to the relatively small percentage of other households that do qualify is actually the largest of the 3 groups. This finding is consistent with existing public coverage for seniors that requires significant cost sharing in some provinces, but still protects them from ruinous drug costs. Other, non-indigent households typically have low drug consumption, or relatively comprehensive insurance or both of these. A small percentage, however, face very large drug costs with insufficient insurance coverage and would be among those who benefit most from the proposed program.

Second, unsurprisingly, the proposed drug program would provide larger subsidies to residents of provinces with less comprehensive government drug plans. This is particularly

⁶While the literature suggests that drug use is quite unresponsive to changes in price (in most studies, the price elasticity of drug use is less than 0.3 in absolute value), it is unclear what the effective change in drug prices would be under the new program. This depends on households' pre-program drug coverage and the likelihood that households exceed their annual deductible; the SHS data do not contain information on these parameters.

evident for senior households: mean subsidies for senior households in BC - a province with relatively low beneficiary cost sharing and in which a relatively high proportion of new drugs are listed (Grootendorst et al 2003) - are \$29. Conversely, seniors residing in Newfoundland - a province with relatively high cost sharing and a restrictive formulary - would receive \$243 on average. These results suggest that private insurers are not filling the gaps in provincial drug coverage for seniors, or at least that seniors are not electing to purchase such coverage, if it exists.

The same pattern exists for non-senior, non-indigent households: Households residing in the Atlantic provinces, where no public catastrophic drug coverage is available, would generally receive higher subsidies than would households in other provinces. However, the interprovincial variation in mean subsidies is not as large as for senior households. And there are exceptions to the general relationship. Households in New Brunswick, for instance, would receive lower mean subsidies (\$21) than would households in Saskatchewan (\$37), despite the fact that Saskatchewan has public drug coverage for this group. This coverage, however, has semi-annual deductibles of \$850 with 35% coinsurance rates, making it the least comprehensive of all the provincial plans. This suggests that other factors that affect either drug expenditures or the take-up of private drug coverage varies between these provinces.

Third, the proposed catastrophic drug program would deliver larger mean subsidies to lower income households. The reason is that lower income households are much more likely to spend at least 3% of their income on drugs and hence be eligible for program benefits. (Among eligible senior households, mean subsidies actually increase with household income; for non-seniors, they are roughly independent of income.) The income gradients are particularly pronounced among non-senior households: households in the lowest income quintile would receive a mean subsidy over 22 times the mean subsidy accruing to households in the highest income quintile. For senior households, this ratio is 6. These patterns exist despite the element of low-income targeting present in most provincial drug subsidy programs.

Fourth, the cost to the federal government of having provincial and private insurers raise the minimum standard of drug coverage for all households, currently insured or otherwise, is estimated to be at least \$461 million, not including administration and implementation costs. Somewhat less than \$80 million of this

would be offset by a reduction in outlays from the federal personal income tax credit for medical expenses. If the federal government simultaneously eliminated the medical expense credit for pharmaceutical drugs, this would lead to a larger tax revenue offset of about \$180 million. (In each case there would also be provincial government revenue effects as well, which might be as large as 50 per cent of the federal government effects.) These estimates are somewhat sensitive to the assumption that the introduction of the scheme does not change total drug expenditures. Modest percentage increases in household drug spending would increase estimated program costs by about twice the increase. If, for example, drug expenditures increase by 10% under the plan, the estimated program cost would increase by about 20%. Also if provincial governments change their plans to take advantage of a federal government catastrophic drug plan, this would lead to a further increase in the costs to the federal government although this increase would be correspond to a provincial government expenditure saving. Program costs might also increase if existing private plan drug insurers eliminated catastrophic coverage for their current enrollees, focusing instead on the provision of drug benefits that are excluded from the federal program.

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Appendix 1 Parameter estimates of models of probability of assistance and log level assistance for subsamples of senior households. Results expressed as marginal effects.

Seniors sample - probability of assistance
N=3,245; Pseudo R2=0.1363

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
Age - reference group: head 65-74 years						
75+	.0551268	.01454	3.79	0.000	.026636 .083617	.457011
Marital Status - ref group: separated/divorced/widowed/never married						
married/cl	.1253623	.0177	7.08	0.000	.090676 .160049	.48074
Household income quintiles - ref group: lowest quintile						
quintile 2	-.0717771	.01604	-4.48	0.000	-.103208 -.040346	.323883
quintile 3	-.1357791	.01459	-9.31	0.000	-.164371 -.107187	.160863
quintile 4	-.1639358	.01243	-13.19	0.000	-.188297 -.139575	.081356
quintile 5	-.1831312	.00989	-18.51	0.000	-.202518 -.163745	.037904
Province of residence - ref group: Ontario						
NF	.2923679	.04937	5.92	0.000	.195603 .389132	.086903
PEI	.3459264	.05823	5.94	0.000	.231803 .46005	.047766
NS	.1588359	.04676	3.40	0.001	.067188 .250484	.096764
NB	.1703542	.04735	3.60	0.000	.077558 .263151	.091217
PQ	.3519419	.0461	7.63	0.000	.261582 .442302	.114946
MB	.3512155	.046	7.63	0.000	.261051 .44138	.113405
SK	.4848102	.04349	11.15	0.000	.399562 .570058	.110324
AB	.2608019	.04981	5.24	0.000	.163183 .35842	.087519
BC	.002182	.03778	0.06	0.954	-.071866 .07623	.128197

Estimates are absolute changes in probability relative to reference group

Seniors sample - log amount of assistance among eligible households
N=667; Adj R-squared=0.0683

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
Age - reference group: head 65-74 years						
75+	-.1339454	.11052	-1.21	0.226	-.35057 .082679	.530735
Marital Status - ref group: separated/divorced/widowed/never married						
married/cl	.2680491	.13094	2.05	0.041	.011413 .524686	.502249
Household income quintiles - ref group: lowest quintile						
quintile 2	.2061544	.13275	1.55	0.120	-.05404 .466349	.362819
quintile 3	.1225344	.1892	0.65	0.517	-.248285 .493354	.109445
quintile 4	.8152435	.32685	2.49	0.013	.174624 1.45586	.028486
quintile 5	.6916728	1.33367	0.52	0.604	-1.92227 3.30562	.001499
Province of residence - ref group: Ontario						
NF	.3706546	.33555	1.10	0.269	-.287012 1.02832	.103448
PEI	.3562129	.35567	1.00	0.317	-.340891 1.05332	.065967
NS	-.1408331	.35558	-0.40	0.692	-.837759 .556092	.065967
NB	.0282968	.3509	0.08	0.936	-.659452 .716046	.071964
PQ	-.3144552	.32159	-0.98	0.328	-.944756 .315846	.16042
MB	-.3632317	.32153	-1.13	0.259	-.993415 .266952	.16042
SK	.296296	.31458	0.94	0.346	-.320271 .912863	.226387
AB	-.3681503	.34479	-1.07	0.286	-1.04394 .307635	.082459
BC	-.5007579	.41053	-1.22	0.223	-1.30539 .30387	.032984

Estimates are proportionate changes in assistance levels relative to reference group

Appendix 2 Parameter estimates of models of probability of assistance and log level assistance for subsample of non-senior households. Results expressed as marginal effects.

Non-Seniors sample - probability of assistance
 N=10,842; Pseudo R2=0.1599

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
Age - reference group: head < 30 years								
30-44	.0050116	.00457	1.10	0.273	-.003954	.013977		.422247
45-64	.0281126	.0051	5.51	0.000	.018108	.038118		.439587
Marital Status - ref group: separated/divorced/widowed/never married								
Married/cl	.0075585	.00259	2.91	0.004	.002474	.012643		.665468
Number of kids <18 - ref group: no kids								
1-2	-.0106244	.00285	-3.73	0.000	-.016209	-.005039		.375115
3+	-.0023314	.00514	-0.45	0.650	-.012409	.007746		.080612
Number of others 18+ (besides spouse) - ref group: no others								
1-2	.0065545	.00341	1.92	0.055	-.000132	.013241		.238148
3+	.0220042	.02317	0.95	0.342	-.023415	.067424		.010884
Number of full time earners - ref group: no FT earners								
1	-.0091874	.00293	-3.14	0.002	-.014921	-.003454		.456742
2+	-.0095341	.00379	-2.52	0.012	-.016958	-.00211		.234366
Household income quintiles - ref group: lowest quintile								
Quintile 2	-.0162359	.00217	-7.47	0.000	-.020496	-.011976		.164638
Quintile 3	-.023011	.00244	-9.43	0.000	-.027794	-.018228		.213337
Quintile 4	-.0335277	.00288	-11.64	0.000	-.039173	-.027882		.235196
Quintile 5	-.0413135	.00323	-12.79	0.000	-.047643	-.034984		.243405
Province of residence - ref group: Ontario								
NF	-.004441	.00431	-1.03	0.302	-.012881	.003999		.091773
PEI	.0120687	.00849	1.42	0.155	-.004572	.02871		.04418
NS	.0037961	.00568	0.67	0.504	-.007338	.01493		.088821
NB	-.0014792	.00498	-0.30	0.767	-.01125	.008291		.087899
PQ	-.0123775	.00323	-3.83	0.000	-.01871	-.006045		.133278
MB	-.0045606	.00452	-1.01	0.312	-.013411	.004289		.097399
SK	.0023326	.0057	0.41	0.682	-.008834	.013499		.083841
AB	-.0010834	.0051	-0.21	0.832	-.011088	.008922		.112341
BC	-.0048094	.00427	-1.13	0.260	-.013178	.00356		.127744

Estimates are absolute changes in probability relative to reference group

Non-Seniors sample - log amount of assistance among eligible households

N=398; Adj R-squared=0.0640

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
Age - reference group: head < 30 years								
30-44	.3416574	.30167	1.13	0.257	-.24961	.932924		.201005
45-64	.4715962	.28227	1.67	0.095	-.081643	1.02484		.721106
Marital Status - ref group: separated/divorced/widowed/never married								
Married/cl	.4783135	.15048	3.18	0.001	.183378	.773249		.512563
Number of kids <18 - ref group: no kids								
1-2	.310458	.2041	1.52	0.128	-.089574	.71049		.180905
3+	.07888	.37355	0.21	0.833	-.653265	.811025		.045226
Number of others 18+ (besides spouse) - ref group: no others								
1-2	.1304434	.18331	0.71	0.477	-.22884	.489727		.208543
3+	.25647	.7817	0.33	0.743	-1.27564	1.78858		.007538
Number of full time earners - ref group: no FT earners								
1	.2238763	.16737	1.34	0.181	-.104157	.55191		.281407
2+	.2664435	.28653	0.93	0.352	-.295145	.828032		.080402
Household income quintiles - ref group: lowest quintile								
Quintile 2	.0171687	.18168	0.09	0.925	-.338927	.373264		.238693
Quintile 3	.1024055	.21227	0.48	0.630	-.313637	.518448		.18593
Quintile 4	.0034601	.30156	0.01	0.991	-.587582	.594502		.077889
Quintile 5	.283441	.36801	0.77	0.441	-.437843	1.00473		.045226
Province of residence - ref group: Ontario								
NF	-.1979476	.28149	-0.70	0.482	-.749662	.353767		.120603
PEI	-.3963131	.31445	-1.26	0.208	-1.01263	.220002		.077889
NS	-.0659518	.27627	-0.24	0.811	-.60743	.475527		.128141
NB	-.4499101	.28593	-1.57	0.116	-1.01032	.110504		.110553
PQ	-.5657922	.29663	-1.91	0.056	-1.14717	.015584		.090452
MB	-.4179198	.30393	-1.38	0.169	-1.01362	.177777		.082915
SK	-.4991385	.29076	-1.72	0.086	-1.06902	.070748		.100503
AB	-.4598791	.30812	-1.49	0.136	-1.06379	.144033		.077889
BC	-.8606396	.28924	-2.98	0.003	-1.42754	-.293741		.09799

Estimates are proportionate changes in assistance levels relative to reference group

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