APPENDIX 1 (AS SUPPLIED BY THE AUTHORS): TECHNICAL DETAILS CONCERNING COST MODELLING

This is a secondary analysis of data published in the Canadian Rx Atlas, 3rd Edition, which used fiscal 2012/13 data collected by IMS Brogan (IMS Health Canada Inc.) from a panel of over 5,700 pharmacies from across all provinces – representing more than 60% of all retail pharmacies in Canada – to quantify drug utilization and spending patterns within each province and within each of 33 therapeutic categories of treatment.[1,2] The source data track the total costs of medicines purchased at retail pharmacies across Canada, including mark-ups and pharmacists fees. Pharmacists' fees were separated from drug costs using province-specific estimates of retail drug prices and average dispensing fees.

We draw on the Canadian Rx Atlas estimates of the annual volume and cost of prescriptions filled for brand-name drugs for which there are no generic competitors, brand-name drugs with generic competitors, and generic drugs, stratified by province, therapeutic category, and source of finance (private drug plans, public drug plans, and out-of-pocket).

Using an economic framework developed for analyses of the determinants of prescription drug spending, we model the total cost of prescriptions – stratified by province, therapeutic category, and source of financing – as a function of the volume of purchases made, products selected, and prices paid for selected products.[3-5] We estimate the impact of universal public drug coverage on drug costs based on assumptions regarding changes in the volume of purchases, product selection decisions, and drug prices. We selected values for each set of parameters in our analysis based on current policies and practices observed either in a Canadian province or in an international comparator.

Modeling parameters

Utilization responses

The experience of Quebec's compulsory drug insurance policy indicates that newly-insured patients may be expected to increase their utilization of prescriptions by 12% to 16%.[6] Our base scenario for estimating the impact of universal public drug coverage therefore involves a 15% increase in prescriptions filled by patients who currently pay for their prescriptions out-of-pocket – including those currently uninsured and those who face high deductibles under existing drug plans. We assume that there will be no change in utilization by patients whose prescriptions are already paid for by public or private plans. We compare results with these assumptions against a scenario in which uninsured patients increase their utilization by 20% and insured patients increase their utilization by 5% and a scenario where the changes in utilization are 10% and 0% respectively.

Product selection decisions

The type of drug purchased for a given course of treatment can have a significant impact on the cost of treatment. To be conservative in estimates of the cost of a public drug plan, we assume that the universal public program would cover all medicines within therapeutic categories when they are appropriate for patients. However, a universal public drug benefit program can promote cost-effective product selection decisions through an evidence-based formulary with step protocols and tiered co-payments.[7] To be conservative in our estimates we focus our analysis of product selection decisions that affect generic drug use in particular: prescribing of off-patent drugs (i.e., generic prescribing) and generic substitutions (i.e., selection of generics when available).

Appendix to: Morgan S, Law M, Daw JR, et al. Estimated cost of universal public coverage of prescription drugs in Canada. *CMAJ* 2015. DOI:10.1503/cmaj.141564.

We use product selection decisions observed under existing provincial drug plans to estimate the effect a universal public drug plan would have on overall product selection decisions. In our base scenario, we assume the rate at which off-patent drugs are prescribed would equal the third highest rate of such prescribing currently achieved by provincial drug plans in Canada. Similarly, we assume that generic substitution rates in the base scenario will equal the third highest generic substitution rate among provincial drug plans today. We compare results with these assumptions against results from a scenario in which off-patent prescribing and generic substitution rates match the median rates across provincial drug plans and a scenario wherein they match the top rates among provincial drug plans.

Given the narrow range of therapeutic options in such classes, we assumed no change in prescribing of off-patent drugs nor any change in generic substitution rates in six speciality drug classes that accounted for 14% of all retail sales: biologics for inflammatory conditions, antineoplastics, antiretrovirals for HIV, drugs for multiple sclerosis, drugs for glaucoma, and drugs for ocular vascular conditions. Changes in the cost of these medicines in our analyses stem only from changes in utilization and changes in the price of brand-name and generic drugs.

Brand-name drug prices

Because single-payer financing systems can exert more purchasing power in the global pharmaceutical market than multi-payer systems, we assume that prices of brand-name drugs will fall under a system of universal public drug coverage in Canada. Current regulations in Canada require that list, wholesale prices of patented drug prices be equal or better than the median of seven of the most expensive comparator countries in the OECD: France, Germany, Italy, Sweden, Switzerland, the United Kingdom, and the United States.[8] However, bi-lateral price comparisons show that Canadian prices for brand-name drugs are higher than most of these comparator countries except for the United States.[9]

In our base scenario, Canadian prices for brand-name drugs fall to a level equal to the United Kingdom, where list prices for patented (brand-name) drugs are 23% lower than in Canada.[9] We chose the United Kingdom because it has moderate prices among Canada's official comparator countries for patented drug pricing, it has a universal public health care system, and it is a high performing country in terms of pharmaceutical research and development investment – attracting five times the per capita pharmaceutical R&D that Canada attracts.[10,11] We compare results with this assumption against results when Canadian prices match prices in a high-price comparator (Sweden, 10% lower than Canada) and one in which prices match a low-price comparator (France, 28% lower).[9]

Generic drug prices

A single-payer financing system would enable competitive processes for generic drug acquisition on behalf of the entire population. This contrasts with the status quo, wherein provincial drug plans accept to pay retail prices for generic drugs that are set in relation to brand-name prices, with the lowest generic prices set at 18% of the price of the brand. Though generic firms compete with each other by lowering the cost paid by retailers for the medicines, savings generated from such competition is not passed onto patients or drug plans.[12] The result is much higher retail generic drug prices in Canada than in comparable countries.[13-16]

In our base scenario for universal public drug coverage in Canada, we assume Canadian prices for generic drugs will fall to a level equal to moderate performing comparators, such as the United Kingdom and Sweden.[17] We chose these comparators as a conservative estimate of what a single-payer system could achieve for Canada – these countries do not apply tendering in ways such as the US Veterans

Health Administration, New Zealand, and the Netherlands. This somewhat conservative base assumption may reflect the end result of a tendering system in Canada if Canada's regulatory "linkage" policies create higher than average costs of market entry for generic drugs – costs that might still have to be passed on to payers.[18]

We compare results with this base assumption against a scenario in which Canadian generic prices fall only to the median of international comparators – the same regulation as our patented drug price rules currently apply. We also compute a scenario in which Canadian generic prices fall to levels found where generics are purchased by tendering supply contracts, such as the US Veterans Health Administration, New Zealand, and the Netherlands. [13-17]

To account for the fact that Canada's generic drug prices relative to foreign prices can vary by drug class, we use available estimates of median-to-Canada price ratios by therapeutic category to calibrate our generic price estimates for each drug class included in our analysis (median-to-Canada price ratios range by therapeutic category from 0.38 to 0.78).[17]

Patient Co-payments

We assume that a universal public drug plan would apply tiered co-payments to encourage cost-effective product selections, with exemptions for low-income families. In our base scenario, we assume an average co-payment of $2.00 for generic drugs and $10.00 for brand-name drugs. These copayments are consistent with average levels found in the United Kingdom and the Netherlands.[11] We test results with those assumptions against a scenario with no co-payments for generic drugs and average co-payments of $5.00 for brand-name prescriptions and a scenario with average co-payments of $5.00 for generic drugs and $15.00 for brand-name drugs.

Indirect public financing

Finally, to analyse the incremental public cost of a universal public drug plan, we account for the direct cost of existing public drug benefit programs and the current indirect cost to governments of private insurance for public sector employees. Governments in Canada spend approximately $3-billion on private drug benefit plans for public sector employees, or 30% of the total market for private insurance for prescription drugs in Canada.[19] We derived this estimate from industry average drug claims per beneficiary, multiplied by the estimated 2.5 million public sector employees who receive extended health benefits covering prescription drug costs for themselves and their families.[20-23] We therefore assume that 30% of private insurance spending on the drugs in our analysis is an indirect form of public spending on those prescription medicines.

A summary of class-varying parameters – generic prices and product selection decisions – is provided in table A1.

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Table A1: Drug-class-specific model parameters for our base scenario and for best-case and worst-case scenarios from the perspective of assessing the cost to government of a universal public drug plan

	Generic Prices (reference-to-Canadian ratio)			Generic Substitution Target (minimum rate)			Sole-source Brand Prescribing Target (maximum rate)		
	Base	Best-case	Worst-case	Base	Best-case	Worst-case	Base	Best-case	Worst-case
Antihypertensives	0.32	0.23	0.38	89%	93%	89%	7%	6%	8%
Cholesterol-lowering drugs	0.32	0.23	0.38	96%	97%	94%	3%	0%	4%
Antidepressants	0.59	0.42	0.70	98%	99%	98%	3%	2%	5%
Acid-reducing drugs	0.49	0.35	0.58	82%	89%	80%	0%	0%	0%
Drugs for diabetes: Non-insulins	0.49	0.35	0.58	96%	98%	94%	3%	1%	5%
Antibiotics	0.59	0.42	0.70	86%	94%	85%	6%	5%	8%
Antipsychotics	0.59	0.42	0.70	94%	98%	89%	9%	5%	11%
Non-steroidal anti-inflammatory drugs	0.66	0.47	0.78	99%	99%	99%	34%	7%	47%
Pregabalin and gabapentin	0.59	0.42	0.70	93%	96%	90%	0%	0%	0%
Drugs for ADHD	0.59	0.42	0.70	80%	96%	57%	21%	6%	38%
Benzodiazepines	0.59	0.42	0.70	98%	98%	97%	1%	0%	1%
Drugs for osteoporosis	0.66	0.47	0.78	98%	99%	98%	2%	0%	4%
Anticoagulants	0.51	0.36	0.60	99%	99%	99%	13%	2%	14%
Drugs for benign prostatic hypertrophy	0.69	0.49	0.82	99%	99%	99%	8%	3%	14%
Antiplatelets	0.51	0.36	0.60	37%	76%	31%	0%	0%	0%
Drugs for dementia	0.59	0.42	0.70	98%	99%	97%	62%	56%	70%
Hormone replacement therapy	0.69	0.49	0.82	44%	55%	32%	39%	33%	39%
Drugs for migraines	0.59	0.42	0.70	95%	99%	91%	15%	5%	16%
Drugs for respiratory conditions	0.44	0.31	0.52	86%	35%	58%	86%	65%	42%
Opioids	0.59	0.42	0.70	47%	47%	47%	29%	29%	29%
Drugs for diabetes: Insulins	0.49	0.35	0.58	86%	35%	58%	86%	65%	42%
Hormonal contraceptives	0.69	0.49	0.82	86%	35%	58%	86%	65%	42%
Drugs for hypothyroidism	0.49	0.35	0.58	49%	49%	49%	100%	100%	100%
Drugs for urinary frequency and incontinence	0.69	0.49	0.82	99%	99%	99%	54%	11%	64%
Androgens	0.69	0.49	0.82	86%	35%	58%	86%	65%	42%
Biologics for inflammatory conditions	0.63	0.45	0.74	N/A	N/A	N/A	N/A	N/A	N/A
Antineoplastics	0.63	0.45	0.74	N/A	N/A	N/A	N/A	N/A	N/A
Antiretrovirals for HIV	0.63	0.45	0.74	N/A	N/A	N/A	N/A	N/A	N/A
Drugs for multiple sclerosis	0.59	0.42	0.70	N/A	N/A	N/A	N/A	N/A	N/A
Drugs for glaucoma	0.49	0.35	0.58	N/A	N/A	N/A	N/A	N/A	N/A
Drugs for ocular vascular conditions	0.49	0.35	0.58	N/A	N/A	N/A	N/A	N/A	N/A
All other drugs not classified in study	0.49	0.35	0.58	86%	35%	58%	14%	35%	58%

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