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3 **The impact of OHIP+ universal pharmacare on prescription drug use and costs among children**
4 **and youth under 25 years in Ontario: A time-series analysis.**
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35 **Key messages:**

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- Adopting a universal pharmacare model (OHIP+) in Ontario for those under 25 years led to a significant increase in publicly covered prescriptions and plan expenditures as predicted.
 - A later modification of OHIP+ that restricted eligibility to only those who do not have private drug insurance coverage led to a significant decrease in publicly covered prescriptions and plan expenditures.
 - This study is useful to inform the ongoing debate over national pharmacare in Canada, largely confirming the government's predicted cost of OHIP+.
 - Future research should examine associations of the implementation and changes in policy with health outcomes.

Abstract

Introduction: In January 2018, Ontario implemented a universal pharmacare program (OHIP+) for people under 25 years old, providing full coverage of prescription medications included in the provincial formulary. OHIP+ was modified in April 2019 to exclude private drug-insurance holders. We assessed the utilization and costs of publicly covered prescriptions before and after the implementation and modification, using British Columbia (BC) as control.

Methods: We conducted a population-based interrupted time-series analysis using the CIHI NPDUIS prescription-drug claims data from January 2016 to October 2019. We assessed changes in the level and trend of publicly covered prescriptions and public sector expenditures after the introduction and modifications of OHIP+.

Results: Publicly covered prescriptions per 1,000 in ON increased by 74%, from 756 per 1,000 people in the two years before OHIP+ implementation, to 2,952 per 1,000 from January 2018 to April 2019 ($p<0.001$), and following the program modification in April 2019 it decreased by 52% to 1,421 per 1,000 ($p<0.001$). Similarly, total public drug expenditure increased by 255% from \$189 million CAD in 2017 to \$671 million CAD in 2018, then reduced by 70% to \$204 million CAD in 2019. Monthly public plan expenditures increased by \$115.94 (95%CI, \$100.93-\$130.94, $p<0.001$) post OHIP+ implementation in 2018, and decreased by \$99.97 (95%CI, \$119.79-\$80.15, $p<0.001$) per person per month after April 2019.

Interpretation: Adopting OHIP+ increased utilization of publicly funded prescription medicines and increased drug benefits costs with a substantial decrease in both following the modification. This study is useful to inform the debate over national pharmacare and largely confirmed the government predicted additional cost of OHIP+. Future research should investigate associations with health outcomes.

Background

Universal Health Coverage (UHC) promotes access to necessary care and protects patients from health-related financial hardship that may affect health outcomes. The World Health Organization declared that governments are obligated to promote universal coverage of essential healthcare services, including prescription drugs¹⁻⁴. Given the importance of reducing out-of-pocket spending for prescription drugs, universal access to affordable, safe and appropriately prescribed treatments is a significant health system goal in all countries²⁻⁵. However, approaches to UHC for prescription medications or universal pharmacare varies based on the population covered (who), health products and technologies (what) and the extent of coverage (proportion of direct costs covered). The amount spent on prescription drugs, including the per capita spending, has significantly increased over time⁴⁻⁷. Health-system expenditure on prescription drugs has also increased in many countries, often growing faster than other health-system costs⁵⁻¹⁴. Therefore, implementing universal pharmacare can enhance equitable access to needed care⁷⁻³³.

While provincial and territorial health systems in Canada provide a single-payer system with coverage for medically necessary hospital and physician-based care, this universality does not extend to out-patient prescription medications.²⁻⁵ Instead, prescription drugs are funded by a fragmented patchwork of public and private drug plans that varies by province and leaves many Canadians with little or no drug coverage.⁴⁻⁶ Children and youth are a vulnerable population and the data produced has shown that younger adults are mostly disadvantaged in coverage and limited studies have investigated the status of coverage variation⁷⁻²³. The provincial government implemented the Ontario Health Insurance Plan Plus (OHIP+) in January 2018, which offered full coverage for more than 4,400 medication products from the Ontario Drug Benefit (ODB) formulary. According to the provincial government, the estimated predicted additional annual investment was \$465 million to expand coverage of young people through OHIP+.²⁵⁻²⁶ However, the initial scope of OHIP+ was modified in April 2019, restricting eligibility to those without private drug plans most often from parental coverage.²⁵⁻²⁷ The primary objective of this study was to assess the impact of the introduction and the subsequent modification of OHIP+ on the number of publicly covered prescriptions and plan expenditures. The

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3 secondary objective was to use the same metrics to assess prescription medications for two conditions
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5 (asthma and diabetes).
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9 **Methods**

10 **Design**

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12 We used an interrupted time series (ITS) design to estimate changes in the number of publicly
13 covered prescriptions and plan expenditures. It is a rigorous and commonly used method to examine
14 the longitudinal effects of introducing new programs and policies¹⁷⁻³⁰.
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22 **Setting and policy intervention**

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24 The implementation of OHIP+ in January 2018 and its modification in April 2019 provides two
25 time points of interest. The original program offered full coverage for more than 4,400 medication
26 products from the Ontario Drug Benefit (ODB) formulary for those under 25 years old. In April 2019,
27 the program was modified to exclude private drug plan holders and those eligible for the Ontario Drug
28 Benefit program (e.g., through the Trillium Drug Program and those receiving social assistance). We
29 used the province of British Columbia (BC) as a non-equivalent control jurisdiction, as it had
30 comparable coverage for youth and children and social assistance programs.
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41 **Data sources**

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43 The National Prescription Drug Utilization Information System (NPDUIS) provided
44 anonymized public prescriptions and drug plan reimbursement benefit aggregated numbers for ON and
45 BC for 24 months preceding and 15 months following the adoption of OHIP+, and seven months after
46 modifying OHIP+. The data set included medication class, product name, the dose of the drug, the
47 number of active beneficiaries enrolled in the plan over each month, the number of paid beneficiaries,
48 number of prescriptions, program paid in reimbursed dollars claims.⁸
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58 **Outcome variables**

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3 The primary outcome variables for the primary and secondary analyses included: 1) number
4 and rate of publicly covered prescriptions; and 2) public plan expenditure in Ontario through the study
5 period. To calculate the overall utilization rate, we used the number of publicly covered prescriptions
6 recorded as the total number of claims accepted per month divided by the general Ontario population
7 aged 24 years and under as the intervention group and BC population as the control group. We then
8 made the same calculations for the secondary analysis focused on asthma and diabetes prescription
9 medications. Overall, public-plan expenditure was calculated as the average monthly public
10 reimbursement dollars per person per population for all prescription drugs for Ontario and BC. The
11 Ontario and BC population were linearly interpolated for each month from annual Statistics Canada
12 population estimates over the study period.
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26 **Data analysis plan**

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28 We used a segmented regression analysis model. Utilization rates were calculated in three
29 segments, each with multiple observations: 1) before the first OHIP+ policy change or adoption of
30 OHIP+; 2) after the first policy change, and 3) after the second policy change or modification. We fit
31 the segmented regression models using a generalized least squares model and incorporated appropriate
32 autocorrelation parameters for each model based on standard diagnostic criteria¹⁹. The intervention and
33 control group models included terms for the existing level and trend in the outcome and changes or
34 shifts on both the level and trend, as they also included an indicator variable for January, as use and
35 cost change with a rollover of the OHIP+ in that month. The underlying assumption in such models is
36 that the ON trend would change in the same manner as BC absent OHIP+ policy change. No sensitivity
37 analyses were conducted.
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51 **Ethics approval**

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53 Ethics approval was provided by the Hamilton integrated research ethics board (HiREB) before
54 conducting the study (protocol number #10991-C).
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Results

Table 1 contains data on the monthly counts and selected characteristics of the OHIP+-eligible residents < 25 years of age who filled publicly covered prescriptions during the study period. The total number of people covered by all ODB and BC drug plans averaged 260,930 and 119,881 per month, respectively. The study sample from Ontario was evenly balanced between younger age groups (0-17 years) and older (18-25 years), gender, but not for socioeconomic status (SES) where 60% of those who received the publicly covered prescriptions were from either low or low-middle SES.

Prescription utilization

Overall prescription use

The total number of publicly covered prescriptions paid for by the benefits plan over the 46-month period was 24,869,544.

As shown in Figure 1 and Table 2, we found a level increase rate of 2.13 publicly covered prescriptions per person per month paid for by the plans at the implementation (95% CI 1.89 to 2.37) and a significant immediate level drop at the modification of -1.61 publicly covered prescriptions per person per month (95% CI -1.95 to -1.26) and no statistically significant increase in the trends after that. Compared to BC, where utilization was stable, overall publicly covered prescriptions in ON increased by 74%, from a mean of 756 per 1,000 young people in the two years before OHIP+ implementation, to 2,952 per 1000 from January 2018 to April 2019, then decreased by 52% to 1,421 per 1,000 as shown in Table 3.

Asthma and diabetes drug prescription use

As shown in Table 2, we found an immediate increase of 0.27 publicly covered prescriptions per person per month for asthma paid for by the plans at the first policy change (95% CI 0.20 to 0.35), and an immediate drop of 0.16 publicly covered prescriptions per person per month at the second policy change (95% CI -0.24 to - 0.08). For both policy intervention changes there was no statistically significant increase in the trend thereafter. On the other hand, we found a level increase of 0.03 publicly

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3 covered drug prescriptions per person per month for diabetes paid for by the plans at the first policy
4 change (95% CI 2.35 to 3.40) and a significant immediate level drop at the second policy change of -
5 0.02 publicly covered prescriptions per person per month (95% CI -2.84 to -1.49) and no statistically
6 significant increase in the trends thereafter.
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11 Many of the changes in publicly covered prescription use for asthma and diabetes prescriptions
12 were substantial with increases of 100% or more and dropping for the overall and individual ingredients
13 by 50% or more (see Table 3). The largest increases for the monthly mean asthma publicly covered
14 prescriptions were reported for omalizumab, mometasone, vilanterol fluticasone, and budesonide (all
15 reporting above 900% change). The largest declines were for ivacafter and mometasone which reported
16 more than 90% change. Whereas for diabetes, the largest increase for the monthly mean publicly
17 covered prescriptions change were for insulin glulisine and empagliflozin reporting > 700% change.
18 The largest decline was found for insulin detemir, insulin aspart, and for diagnostic agents - test strips,
19 all reporting a decline by more than 65% (Table 3 and Appendix I).
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33 **Prescription drug plan expenditures**

34 *Overall findings*

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37 The total number of publicly covered prescription and plan expenditures reimbursed by the
38 benefits plan over the 46 months was \$1,421,248,106. As shown in Figure 2, there was an increased
39 plan expenditure rate of \$115.94 per person per month after OHIP+ policy one implementation (95%
40 CI \$100.93 to \$130.94) and a level drop of plan expenditure rate of -\$99.97 per person per month after
41 OHIP+ modification (95% CI \$119.79 to -\$80.15). The estimated trend-change noted a slight monthly
42 increase of \$0.03 per person per month (95% CI \$0.15 to \$0.20) with an opposite direction after
43 modification. Compared to the stable BC utilization, publicly covered prescriptions plan expenditure in
44 ON increased by 252%, from a mean of \$4,601 per 1,000 young people in the two years before OHIP+
45 implementation, to \$16,202 per 1000 from January 2018 to April 2019, then decreased by 99% to
46 \$1,606 per 1,000.
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Asthma and diabetes drug prescription expenditure

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3 As shown in Table 2, we found an immediate increase of plan expenditure rate of \$12.80 per
4 person per month for asthma publicly covered prescription reimbursed dollars for by the benefits plans
5 after the adoption of the first OHIP+ policy (95% CI \$10.85 to \$14.76). Subsequently an immediate
6 plan expenditure drop of \$8.58 per person per month asthma publicly covered prescriptions reimbursed
7 dollars after the second policy change (-\$8.58, 95% CI. -\$10.82 to -\$6.33). Following the first policy
8 intervention, the estimated trend-change was \$0.039 per person per month (95% CI \$-\$0.23 to \$0.31).
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10 For diabetes, drug-plan expenditure increased by \$7.32 per person per month after the adoption of
11 OHIP+ (95% CI \$5.78 to \$8.86) and a level drop of plan expenditure of \$-3.75 per person per month
12 after the program modification (95% CI \$-5.68 to \$-1.83). The estimated trend-change increased with
13 \$1.86 per month (95% CI \$0.27 to \$3.46), and the trend after modifying OHIP+ was not statistically
14 significant.
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17 Many of the changes for asthma and diabetes public-drug plan expenditures were substantial,
18 with reimbursements increasing by 100% or more and dropping for the overall and individual
19 ingredients by 50% or more after the program modification (see Table 3). The largest increases for
20 mean publicly covered prescription plan expenditure for asthma prescriptions was for omalizumab,
21 mometasone, ipratropium, tiotropium, budesonide (above 900% change) and the largest declines were
22 for Ivacafter and ipratropium (> 90% change). The largest increases for monthly mean for publicly
23 covered prescription plan expenditure diabetes prescriptions was for empagliflozin, dapagliflozin,
24 insulin glulisine (>800%) and the largest declines were for dapagliflozin, insulin detemir (> 70%
25 change) (see Appendix I).
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48 **Interpretation**

49 **Principal findings**

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51 When it was introduced, OHIP+ represented a major change in drug coverage in Canada. Our
52 analysis found that both publicly covered prescriptions and costs in ON increased considerably by
53 >70% pre-post OHIP+ adoption. Further, we found that the April 2019 change in the eligibility criteria
54 substantially reduced this by >50%. We also found that the asthma and diabetes monthly rates for
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3 publicly covered prescriptions and plan expenditures all reported an immediate significant increase after
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5 OHIP+ implementation and a subsequent drop with the modification of the OHIP+ policy.
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7 The more generous universal drug coverage offered through the initial scope of OHIP+
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9 increased access to publicly funded medicines. Our study aligns with others that have found that public
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11 prescription-drug plans that provide non-catastrophic first-dollar coverage increase utilization of
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13 publicly covered medication and lower rates of cost-related non-adherence.^{5-7,11,41} Other studies have
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15 shown that higher financial coverage promotes higher utilization and access to drugs among
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17 populations.^{1,16,41} In contrast, a more restrictive universal drug coverage model offers limited access and
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19 mixed drug expenditure based on the payer.^{1,4,6,16} These findings align with those from our study.
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22 Due to data access limitations, we were unable to measure health outcomes across the time
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24 periods of the study. This is crucial data to pursue, as improving health outcomes is the ultimate goal
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26 of these policy changes. Several randomized trials have been undertaken in the United States and
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28 Canada, to examine the health outcomes and adherence of patients provided free access to their
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30 medications.⁴¹⁻⁴⁴ Overall, there was no improvement in health outcomes, but the recently published 2-
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32 year follow-up of the CLEANMeds randomized trial involving Ontario patients with cost-related non-
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34 adherence, showed improved adherence and reduced total healthcare costs over 2 years.⁴² Further work
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36 on the cost-effectiveness of a variety of drug coverage policies, is essential.⁴²⁻⁴⁴ We are not aware of a
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38 randomized trial examining free essential medications just for children and youth, arguable the group
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40 likely to prove the most cost-effective given lower per person costs and longer life-years remaining.
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42 Expanded financial coverage likely accounted for the increases in utilization of publicly covered
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44 prescriptions found in our study.
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50 **Implications**

51 Findings from this study provide implications both for policy and future research. For policy,
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53 our findings can be used to inform the ongoing discussions regarding a national universal pharmacare
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55 program in Canada. Expanding coverage would increase access to prescription medicines (essential and
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57 non-essential) and would likely reduce cost burdens on many individuals in lower socioeconomic strata,
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59 but would increase costs for governments by an amount that appears to be predictable. Future research
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3 should focus on the associations of implementing and modifying OHIP+ with health outcomes, as this
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5 would generate the crucial data for cost-effectiveness analysis.
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9 10 **Strength and limitations**

11 Our analysis has strengths and limitations worth noting. The main strength is the use of
12 province-wide data to calculate utilization rates and plan expenditure, which provides a robust
13 assessment of the impact of OHIP+ and its modification on these outcomes. The limitations for our
14 study include selecting a small number of indicators, based on what was available through NPDUIS.
15 Additionally, while we are unaware of any changes affecting plan beneficiary members around the time
16 of the OHIP+ policy change, there is potential for bias in our estimates if such changes did occur and
17 these confounders were not included in our models. It was also impossible to ascertain whether plan
18 members had a private coverage plan, and the extent of coverage effects like stopping therapies
19 altogether.
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33 **Conclusion**

34 Adopting a universal pharmacare (OHIP+) for Ontarians < 25 years of age increased
35 considerably the number of publicly covered prescriptions and public expenditures with a decrease in
36 both following the modification of the program. This study is useful to inform the debate over national
37 pharmacare and largely confirmed the government predicted additional cost of OHIP+. Future research
38 should focus on examining associations of implementing OHIP+ and changes in policy with health
39 outcomes so that cost-effectiveness can be estimated.
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53 therefore, no funding was required for this project.
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Table 1: Sample characteristics of the ON population, ODB medication-related utilization and costs

Characteristic	Period; no. (%) of observations		
	Month pre-1 st policy (Dec. 2017)	Month pre- 2 nd policy (Mar. 2019)	Last month (Oct. 2019)
Total no. beneficiaries	81,556	559,044	251,218
Age			
0-17 years	46,626 (57.2)	307,056 (54.9)	134,224 (53.4)
18-25 years	34,930 (42.8)	251,988 (45.1)	116,994 (46.6)
Sex			
Male	39,943 (49.0)	240,835 (43.1)	111,545 (44.4)
Female	40,612 (49.8)	317,954 (56.9)	139,467 (55.5)
Other	1,001 (1.2)	255 (0.05)	206 (0.08)
SES (Income quintile)			
Low (1).	33,964 (41.6)	108,218 (19.4)	68,372 (27.2)
Low-middle (2)	18,119 (22.2)	102,359 (18.3)	51,718 (20.6)
Middle (3)	12,407 (15.2)	109,887 (19.7)	46,292 (18.4)
Middle-upper (4)	8,962 (11.0)	114,927 (20.6)	41,896 (16.7)
Upper (5)	6,452 (7.9)	117,608 (21.0)	38,995 (15.5)
Prescriptions			
Total prescriptions	265,709	1,041,849	558,919
Overall plan cost	\$16,251,475	62,057,345	33,694,070
Prescriptions (Asthma)			
Total prescriptions	3,166	12,183	5,732
Overall plan costs.	\$259,015	\$1,415,801	\$560,200
Prescriptions (Diabetes)			
Total prescriptions	20,715	108,300	54,919
Overall plan costs	\$ 722,872	\$4,763,749	\$2,179,416
Rate of use per 1,000 Population aged <25 yr	783 (0.78)	2,993 (2.99)	1,606 (1.61)

Table 2: OHIP+ policy effects rate change in monthly ODB publicly covered prescriptions and plan expenditure volumes

Parameter (level & trend)	Period; effects rate change in no. of observations (coefficient, 95%CI, P-value)	
	Period pre-post 1 st policy	Period between 1 st and 2 nd policy
Overall prescriptions use & costs		
Overall Prescription		
Level change.	2.13 (1.89 - 2.37; P < 0.001)	-1.610 (-1.95 - -1.26; p< 0.001)
Trend change.	0.01 (-0.02 - 0.03; p < 0.055).	0.003 (-0.07 - 0.07; p < 0.9321)
Overall Plan costs		
Level change.	\$115.94(100.93-130.94; P<0.001)	\$-99.97 (-119.79 - -80.14 p< 0.001)
Trend change.	\$1.86 (-0.27-3.46; p<0.025).	\$-0.64 (-3.70 - 4.98; p < 0.773)
Asthma (A10)		
Overall prescription		
Level change.	0.27 (0.20-0.35; p < 0.001)	-0.161 (-0.24 - - 0.08; P < 0.001)
Trend change	0.0002 (-0.11 -0.01; p < 0.978.	0.0008 (-0.03 - 0.02; P < 0.948)

Overall plan costs		
Level change.	\$12.80 (10.85 – 14.76; p<0.001)	\$-8.58 (-10.82 - -6.33; P < 0.001)
Trend change	\$0.039 (-0.23 – 0.31); P < 0.001	\$0.1781 (-0.44 – 0.80; P < 0.574)
Diabetes (A10)		
Overall Prescription		
Level change.	0.03 (2.35- 3.40; P< 0.001)	-0.02 (-2.84 - -1.49; p< 0.001)
Trend change.	0.0002 (-4.02-7.43; p<0.5619)	-0.0004 (-1.15-1.91; p <0.6288)
Overall Plan costs		
Level change.	\$7.32 (5.78-8.86; P< 0.001)	\$-3.75 (-5.68 - -1.83; p< 0.001)
Trend change.	\$0.03 (-0.15 - 0.20; p<0.078)	\$-0.04 (-0.42 - 0.49; p <0.873)

Table 3: Top changes in terms of the largest increase and reduction in publicly covered prescription and plan expenditure volumes following the adoption and modification of OHIP+

Ingredients	Drug utilization pre-post OHIP+ Policy 1 (adoption phase)			Drug utilization pre-post OHIP+ policy 2 (modification phase)	
	Parameter	Pre index (Nos.)	Post index (Nos.)	% Change from Pre-index	Post index (Nos.)
Total no. of beneficiaries	1,864,796	8,314,971	+613%	1,822,971	-53%
Overall prescriptions	6,126,278	15,280,827	+299%	3,462,439	-52%
Rate of pres. use per 1000	756	2,952	+74%	1,421	-52%
Overall plan costs	\$378,864,749	\$838,556,189	+254%	\$203,827,168	-49%
Rate of cost per 1000	\$4,602	\$16,202	+252%	\$1,606	-99%
Drug Prescription use (asthma)	408,517	1,617,430	+534%	307,354	-59%
R03DX05 -Omalizumab	28	2,704	+17900%	552	-56%
R03BA07 -Mometasone	51	1,369	+4450%	46	-92%
R01AD05 -Budesonide	8,632	47,245	+775%	11,194	-49%
R03AK09 -Formoterol & mometasone	3,733	18,618	+696%	3,513	-60%
Drug prescription use (diabetes)	69,598	172,492	+297%	36,471	-55%
Rate of use per 1000	9	33	+288%	15	-55%
A10BK03 - Empagliflozin	98	1,596	+2500%	655	-12%
A10AB06 - Insulin Glusine	340	1,818	+764%	318	-63%
A10BD07 - Metformin & Sitagliptin	1,270	2,731	+244%	1,106	-13%
Drug plan expenditure (asthma)	\$15,731,734	\$67,238,150	+584%	\$12,598,120	-20%
Rate of use per 1000	\$1,940	\$12,990	+570%	\$4,548	-64%
R03DX05 - Omalizumab	\$41,642	\$4,183,232	+15974%	\$765,228	-61%
R03BB01- Ipratropium	\$25720	\$6827	+9452%	\$17,331	-98%
R03BA07 - Mometasone	\$2,456	\$75,830	+4856%	\$2,344	-93%
Drug expenditure (diabetes)	\$15,731,734	\$67,238,150	+584%	\$12,598,120	-20%
Rate of use per 100,0	\$716	\$3584	+410%	\$1489	-62%
A10BK03 - Empagliflozin	\$8,785	\$176536	+3100%	\$56926	-31%
A10BK01- Dapagliflozin	\$3,856	\$51501	+2032%	\$5075	-79%

A10AB06 - Insulin Glusine	\$28,803	\$173455	+864%	\$32635	-60%
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Figures 1-2.

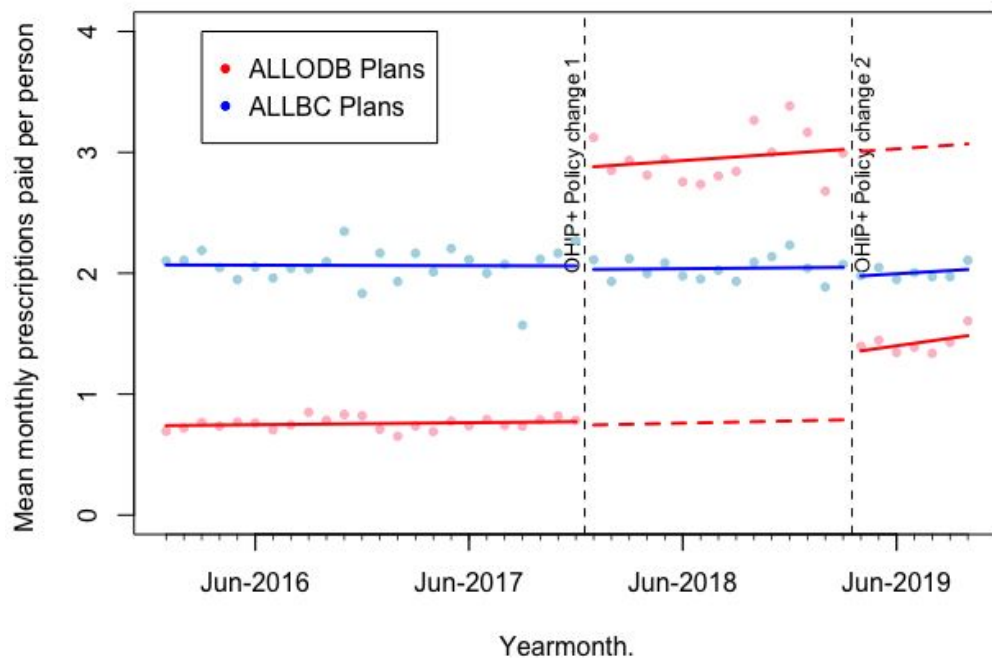


Figure 1: Average monthly number of publicly covered prescriptions per person per population where at least a portion was paid by the benefits plan, before and after the first and second OHIP+ policy intervention changes in January 2018 and in April 2019. The solid lines represent the estimated monthly rates and dashed lines (counterfactual), predicated estimates.

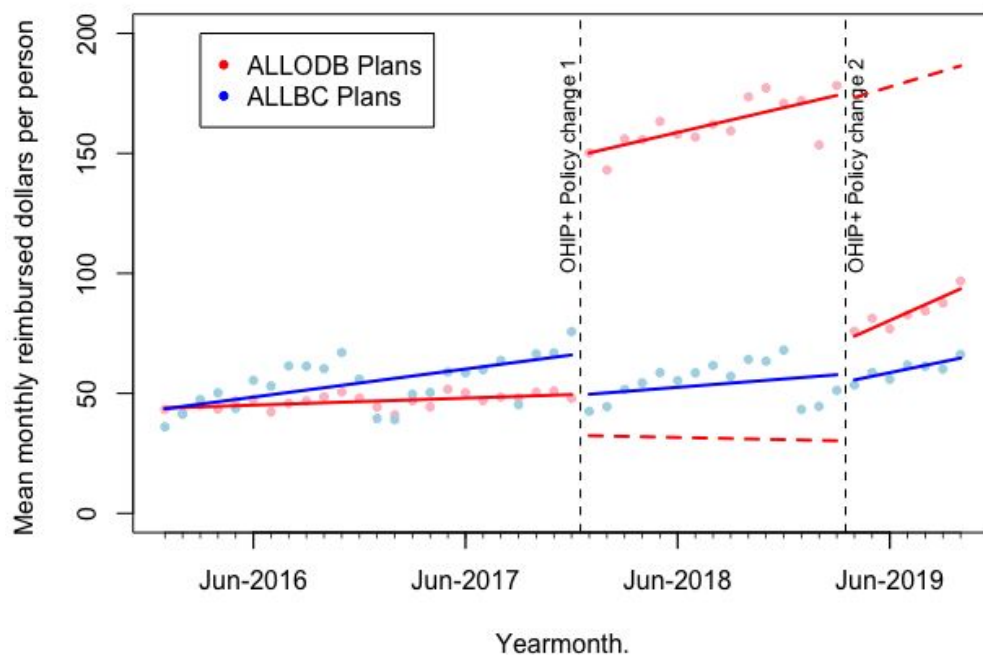


Figure 2: Interrupted time-series analysis of overall reimbursed dollars per person per population before and after the first and second OHIP+ policy intervention changes in January 2018 and in April 2019. The solid lines represent the estimated monthly rates and dashed lines (counterfactual), predicated estimates.

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Appendix I

Table S1: Data elements for studying the OHIP+ trends of publicly covered prescription utilization and expenditures

Data Element	Definition
Calendar Year/month	The calendar year and month during which a claim was dispensed.
Province	The provincial/jurisdiction responsible for financing the claim: <ul style="list-style-type: none"> • Ontario (ON) • British Columbia (BC)
Program Group	See Plans and Programs in the NPDUIS Database section for more detail A drug benefits plan/program to which the claim was submitted for payment.
Neighborhood Income Quintile	A grouping by the neighborhood income quintile (based on national distribution) associated with patient postal code. That is, Quintile 1 (Lowest income), 2, 3, 4, 5 (Highest Income), and 9 (Missing).
Patient Sex	The sex of the patient at the time of claim, and grouped as male, female, other.
Patient Age Category	The age of the patient at the time of claim (service date), grouped as 0-17, 18-25.
ATC level 5 code/description (only for diabetic and respiratory drugs)	An ATC code and English description is defined by the WHO Collaborative Centre for Drug Statistics Methodology and is assigned by Health Canada at the product level. Chemical substance — indicated by the full 7 characters of the ATC code.
PDIN flag (only for diabetic and respiratory drugs)	A flag that indicates whether the product is listed as a pseudo-drug identification number (PDIN). The drug identification number (DIN) or pseudo-DIN (PDIN) identifies drug products sold in a dosage form in Canada. DINs are assigned by Health Canada, and PDINs are assigned by the plan/program. If the PDIN Flag is Y, the value received is a PDIN. If the PDIN Flag is N, the value received is a DIN.

Form (only for diabetic and respiratory drugs)	A pharmaceutical dosage form description of drug products used within the CIHI database. It is derived from the Health Canada dosage form and modified using predetermined form-mapping rules to ensure standard reporting. For more information, see the CIHI Pharmaceutical Form Mapping For PDINs, this data element will be reported as blank. (https://www.cihi.ca/en/system/files/document/pharmaceutical_mapping2008_en.pdf) document.
Route of administration (only for diabetic and respiratory drugs)	The route of administration for the drug as reported in Health Canada Drug product Database. For PDINs, this data element will be reported as blank.
Strength (only for diabetic and respiratory drugs)	Standardized strength of a DIN for use in establishing the CIHI Uniform Description.

# of Claims Accepted	The number of claims where the public plan/program accepted at least part of the claim, either toward a deductible (if applicable) or for payment for the given drug class.
# of Active Beneficiaries	The number of people from whom the public plan/program has accepted at least part of at least one claim for the given drug class, either toward a deductible (if applicable) or for payment.
# of Paid Beneficiaries	The number of people for whom the public plan/program paid at least part of at least 1 claim for the given drug class.
Program Paid Amount	The Amount from the total prescription cost accepted that is paid by the plan/program for the given drug class.
# of active beneficiaries (all drugs)	The number of individuals from whom the public plan/program has accepted at least part of at least one claim, either toward a deductible (if applicable) or for payment, for any drug product.
# of paid beneficiaries (all drugs)	The number of people for whom the public plan/program paid at least part of at least 1 claim for any drug product.
# of Claims Accepted (all drugs)	The number of claims where the public plan/program accepted at least part of the claim, either toward a deductible (if applicable) or for payment any drug.
Program Paid Amount (all drugs)	The Amount from the total prescription cost accepted is paid by the plan/program for any drug product.

Table S2: Top changes in asthma publicly covered prescription use volumes and plan expenditures pre-post policy changes

Ingredient-parameter	Period; no. of prescriptions and costs (monthly mean, %) change				
	Before 1 st policy	After 1 st policy	% change	After 2 nd policy	% change
Total no. beneficiaries	1864796 (77700)	8314971(554331)	+613.4	1822971 (260424)	-53.0
Prescriptions					
Overall prescriptions	6126278 (255262)	15280827 (1018722)	+299.1	3462439 (494634)	-51.5
Rate of use per 1000	756 (0.756)	2952 (2.952)		1421 (1.421)	
Overall plan costs	\$378864749 (15786031)	\$838556189(55903746)	+254.1	\$203827168(29118167)	-47.9
Rate of cost per 1000	\$162018 (46.02)	\$162018 (162.02)		\$1606 (1.61)	
Prescriptions (Asthma)					
Overall prescriptions	408517 (17022)	1617430 (107829)	+533.5	307354 (43908)	-59.3
Rate of use per 1000	50.5 (0.050395126)	313 (0.312504528)		26.2 (0.12614199)	
Beclomethasone-R01AD01	6149 (256)	18237(1216)	+375	4152 (593)	-51.2
Beclometasone-R03BA01	3790 (158)	15457 (1030)	+551.9	2204 (315)	-69.4
Budesonide-R01AD05	8632 (360)	47245 (3150)	+775	11194 (1599)	-49.2
Budesonide-R03BA02	3526 (147)	9673 (645)	+338.8	1577 (225)	-65.1
Fluticasone-R03BA05	90672 (3778)	417072 (27805)	+636	66651 (9522)	-65.8
Ciclesonide-R01AD13	36516 (1522)	64866 (4324)	+184.1	34324 (4903)	-13.3
Ciclesonide-R03BA08	9176 (382)	39957 (2664)	+597.4	5190 (741)	-72.2
Mometasone-R03BA07	51 (2)	1369 (91)	+4450	46 (7)	-92.3
Salbutamol-R03AC02	183504 (7646)	783621 (52241)	+585	133055 (19008)	-12.5
Terbutaline-R03AC03	1420 (59)	6233 (416)	+605.1	815 (116)	-72.1
Salmeterol and Fluticasone R03AK06	11039 (460)	30282 (2019)	+338.9	5265 (752)	-62.8
Vilanterol and Fluticasone- R03AK10	617 (26)	7921 (528)	+1930.7	1635 (234)	-55.7
Formoterol and Budesonide-R03AK07	8863 (369)	37085 (2472)	+569.9	7593 (1085)	-56.1
Formoterol&Mometasone-R03AK09	3733(156)	18618 (1241)	+695.5	3513 (502)	-59.5

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Table S3: Top changes in diabetes publicly covered prescription use volumes and plan expenditure pre-post policy changes

Ingredient-parameter	Period: no. of prescriptions and costs (%) change				
	Before 1 st policy	After 1 st policy	% change	After 2 nd policy	% change
Total no. beneficiaries	1864796 (77700)	8314971(554331)	+613.4	1822971 (260424)	-53.0
Prescriptions					
Overall prescriptions	6126278 (255262)	15280827 (1018722)	+299.1	3462439 (494634)	-51.5
Rate of use per 1000	756 (0.756)	2952 (2.952)		1421 (1.421)	
Overall plan costs	\$378864749(15786031)	\$838556189(55903746)	+254.1	\$203827168 (29118167)	-47.9
Rate of cost per 1000	\$46020 (46.02)	\$162018 (162.02)		\$1606 (1.61)	
Prescriptions (Diabetes)					
Overall prescriptions	69598 (2900)	172492 (11499)	+296.5	36471 (5210)	-54.7
Rate of use per 1000	8.58 (0.00858)	33.3 (0.03333)		14.9 (0.01497)	
Insulin (A10A)	5391841 (224660)	17459280 (1163952)	+418.1	3297138 (471020)	-59.5

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3	Insulin Aspart -A10AB05	18554 (773)	57313 (3821)	+394.3	8863 (1266)	-66.9
4	Insulin Glargine - A10AE04.	12159 (507)	29401 (1960)	+286.6	5192 (742)	-62.1
5	Insulin Lispro -A10AB04	10605 (442)	31924 (2128)	+381.4	5214 (745)	-65.0
6	Insulin(humansusp)-	5311 (221)	7645 (510)	+130.8	1239 (177)	-65.3
7	A10AC01					
8						
9	Insulin Glulisine - A10AB06	340 (14)	1818 (121)	+764.3	318 (45)	-62.8
10	Insulin Detemir- A10AE05	3576 (149)	6128 (409)	+174.5	840 (120)	-70.7
11	Blood GL meds- (A10B)	414747 (17281)	1092027 (72802)	+321.3	330960 (47280)	-35.1
12	Metformin-A10BA02	14232 (593)	25542 (1703)	+187.2	8727 (1247)	-26.8
13	Metformin sitagliptin-	1270 (53)	2731 (182)	+243.4	1106 (158)	-13.2
14	A10BD07					
15						
16	Glaclazide-A10BB09	1341 (56)	2034 (136)	+142.9	892 (127)	-6.6
17	Sitagliptin-A10BH01.	954 (40)	1116 (74)	+85.0	429 (61)	-17.6
18	Canagliflozin-A10BK02	1072 (45)	906 (60)	+33.0	211 (30)	-50.0
19	empagliflozin-A10BK03.	98 (4)	1596 (106)	+2500	655 (94)	-11.3
20	teststrips-Z99AA	36029 (1501)	87831 (5855)	+290.1	14272 (2039)	-65.2
21	Overall plan costs.	\$5806588 (241941)	\$18551307 (1236754)	+411.2	\$3628098 (518300)	-58.1
22	Rate of use per 1000	\$716.31 (0.71631)	\$3584.3(3,58431)		\$1489.02 (1.48902)	
23	Insulin (A10A)	\$5391841 (224660)	\$ 17459280 (1163952)	+418.1	\$3297138 (471020)	-59.5
24	Insulin aspart -A10AB05	\$1804849 (75202)	\$6758411 (450561)	+499.1	\$1066830 (152404)	-66.2
25	Insulin Glargine - A10AE04	\$1641723 (68405)	\$4570759 (304717)	+345.5	\$824965 (117852)	-61.3
26						
27	Insulin lispro -A10AB04	\$924483 (38520)	\$3513537 (234236)	+508.1	\$588106 (84015)	-64.1
28	Insulin(humansusp)-	\$379536 (15814)	\$615104 (41007)	+159.3	\$103675 (14811)	-63.9
29	A10AC01					
30	Insulin detemir- A10AE05	\$606615 (25276)	\$1135139 (75676)	+199.4	\$157560 (22509)	-70.3
31						
32	Insulin Glulisine - A10AB06	\$28803 (1200)	\$173455 (11564)	+863.7	\$32635 (4662)	-59.7
33	BGLM - A10B	\$414747 (17281)	\$1092027 (72802)	+321.3	\$330960 (47280)	-35.1
34	Metformin-A10BA02	\$122944 (5123)	\$252900 (16860)	+229.1	\$71455 (10208)	-39.5
35	Metformin-sitagliptin-	\$112213 (4676)	\$325714 (21714)	+364.3	\$115665 (16524)	-23.9
36	A10BD07					
37						
38	Glaclazide-A10BB09	\$14298 (596)	\$21832 (1455).	+144.1	\$8306 (1187)	-18.4
39	Sitagliptin-A10BH01.	\$ 81059(3377)	\$ 156011 (10401)	+207.9	\$50930 (7276)	-30.1
40	Canagliflozin-A10BK02	\$70096 (2921)	\$89951 (5997)	+105.3	\$18797 (2685)	-55.2
41	Empagliflozin-A10BK03.	\$8785 (366)	\$176536 (11769)	+3100.2	\$56926 (8132)	-30.9
42	Dapagliflozin-A10BK01	\$3856 (161)	\$51501 (3433)	+2032.2	\$5075 (725)	-78.9
43	Teststrips-Z99AA	\$4513868 (188078)	\$13466558 (897771)	+377.3	\$2063280 (294754)	-67.2
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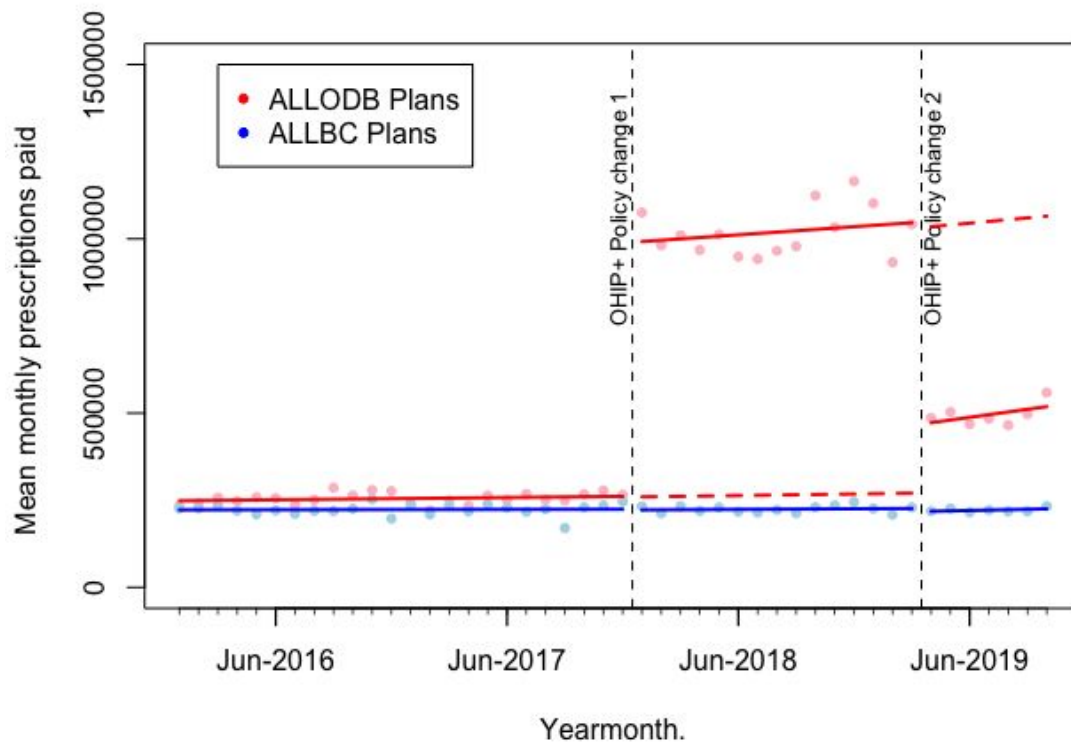


Figure S1: Average monthly number of prescriptions where at least a portion was paid by the benefits plan, before and after the first and second OHIP+ policy intervention changes in January 2018 and April 2019. The solid lines represent the estimated monthly rates and dashed lines (counterfactual), predicated estimates.

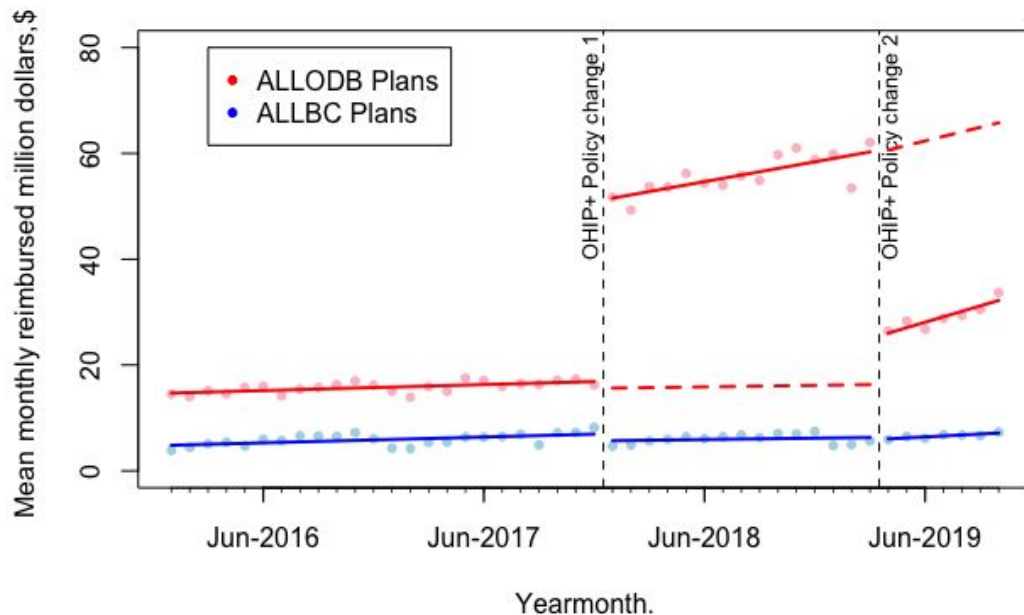


Figure S2: Interrupted time-series analysis of overall reimbursed dollars per month before and after the first and second OHIP+ policy intervention changes in January 2018 and April 2019. The solid lines represent the estimated monthly rates and dashed lines (counterfactual), predicated estimates.

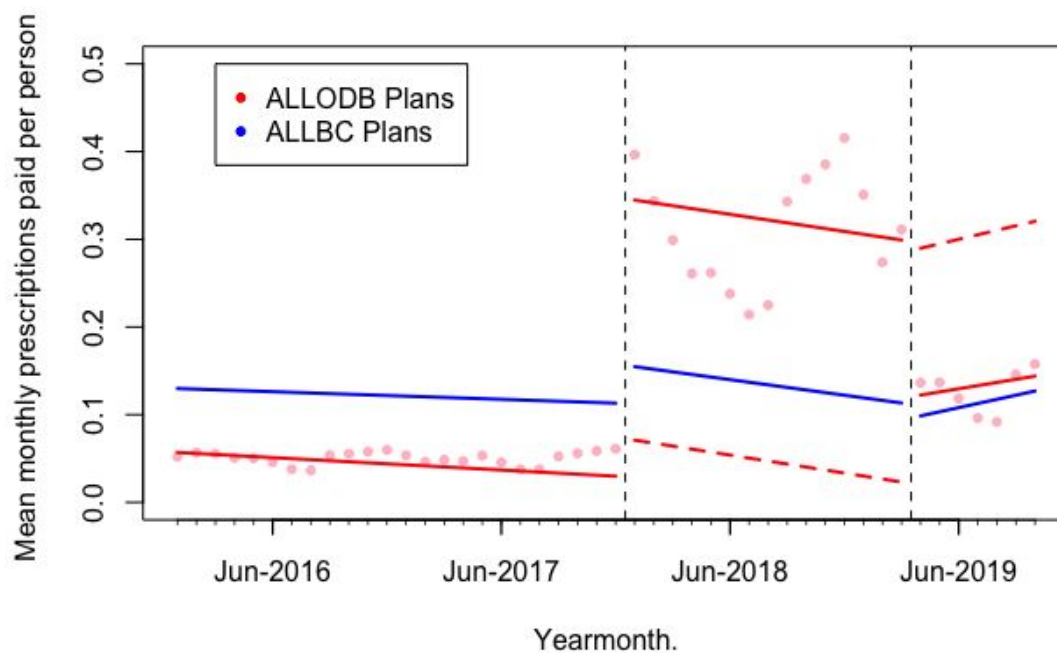


Figure S3: Average monthly number of asthma medication prescriptions per person per population where at least a portion was paid by the benefits plan, before and after the first and second OHIP+ policy intervention changes in January 2018 and in April 2019. The solid lines represent the estimated monthly rates and dashed lines (counterfactual), predicated estimates.

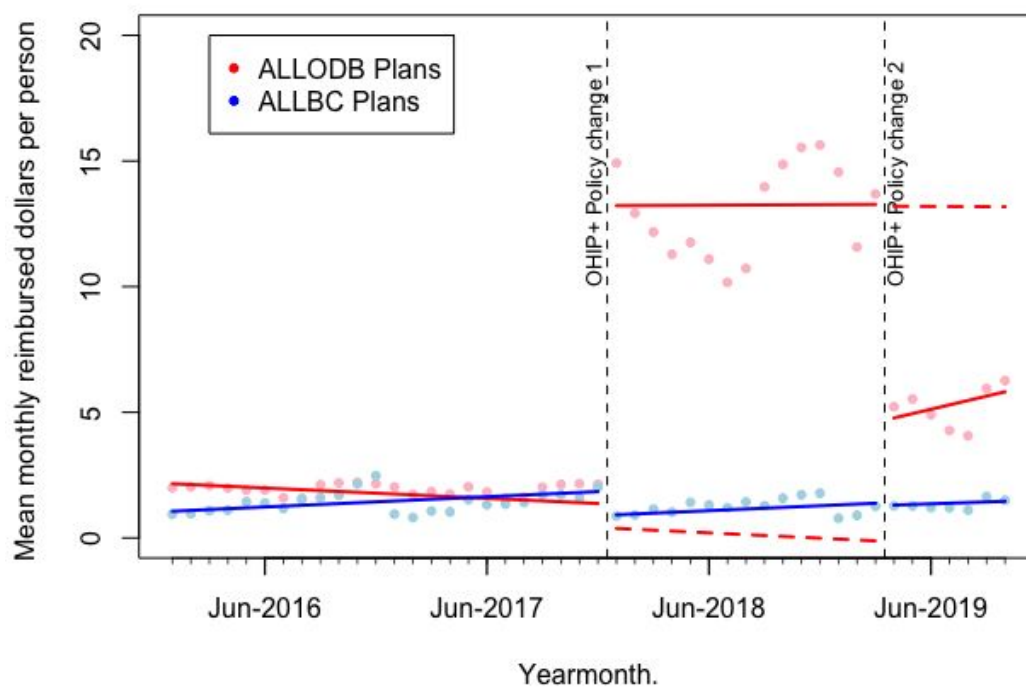


Figure S4: Interrupted time-series analysis of asthma medication reimbursed dollars per person per population before and after the first and second OHIP+ policy intervention changes in January 2018 and April 2019. The solid lines represent the estimated monthly rates and dashed lines (counterfactual), predicated estimates.

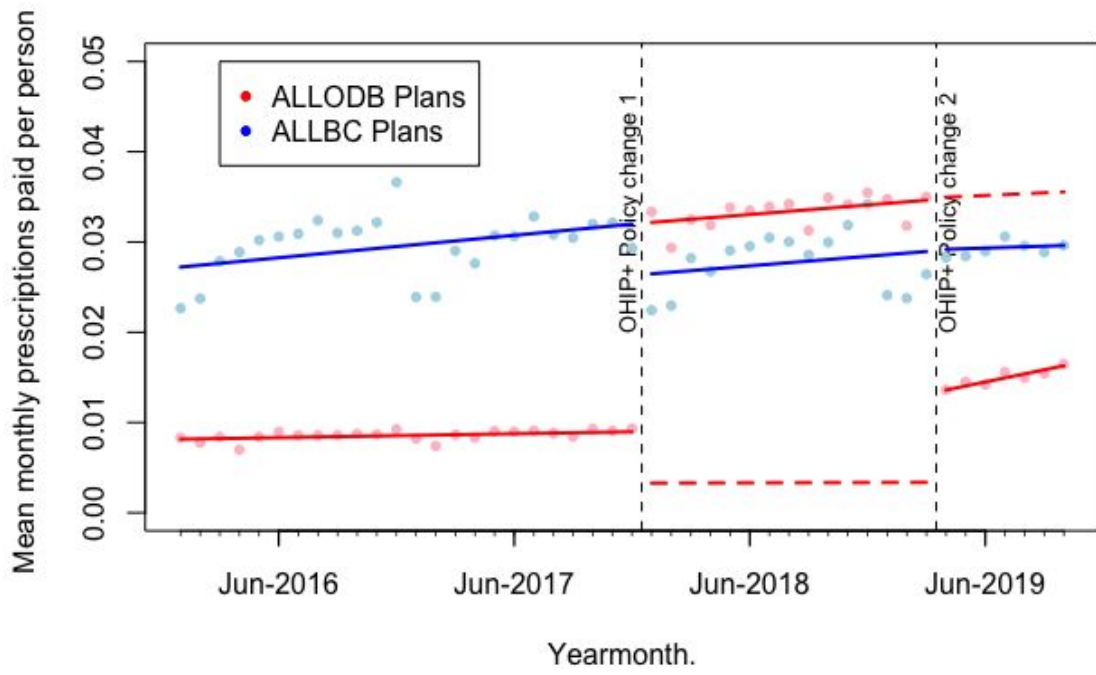


Figure S5: Average monthly number of diabetes publicly covered prescriptions per person per population where at least a portion was paid by the benefits plan, before and after the first and second OHIP+ policy intervention changes in January 2018 and in April 2019. The solid lines represent the estimated monthly rates and dashed lines (counterfactual), predicated estimates.

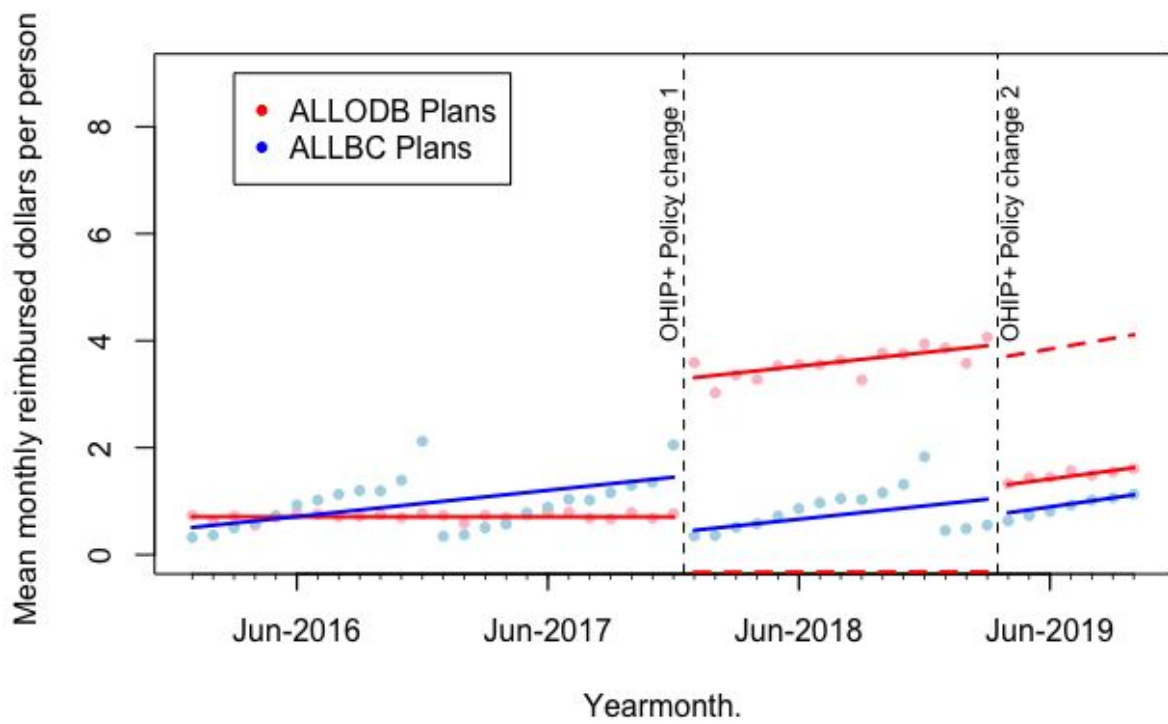


Figure S6: Interrupted time-series analysis of diabetes publicly covered medication reimbursed dollars per person per population before and after the first and second OHIP+ policy intervention changes in January 2018 and April 2019. The solid lines represent the estimated monthly rates and dashed lines (counterfactual), predicated estimates.