




# Strategies to Reduce Out-of-Pocket Medication Costs for Canadians Living with Heart Failure

William F. McIntyre<sup>1,2,3</sup> · Peter Belesiotis<sup>4</sup> · Graham R. McClure<sup>1,5</sup> · Catherine Demers<sup>2</sup> · Gurneet Chahill<sup>1</sup> · Abigail Hayes<sup>1</sup> · Gursharan Sohi<sup>1</sup> · Wendy Bordman<sup>6</sup> · Richard P. Whitlock<sup>1,3,5</sup> · Emilie P. Belley-Côté<sup>1,2</sup> 

Accepted: 27 July 2020 / Published online: 17 August 2020  
© Springer Science+Business Media, LLC, part of Springer Nature 2020

## Abstract

**Introduction** Daily medication is the cornerstone of evidence-based therapy to reduce mortality and morbidity in patients with heart failure (HF). Up to 20% of Canadian patients pay for medications out of pocket. We sought to identify strategies that patients and prescribers can employ to reduce these costs.

**Methods** We collected data from outpatient pharmacies in Hamilton, Ontario. We determined prices for different medications in each of the drug classes recommended for HF with reduced ejection fraction in the Canadian Cardiovascular Society's guidelines. We examined differences in dispensing and delivery fees and inquired about other cost-saving strategies.

**Results** We collected data from 24 different pharmacies, including a selection of hospital-based, independent, and larger chain pharmacies. In the most extreme scenario (i.e., 90-day prescription instead of a 30-day prescription and the least expensive generic drug instead of the most expensive brand name drug), total medication costs can differ by up to \$495.56 per month. Costs were affected by choice of agent within a drug class, generic versus brand-name drug, quantity dispensed, dispensing fee, and delivery cost.

**Conclusions** Prescription content, dispensing practice, and pharmacy choice can remarkably impact out-of-pocket costs for HF medications. Prescribers can reduce costs by writing 90-day prescriptions and choosing the lowest-cost generic drugs in each therapeutic class. Patients should consider the services received for their pharmacy dispensing fees, use free delivery services where needed, and request inexpensive generic drugs. Pharmacists can facilitate cost minimization without compromising therapeutic efficacy.

**Keywords** Pharmicare · Heart failure · Prescribing · Pharmicare

## Introduction

Approximately 670,000 Canadians live with heart failure (HF), and the incidence and prevalence of HF are rising [1].

Daily use of evidence-based HF medications by patients living with HF with reduced ejection fraction not only impacts survival but also leads to improved quality of life [2]. In Canada's single-payer healthcare system, physician and hospital-based services are covered. However, prescription medication coverage is not universal and some patients have to pay to access medications. In fact, Canada is one of the few countries with socialized medicine that does not provide universal pharmacare [3]. One in five Canadians does not have prescription drug insurance or is underinsured [3]. Approximately 1 in 12 Canadians over 55 years of age has not filled a prescription or missed doses because they could not afford out-of-pocket costs [4]. Out-of-pocket drug expenses contribute to non-adherence, but may also lead to an increase risk of hospitalizations, morbidity, and mortality [5]. Prescribing healthcare providers are generally not knowledgeable of costs and how they can impact access to medications [6, 7]. They may also overlook potential strategies that could minimize out-of-pocket prescription drug costs.

✉ Emilie P. Belley-Côté  
emilie.belley-cote@phri.ca

<sup>1</sup> Population Health Research Institute, McMaster University, Hamilton, Ontario, Canada  
<sup>2</sup> Department of Medicine, McMaster University, Hamilton, Ontario, Canada  
<sup>3</sup> Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, Ontario, Canada  
<sup>4</sup> Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada  
<sup>5</sup> Department of Surgery, McMaster University, Hamilton, Ontario, Canada  
<sup>6</sup> The Hospital For Sick Children, Toronto, Ontario, Canada

The objective of the present study was to identify potential methods patients and prescribers can employ to reduce prescription costs for individuals with HF who pay for medications out of pocket.

## Methods

We collected data from outpatient pharmacies in Hamilton, Ontario. We aimed to collect data from two locations for each of the major chain pharmacies in the area and from a selection of independent pharmacies. Between March and June 2019, study personnel administered a standardized questionnaire to pharmacists or their designate in-person, over the telephone, or through the online REDCap electronic data capture tools hosted at McMaster University (Appendix 1) [8, 9]. Questions focused on pricing information for all pharmacological therapies at evidence-based dosages included in the Canadian Cardiovascular Society's 2017 Comprehensive Update of the Canadian Cardiovascular Society Guidelines for the Management of HF (Appendix Table 5) [2]. Our questionnaire also gathered information on supplementary charges for delivery, pill-splitting, and blister packaging. We determined the dispensing fee, drug price, and total price of a (1) 30-day generic prescription, (2) 30-day brand-name

prescription, and (3) 90-day generic prescription of the drugs/dosages indicated in Table 1 at each pharmacy. In cases where more than one generic or brand-name version of a drug was stocked at a pharmacy, we obtained the price of the least expensive option. We then calculated the minimum total price, maximum total price, range, and mean for each prescription option.

To explore the generalizability of our results, we administered our questionnaires to a smaller number of pharmacies in the Greater Toronto Area (Ontario) and in Winnipeg (Manitoba).

We confirmed with the Hamilton Integrated Research Ethics Board that ethics approval was not required to conduct the present study.

## Results

We collected data from 24 different pharmacies. This included 4 hospital-based pharmacies, 17 pharmacies that were part of chains, and 3 pharmacies that were identified as independent (Table 1, Appendix Table 6). The average annual household income in the postal codes where the responding pharmacies were located ranged from \$41,396 to \$190,813, according to Canadian Census data [10].

**Table 1** Description of participating pharmacies

ID <sup>a</sup>	Type	Household income in area <sup>b</sup>	Dispensing fee (\$)	Delivery	Dosette packaging	Pill-splitting	Independent pricing
1	Hospital	698,759	11.99	At a cost	Yes	Yes	Yes
2	Hospital	47,483	11.99	Free	Yes	Yes	No
3	Hospital	67,295	11.99	At a cost	Yes	Yes	Yes
4	Hospital	86,440	11.99	At a cost	No	No	No
5	Chain S	96,572	11.99	Free	Yes	Yes	Yes
6	Chain S	47,483	11.99	Free	Yes	Yes	Yes
7	Chain R	104,640	12.99	Free	Yes	Yes	Yes
8	Chain R	46,369	9.99	Free	Yes	Yes	Yes
9	Chain W	76,431	9.97	No	Yes	Yes	No
10	Chain W	57,528	9.97	No	Yes	Yes	No
11	Chain C	137,452	3.89	No	Yes	Yes	No
12	Chain C	89,360	3.89	No	Yes	Yes	No
13	Chain F	74,464	10.49	Free	Yes	Yes	No
14	Chain F	114,061	10.49	Free	Yes	Yes	No
15	Chain G	41,396	10.99	At a cost	Yes	Yes	Yes
16	Chain G	190,813	11.99	Free	Yes	Yes	No
17	Chain P	52,509	11.99	Free	Yes	Yes	Yes
18	Chain P	120,857	5.00	Free	Yes	Yes	No
19	Independent	63,616	8.99	Free	Yes	Yes	Yes
20	Independent	87,026	10.99	Free	Yes	Yes	Yes
21	Independent	104,640	11.99	Free	Yes	Yes	No
22	Independent	120,857	12.99	Free	Yes	Yes	Yes
23	Chain C	84,784	4.49	Free	Yes	No	No
24	Chain S	55,625	13.00	Free	Yes	Yes	No

C = Costco, G = Guardian/IDA, F = Fortino's, P = Pharmasave, R = Rexall, S = Shoppers Drug Mart, W = Walmart.

<sup>a</sup> Pharmacy identities appear in Appendix Table 6

<sup>b</sup> Average \$, before tax. Source: Canadian Census 2016 [10]

**Table 2** Cost range for 90 days for all options in each guideline-recommended drug class<sup>a</sup>

Drug class	\$ (Lowest cost agent) <sup>a</sup> \$ (Highest cost agent) <sup>a</sup>	Cost difference (\$)
ACE inhibitors	7.94 (generic ramipril) 747.00 (brand-name lisinopril)	739.06
Angiotensin receptor blockers	15.54 (generic valsartan) 452.70 (brand-name valsartan)	437.16
Angiotensin receptor–neprilysin inhibitors	N/A; brand-name only	N/A
Beta-blockers	10.34 (generic bisoprolol) 339.48 (brand-name carvedilol)	329.14
I <sub>f</sub> inhibitor	N/A; brand-name only	N/A
Mineralocorticoid receptor antagonists	19.17 (generic spironolactone) 353.67 (brand-name eplerenone)	334.50
Vasodilators	16.00 (generic isosorbide dinitrate) 381.60 (brand-name hydralazine)	365.60

<sup>a</sup> Prices represent that of the maximum evidence-based dosage of each drug and do not include any applicable dispensing or shipping fees

## Drug Costs

Table 2 presents the cost ranges—the difference between the most and least expensive option—for each drug class. Table 3 lists the cost ranges for each drug, separately for generic and brand-name drugs. The differences in costs for the same agent manufactured by two different companies and/or sold at two different pharmacies ranged from \$13.05 to \$131.76

per 90 days for generic drugs and from \$36.24 to \$650.07.00 per 90 days for brand-name drugs. Table 4 details the lowest and highest cost regimen (including dispensing fees) for a 90-day supply of guideline-directed medical therapy. Prescribing the least expensive generic as compared with the most expensive brand-name drug for a single class of agent could save a patient as much as \$1486.68 every 90 days.

**Table 3** 90-Day drug cost ranges not including dispensing fees<sup>a</sup>

Drug class	Generic		Brand name	
	(Lowest cost, highest cost) (\$)	Cost difference (\$)	(Lowest cost, highest cost) (\$)	Cost difference (\$)
ACE inhibitors				
Enalapril <sup>^</sup>	(25.73, 74.01)	48.28	(134.64, 411.03)	264.39
Lisinopril	(26.00, 76.01)	50.01	(96.93, 747.00)	650.07
Perindopril	(27.52, 52.01)	24.49	(89.01, 363.39)	274.68
Ramipril	(7.94, 65.17)	57.23	(83.55, 264.03)	180.48
Trandolapril	(22.44, 56.45)	34.01	(87.90, 150.00)	62.10
Angiotensin receptor blockers				
Candesartan	(22.17, 48.45)	26.28	(138.93, 399.72)	260.79
Valsartan	(15.54, 61.01)	45.47	(125.79, 452.70)	326.91
Angiotensin receptor–neprilysin inhibitors				
Sacubitril/valsartan	N/A	N/A	(742.47, 856.00)	113.53
Beta-blockers				
Carvedilol <sup>#</sup>	(34.00, 69.01)	35.01	(132.66, 339.48)	206.82
Bisoprolol	(10.34, 31.47)	21.13	(55.08, 100.95)	45.87
Metoprolol	(13.47, 49.99)	36.52	(64.62, 210.00)	145.38
I <sub>f</sub> inhibitor				
Ivabradine	N/A	N/A	(164.93, 360.86)	195.93
Mineralocorticoid receptor antagonists				
Eplerenone	(200.19, 245.00)	44.81	(281.67, 353.67)	72.00
Spironolactone	(19.17, 97.59)	78.42	(32.46, 135.00)	102.54
Vasodilators				
Hydralazine	(18.24, 150.00)	131.76	(37.86, 381.60)	343.74
Isosorbide dinitrate	(16.00, 63.68)	47.68	(45.42, 111.00)	65.58

<sup>a</sup> Prices represent that of the maximum evidence-based dosage of each drug with the following caveats:

<sup>^</sup>Enalapril dosage was 10 mg BID. CCS guideline's maximum dose is 20 mg BID, but only for patients who are New York Heart Association Functional Class IV

<sup>#</sup>Carvedilol dosage was 25 mg BID. CCS guideline's maximum is 50 mg BID, but only for patients > 85 kg

## Accessory Costs

Dispensing fees ranged from \$3.89 to \$12.99 per prescription. Twenty of 24 pharmacies offered a delivery service; 16 pharmacies offered free delivery (80%). When available at a cost, delivery fees varied from \$5 to courier rates at costs; one pharmacy waived the cost of delivery for three or more prescriptions. All but one pharmacy provided blister packing and pill-splitting; this service was always free. The proportion of pharmacies that set their own prices was 46%, while the remainder were set by a central office. In Canada, manufacturer-sponsored access programs exist for some brand-name only medications [11]. However, representatives confirmed that neither of the guideline-recommended brand-name only agents had such a program.

## Generalizability

Results from pharmacies in Toronto (Ontario) and Winnipeg (Manitoba) were similar (Appendix Table 7).

## Overall Cost Difference

In the most extreme scenario (i.e., by choosing a 90-day prescription instead of a 30-day prescription and the least expensive generic drug instead of the most expensive brand-name drug), prescribers could save patients \$495.56 per month or \$1486.68 every 3 months (Table 4).

## Discussion

### Key Findings

We found significant variations in the costs of evidence-based HF drugs within drug classes and across pharmacies. In the most extreme scenario (i.e., by choosing a 90-day prescription instead of a 30-day prescription and the least expensive generic drug

instead of the most expensive brand-name drug), total medication costs can differ by up to \$495.56 per month. Costs were affected by choice of agent within a drug class, choice of a generic versus brand-name drug, quantity dispensed, dispensing fee, and delivery cost.

We have identified six potential strategies to reduce costs for patients with HF who pay out of pocket for guideline-indicated medical therapy (Fig. 1). In collaboration, prescribers, patients, and pharmacists can minimize drug costs. Prescribers can choose generic drugs and inquire about the cost of different agents within a drug class. They can also prescribe a 90-day supply to minimize dispensing fees and work with patients to apply to manufacturer-sponsored programs, when they exist, for cost subsidies for drugs without a generic alternative. Patients should be cognizant that their choice of pharmacy can impact their out-of-pocket costs. Patients should be informed that pharmacies can differ with respect to dispensing fees and services provided and consider a pharmacy with free delivery if not in walking distance. Finally, patients should also understand that the price of generic drugs could vary between pharmacies. There are several websites that patients can use to compare costs from multiple medication providers simultaneously (e.g., pharmacychecker.com (international); goodrx.com, blinkhealth.com, and wrx.org (USA); and pharmacycompass.ca (British Columbia, Canada)).

Pharmacists play an essential role in minimizing medication costs for patients who pay out of pocket. In contrast to many private and government plans, there are no specific supply dispensing guidelines (e.g., 1 vs. 3 months) for out-of-pocket payers. Pharmacists in most jurisdictions are required to dispense the lowest cost product listed in a category of drugs (there are some exceptions to this policy). In Ontario, this is guided by the *Drug Interchangeability and Dispensing Fee Act* [12].

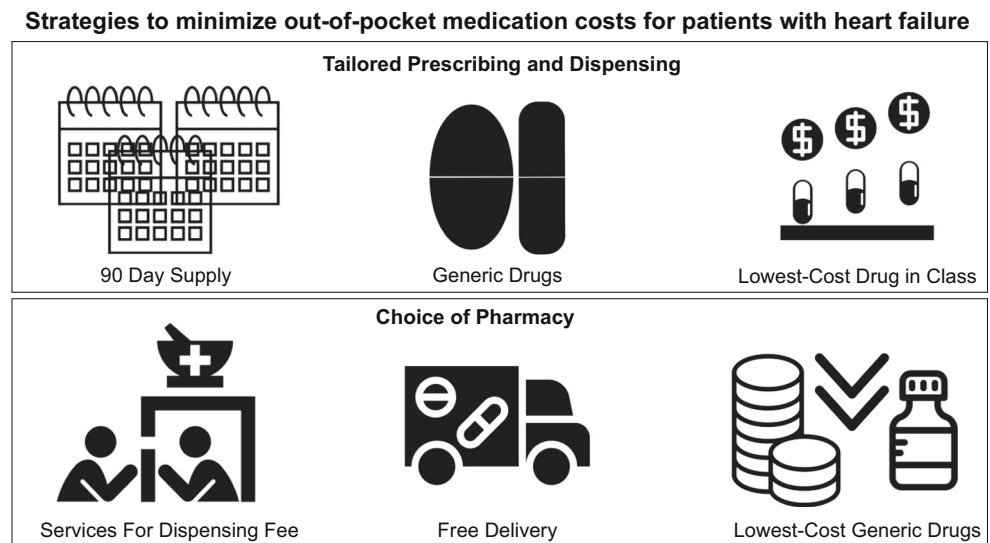
### Results in Context

Our study is the first to comprehensively explore the potential cost variation for a standard evidence-based drug regimen for HF with reduced ejection fraction in Canada.

**Table 4** Lowest and highest cost regimen (including dispensing fees) for a 90-day supply of guideline-directed medical therapy for heart failure with reduced ejection fraction

Drug class	Lowest cost regimen		Highest cost regimen	
	Drug	90-day cost (\$)	Drug	90-day cost (\$)
ACE inhibitor	90-day ramipril (generic)	11.83	30-day lisinopril (brand name)	779.97
Beta-blocker	90-day bisoprolol (generic)	14.39	30-day carvedilol (brand name)	372.45
Mineralocorticoid receptor antagonist	90-day spironolactone (generic)	26.16	30-day eplerenone (brand name)	386.64
Potential cost savings (\$)				
Total quarterly cost		52.38		1539.06
Potential quarterly savings		1486.68		
Total monthly cost		17.46		513.02
Potential monthly savings		495.56		

**Fig. 1** Strategies to minimize out-of-pocket medication costs for patients with heart failure



Medication costs clearly impact patient adherence. A survey of 5784 Medicare beneficiaries in the USA identified strategies used by patients to reduce medication costs and measured their association with medication adherence from claims data [13]. These strategies included obtaining free samples from physicians, splitting higher-dose pills, and purchasing medications from other countries or through the Veterans Administration. In that survey, factors associated with non-adherence included use of more medications, pill-splitting, acquisition of free samples, and male sex. In a multicenter, open-label, randomized clinical trial conducted at nine primary care clinics in Ontario, provision of essential medicines at no charge increased adherence to treatment over 1 year of follow up [14].

Studies conducted in different healthcare systems have identified approaches that may be effective at a system level. A nationwide study of medication claims in Austria (universal drug program; population approximately 9 million) estimated that using the least-expensive agent among frequently used cardiovascular drugs could have reduced overall costs for these drugs by as much as 18% [15].

### Interpretation of Results

Minimizing cost matters to patients. Decreased costs may increase adherence, improve outcomes, and reduce the financial burden of the disease on the patient. Minimizing costs also matters to society. Canadians pay among the highest prescription drug prices in the world [16, 17]. The per-capita expenditures on prescription drugs in Canada were second only to that of Switzerland [17]. Higher medication prices in Canada combined with healthcare providers prescribing costlier drugs accounted for an excess expenditure of \$2.3 bn in 2015. This estimate is derived from the estimated cost if the average

medication cost per day in Canada had been similar to nine other high-income countries with universal healthcare coverage (Australia, France, Germany, The Netherlands, New Zealand, Norway, Sweden, The UK, and Switzerland) [17]. Some of the strategies we have proposed could be implemented not only in the prescription of evidence-based HF therapy but universally to decrease drug costs and to promote adherence, which is likely to result in significant cost savings to public systems [18].

### Strengths and Limitations

This is the first study examining strategies to reduce out-of-pocket HF medication costs for Canadian patients. We assumed all drugs within a class to be equivalent, provided they were listed in the Canadian Guidelines [2]. Cost variations may differ in communities other than Hamilton and over time; healthcare providers may need to assess costs in their own community.

### Conclusion

Prescription content and pharmacy choice impact out-of-pocket costs for HF medications. Prescribers can reduce costs by writing 90-day prescriptions and choosing the lowest-cost generic drugs in each therapeutic class. Patients should know that pharmacies can differ with respect to dispensing fees and services provided, access free delivery services where needed, and request inexpensive generic drugs. Pharmacists can help facilitate cost minimization without compromising therapeutic efficacy.

## Appendix 1. Questionnaire

### Data Collection Table

1. **Data collected:** First Phone Call      Second Phone Call      In-person
2. **Pharmacy :**
3. **3. Collection date**
4. **Data collector:**
5. **TABLE 1: 30-day prescription cost (cheapest generic stocked)**

Drug	Drug cost	Dispensing fee	Total cost
Enalapril 10mg x 60			
Lisinopril 35mg x 30			
Perindopril 8mg x 30			
Ramipril 5mg x 60			
Trandolapril 4mg x 30			
Sacubitril/valsartan 200mg x 60			
Acetylsalicylic acid 81mg x 30			
Clopidogrel 75mg x 30			
Prasugrel 10mg x 30			
Ticagrelor 90mg x 30			
Candesartan 32mg x 30			
Valsartan 160mg x 60			
Carvedilol 25mg x 60			
Bisoprolol 10mg x 30			
Metoprolol 200mg x 30			

Rivaroxaban 2.5mg x 30			
Ivabradine 7.5 mg x 60			
Spirolactone 50mg x 30			
Eplerenone 50mg x 30			
Atorvastatin 40mg x 30			
Rosuvastatin 80mg x 30			
Isosorbide dinitrate 40mg x 90			
Hydralazine 100mg x 120			

**6. TABLE 2: 30-day prescription cost (innovator brand)**

Drug	Drug cost	Dispensing fee	Total cost
Enalapril 10mg x 60			
Lisinopril 35mg x 30			
Perindopril 8mg x 30			
Ramipril 5mg x 60			
Trandolapril 4mg x 30			
Sacubitril/valsartan 200mg x 60			
Acetylsalicylic acid 81mg x 30			
Clopidogrel 75mg x 30			
Prasugrel 10mg x 30			
Ticagrelor 90mg x 30			
Candesartan 32mg x 30			

Valsartan 160mg x 60			
Carvedilol 25mg x 60			
Bisoprolol 10mg x 30			
Metoprolol 200mg x 30			
Rivaroxaban 2.5mg x 30			
Ivabradine 7.5 mg x 60			
Spirolactone 50mg x 30			
Eplerenone 50mg x 30			
Atorvastatin 40mg x 30			
Rosuvastatin 80mg x 30			
Isosorbide dinitrate 40mg x 90			
Hydralazine 100mg x 120			

**7. TABLE 3: 90-day prescription cost (cheapest generic stocked)**

<b>Drug</b>	<b>Drug cost</b>	<b>Dispensing fee</b>	<b>Total cost</b>
Enalapril 10mg x 180			



Lisinopril 35mg x 90			
Perindopril 8mg x 90			
Ramipril 5mg x 180			
Trandolapril 4mg x 90			
Sacubitril/valsartan 200mg x 180			
Acetylsalicylic acid 81mg x 90			
Clopidogrel 75mg x 90			
Prasugrel 10mg x 90			
Ticagrelor 90mg x 90			
Candesartan 32mg x 90			
Valsartan 160mg x 180			
Carvedilol 25mg x 180			
Bisoprolol 10mg x 90			
Metoprolol 200mg x 90			
Rivaroxaban 2.5mg x 90			
Ivabradine 7.5 mg x 180			
Spirolactone 50mg x 90			
Eplerenone 50mg x 90			
Atorvastatin 40mg x 90			
Rosuvastatin 80mg x 90			
Isosorbide dinitrate 40mg x 270			
Hydralazine 100mg x 360			

Drug	Pill splitting available (yes/no)?	Pill splitting options, cost for 30-day script
Enalapril 20 mg daily		
Lisinopril 35mg daily		
Perindopril 8mg daily		
Ramipril 10 mg daily		
Trandolapril 4mg daily		
Sacubitril/valsartan 400mg daily		
Acetylsalicylic acid 81mg daily		
Clopidogrel 75mg daily		
Prasugrel 10mg daily		
Ticagrelor 90mg daily		
Candesartan 32mg daily		
Valsartan 320mg daily		
Carvedilol 50mg daily		
Bisoprolol 10mg daily		
Metoprolol 200mg daily		
Rivaroxaban 2.5mg daily		
Ivabradine 15 mg daily		
Spironolactone 50mg daily		
Eplerenone 50mg daily		
Atorvastatin 40mg daily		

Rosuvastatin 80mg daily		
Isosorbide dinitrate 120mg daily		
Hydralazine 400mg daily		

**9. TABLE 5: Blister Packs**

Drug	Blister packs available (yes/no)?	Additional cost (yes/no)? Indicate difference if yes.
Aspirin		
Rosuvastatin		
Atorvastatin		
Metoprolol		
Clopidogrel		
Ticagrelor		
Prasugrel		
Rivaroxaban		

**10. Customary dispensing fee (CAD):**

**11. Consultation fee separate from dispensing fee (please circle):**      Yes      No

**If yes, specify cost:**

**12. Delivery available (please circle):**      Yes      No

**If yes, specify cost: No additional cost**

**13. Seniors' discount available (please circle):**      Yes      No

**If yes, specify age for eligibility:**

**If yes, specify discount amount:**

**14. Other discount program available (please circle):**      **Yes**      **No**

**If yes, specify eligibility requirements:**

**If yes, specify discount amount:**

**15. Fees and prices set:**                      **Independently**                      **Non-independently**

**16. Additional information from pharmacist:**

## Appendix 2

**Table 5** Evidence-based pharmacologic therapies recommended by the Canadian Cardiovascular Society [1]

Drug	Dose
ACEi	
Enalapril <sup>†</sup>	10 mg BID
Lisinopril <sup>†</sup>	30 mg QD
Perindopril <sup>†</sup>	8 mg QD
Ramipril <sup>†</sup>	5 mg BID
Trandolapril <sup>†</sup>	4 mg QD
ARNI	
Sacubitril/valsartan <sup>†</sup>	200 mg BID
Antiplatelet agents	
Acetylsalicylic acid	81 mg QD
Clopidogrel	75 mg QD
Prasugrel	10 mg QD
Ticagrelor	90 mg QD
ARB	
Candesartan <sup>†</sup>	32 mg QD
Valsartan <sup>†</sup>	160 mg BID
Beta-blockers	
Carvedilol <sup>†</sup>	25 mg BID
Bisoprolol <sup>†</sup>	10 mg QD
Metoprolol	100 mg BID
Direct factor Xa inhibitors	
Rivaroxaban	2.5 mg BID
I <sub>f</sub> inhibitor	
Ivabradine <sup>†</sup>	7.5 mg BID
MRA	
Spironolactone <sup>†</sup>	50 mg QD
Eplerenone <sup>†</sup>	50 mg QD
Statins	
Atorvastatin	80 mg QD
Rosuvastatin	40 mg QD
Vasodilators	
Isosorbide dinitrate <sup>†</sup>	40 mg TID
Hydralazine <sup>†</sup>	100 mg QID

<sup>†</sup> Included 2017 Comprehensive Update of the CCS Guidelines for the Management of HF [1]

ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; ARNI, angiotensin receptor–neprilysin inhibitor; BID, twice per day; HF, heart failure; I<sub>f</sub>, inhibiting f-channel; MRA, mineralocorticoid receptor antagonist; QD, once per day; QID, 4 times per day; TID, 3 times per day

1. Ezekowitz JA, O'Meara E, McDonald MA, et al. 2017 Comprehensive Update of the Canadian Cardiovascular Society Guidelines for the Management of Heart Failure. *Can J Cardiol.* 2017;33:1342–1433.

## Appendix 3

**Table 6** Pharmacies contributing data (refer to Table 1)

1	2	3	4	5	6	7	8
Sunnybrook Pharmacy 2075 Bayview Ave. Toronto, ON M4N 3M5	Hamilton General Drugstore 237 Barton St. E. Hamilton, ON L8L 2X2	McMaster Drugstore 1200 Main St. W. Hamilton, ON L8N 3Z5	SickKids Shoppers 555 University Ave. Toronto, ON M5G 1X8	Shoppers 1599 Upper James St. Hamilton, ON L9B 0H7	Shoppers 232 Cannon St. E. Hamilton, ON L8L 0A9	Rexall 930 Upper Paradise Rd. #13 Hamilton, ON L9B 2N1	Rexall 2 King St. W. #18 Hamilton, ON L8P 1A1
9 Walmart 675 Upper James St. Hamilton, ON L9C 2Z5	10 Walmart 1115 Barton St. E. Hamilton, ON L8H 2V2	11 Costco 100 Legent Crt. Ancaster, ON L9K 1J3	12 Costco 1225 Brant St. E. Burlington, ON L7P 1X7	13 Fortino's 65 Mall Rd. Hamilton, ON L8V 5B5	14 Fortino's 21 Upper Centennial Pkwy Stoney Creek, ON L8J 3W2	15 Guardian/IDA 225 John St. S. Hamilton, ON L8N 2C7	16 Guardian/IDA 672 Brant St. Burlington, ON L7R 2H3
17 Pharmasave 205 Melvin Ave. Hamilton, ON L8H 2J9	18 Pharmasave 179 James St. S. Hamilton, ON L8P 3A3	19 King Medical Pharmacy 505 King St. W. Hamilton, ON L8P 1B9	20 St. Michael's Pharmacy 1568 Main St. W. Hamilton, ON L8S 1E7	21 Westmount Pharmacy 723 Rymal Rd. W. Hamilton, ON L9B 2W2	22 Sutherland Pharmacy 180 James St. S. Hamilton, ON L8P 4V1	23 Costco 1315 St. James St. Winnipeg, MB R3H 0K9	24 Shoppers 917 Portage Ave. Winnipeg, MN R3G 0P6

## Appendix 4

**Table 7** Sensitivity analysis: pharmacies in Toronto and Winnipeg. Pharmacy services and prices for a 30-day supply of select agents, exclusive of dispensing fees

Pharmacy ID city	1 Toronto	4 Toronto	23 Winnipeg	24 Winnipeg
<b>ACE inhibitor</b>				
Enalapril 10 mg b.i.d., 30-day generic: drug price	17.47	23.33	41.03	25.18
Enalapril 10 mg b.i.d., 30-day generic: total price	29.46	35.32	45.52	38.18
Enalapril 10 mg b.i.d., 30-day brand name: drug price	101.95	103.78	74.58	96.85
Enalapril 10 mg b.i.d., 30-day brand name: total price	113.94	115.77	79.07	109.85
Ramipril 5 mg b.i.d., 30-day generic: drug price	5.39	8.46	9.63	5.41
Ramipril 5 mg b.i.d., 30-day generic: total price	17.38	20.45	14.12	18.41
Ramipril 5 mg b.i.d., 30-day brand name: drug price	64.24	65.75	62.64	29.52
Ramipril 5 mg b.i.d., 30-day brand name: total price	76.23	77.74	67.13	42.52
<b>Beta-blockers</b>				
Bisoprolol 10 mg q.d., 30-day generic: drug price	3.45	4.51	7.78	3.45
Bisoprolol 10 mg q.d., 30-day generic: total price	15.44	16.50	12.27	16.45
Bisoprolol 10 mg q.d., 30-day brand name: drug price	N/A	N/A	N/A	N/A
Bisoprolol 10 mg q.d., 30-day brand name: total price	N/A	N/A	N/A	N/A
Metoprolol 100 mg b.i.d., 30-day generic: drug price	8.98	14.38	11.18	9.22
Metoprolol 100 mg b.i.d., 30-day generic: total price	20.97	26.37	15.67	22.22
Metoprolol 100 mg b.i.d., 30-day brand name: drug price	26.95	N/A	29.97	N/A
Metoprolol 100 mg b.i.d., 30-day brand name: total price	38.94	N/A	34.46	N/A
<b>Mineralocorticoid receptor antagonists</b>				
Spirolactone 50 mg q.d., 30-day generic: drug price	6.98	8.65	10.76	N/A
Spirolactone 50 mg q.d., 30-day generic: total price	18.97	20.64	15.25	N/A

**Table 7** (continued)

Pharmacy ID city	1	4	23	24
	Toronto	Toronto	Winnipeg	Winnipeg
Spirolactone 50 mg q.d., 30-day brand name: drug price	11.28	12.41	14.23	N/A
Spirolactone 50 mg q.d., 30-day brand name: total price	23.27	24.40	18.72	N/A
Eplerenone 50 mg q.d., 30-day generic: drug price	67.97	71.58	53.92	N/A
Eplerenone 50 mg q.d., 30-day generic: total price	79.96	83.57	58.41	N/A
Eplerenone 50 mg q.d., 30-day brand name: drug price	97.90	99.71	90.62	N/A
Eplerenone 50 mg q.d., 30-day brand name: total price	109.89	111.70	95.11	N/A
Dispensing fee (\$)	11.99	11.99	4.49	13.00
Delivery fee separate from dispensing fee?	Yes	Yes	No	No
Drug prices and dispensing fee set independently?	Yes	No	No	No
Pill splitting?	Free	No	No	Free
Blister packs?	Free	No	Free	Free

## References

- Report from the Canadian Chronic Disease Surveillance System: Heart Disease in Canada. Public Health Agency of Canada. Ottawa, Ontario 2018.
- Ezekowitz JA, O'Meara E, McDonald MA, et al. 2017 comprehensive update of the Canadian Cardiovascular Society Guidelines for the Management of Heart Failure. *Can J Cardiol*. 2017;33:1342–433.
- Morgan SG, Boothe K. Universal prescription drug coverage in Canada: long-promised yet undelivered. *Healthc Manage Forum*. 2016;29:247–54.
- Morgan SG, Lee A. Cost-related non-adherence to prescribed medicines among older adults: a cross-sectional analysis of a survey in 11 developed countries. *BMJ Open*. 2017;7:e014287.
- Baroletti S, Dell'Orfano H. Medication adherence in cardiovascular disease. *Circulation*. 2010;121:1455–8.
- Allan GM, Lexchin J, Wiebe N. Physician awareness of drug cost: a systematic review. *PLoS Med*. 2007;4:e283.
- Gorfinkel I, Lexchin J. We need to mandate drug cost transparency on electronic medical records. *CMAJ*. 2017;189:E1541–E2.
- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42:377–81.
- Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: building an international community of software platform partners. *J Biomed Inform*. 2019;95:103208.
- Census Profile, 2016 Census (accessed March 11, 2020, at <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E>.)
- Gellad WF, Huskamp HA, Li A, Zhang Y, Safran DG, Donohue JM. Use of prescription drug samples and patient assistance programs, and the role of doctor–patient communication. *J Gen Intern Med*. 2011;26:1458–64.
- Drug Interchangeability and Dispensing Fee Act, R.S.O. 1990, c. P.23 2016. (Accessed March 18, 2020, at <https://www.ontario.ca/laws/statute/90p23>.)
- Musich S, Cheng Y, Wang SS, Hommer CE, Hawkins K, Yeh CS. Pharmaceutical cost-saving strategies and their association with medication adherence in a Medicare supplement population. *J Gen Intern Med*. 2015;30:1208–14.
- Persaud N, Bedard M, Boozary AS, et al. Effect on treatment adherence of distributing essential medicines at no charge: the CLEAN Meds randomized clinical trial. *JAMA Intern Med*. 2019.
- Heinze G, Hronsky M, Reichardt B, Baumgärtel C, Müllner M, Bucsics A, et al. Potential savings in prescription drug costs for hypertension, hyperlipidemia, and diabetes mellitus by equivalent drug substitution in Austria: a nationwide cohort study. *Appl Health Econ Health Policy*. 2015;13:193–205.
- Vogel L. Drug pricing reforms promising but problematic. *CMAJ*. 2017;189:E899–900.
- Morgan SG, Leopold C, Wagner AK. Drivers of expenditure on primary care prescription drugs in 10 high-income countries with universal health coverage. *CMAJ*. 2017;189:E794–E9.
- Lloyd JT, Maresh S, Powers CA, Shrank WH, Alley DE. How much does medication nonadherence cost the Medicare fee-for-service program? *Med Care*. 2019;57:218–24.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.