

Uptake of the MedsCheck annual medication review service in Ontario community pharmacies between 2007 and 2013

Lisa Dolovich, BScPhm, PharmD, MSc; Giulia Consiglio, BSc, MSc; Linda MacKeigan, BScPhm, PhD; Lusine Abrahamyan, MD, PhD, MPH; Petros Pechlivanoglou, MSc, PhD; Valeria E. Rac, MD, PhD; Nedzad Pojskic, HonBSc, MSc, PhD; Elizabeth A. Bojarski, BA, MPH; Jiandong Su, MSc; Murray Krahn, BA, MSc, MD; Suzanne M. Cadarette, PhD



LISA DOLOVICH

The MedsCheck program is the most prominent medication review service in Ontario, and it has been in place for almost 10 years. We hoped that more information about the kinds of people served by the program could help pharmacists consider who might best benefit from a MedsCheck medication review.

Mis en place il y a bientôt 10 ans, le programme MedsCheck est le service d'évaluation des traitements le plus important d'Ontario. Nous espérons qu'en obtenant plus d'information sur les personnes utilisant le programme, les pharmaciens pourraient plus facilement déterminer à qui une évaluation MedsCheck profiterait le plus.

ABSTRACT



Background: MedsCheck Annual (MCA) is an Ontario government-funded medication review service for individuals taking 3 or more prescription medications for chronic conditions.

Methods: This cohort study analyzed linked administrative claims data from April 1, 2007, to March 31, 2013. Trends in MCA claims and recipient characteristics were examined.

Results: A total of 1,498,440 Ontarians (55% seniors, 55% female) received an MCA. One-third (36%) had 2 or more MCAs within 6 years. Service provision increased over time, with a sharper increase from 2010 onward. Almost half of Ontario pharmacies made at least 1 MCA claim in the first month of the program. Hypertension, respiratory disease, diabetes, psychiatric conditions and

arthritis were common comorbidities. Recipients older than 65 years were most commonly dispensed an antihypertensive and/or antihyperlipidemic drug in the prior year and received an average of 11 unique prescription medications. Thirty-eight percent of recipients visited an emergency department or were hospitalized in the year prior to their first MCA.

Discussion: Over the first 6 years of the program, approximately 1 in 9 Ontarians received an MCA. There was rapid and widespread uptake of the service. Common chronic conditions were well represented among MCA recipients. Older MCA recipients had less emergency department use compared with population-based estimates.

Conclusions: Medication reviews increased over time; however, the number of persons receiving the service more than once was low. Service delivery was generally consistent with program eligibility; however, there are some findings possibly consistent with delivery to less complex patients. *Can Pharm J (Ott)* 2016;149:293-302.

Introduction

Medication-related problems are a significant contributor to morbidity, mortality and health care resource utilization in Canada and around the world.¹⁻⁵ Many jurisdictions in Canada and elsewhere have adopted policies and programs

to encourage greater pharmacist responsibility for medication management, including collaboration with other health care providers.⁶⁻¹⁰

Since 2007, community pharmacies in Ontario have been compensated for pharmacist-conducted adherence-focused medication

KNOWLEDGE INTO PRACTICE



- Medication review services are currently funded in most jurisdictions in Canada.
- This study found that there was rapid and widespread uptake of the MedsCheck Annual (MCA) service in Ontario.
- MCA service delivery increased over time; however, the number of persons receiving an MCA more than once was low and a potential missed opportunity.
- MCA service delivery was generally consistent with MCA program eligibility; however, there are some findings possibly consistent with delivery to less complex patients.

reviews (MedsChecks) with Ontario residents who take 3 or more prescription medications for chronic conditions. The MedsCheck Annual (MCA) service is a one-to-one consultation in a community pharmacy that is intended to take approximately 20 to 30 minutes. The service can be provided every 12 months. Its purpose is to help patients better understand their medications, ensure that medications are being taken as prescribed and provide patients with a comprehensive list of their prescription and non-prescription medications.¹¹ Pharmacies were paid \$950 upon submission of their first MCA claim to cover service start-up costs and \$50 per MCA (thereafter raised to \$60 per MCA in June 2010).¹²

The MCA service was the first nondispensing pharmacy service to be reimbursed by the Ontario public drug plan.¹³ It was launched 9 months after a Ministry of Health policy that banned generic drug manufacturers' rebates to pharmacies for purchases of their products and decreased by about 25% the amount that the drug plan would pay pharmacies for generic drugs.^{14,15} Since 2007, the drug plan has expanded its reimbursement of medication review services to include MedsCheck Diabetes, MedsCheck at Home and MedsCheck Long-Term Care, as well as follow-ups for all but MC at Home. MedsCheck was the second medication review service to be reimbursed by any provincial drug plan in Canada, with the first being Quebec, which included a medication review for persons taking at least 8 medications in its pharmaceutical opinion program.¹⁶ Medication review services are currently funded in most jurisdictions in Canada, including Ontario, Alberta, British Columbia, Saskatchewan, New

Brunswick, Newfoundland and Nova Scotia. Ontario has spent more than \$130 million on MCA between inception and March 2013.

Evaluation of the MCA program has been limited. A study of Hamilton area pharmacists' early implementation experience found that the program was well received.¹⁷ However, numerous barriers to implementation were identified, most notably lack of time and pharmacy workflow that was not conducive to an appointment-based, 30-minute service.¹⁷ A recent population-based cohort study examined claims for all MedsCheck programs for the 2012-2013 fiscal year and found that 27.1% ($n = 799,674$) of Ontarians eligible for public drug coverage (primarily those older than 65 years) received a professional pharmacy service, with 64% ($n = 511,490$) of these receiving an MCA.¹⁸ The study also found that as patient complexity (number of prescription medications in the past year) increased, the proportion of Ontario Drug Benefit (ODB) beneficiaries who received a professional pharmacy service, which included a MedsCheck or a Pharmaceutical Opinion, also increased.¹⁸ The Pharmaceutical Opinion Program in Ontario refers to the identification by the pharmacist of a potential drug-related problem during the course of dispensing a new or repeat prescription or when conducting a MedsCheck medication review.¹⁹ With a Pharmaceutical Opinion, based on consultation with the prescriber, the prescription therapy may not be dispensed, may be dispensed as prescribed or a prescription therapy may be adjusted.¹⁹

This study did not examine the characteristics of MCA recipients or trends in service delivery over time, however. A more comprehensive analysis of the uptake of the MCA service (the first and most popular of the MC services) is warranted. It could help clinicians and policy makers understand service uptake and gaps to better direct future delivery of services. Also, trends in service utilization over time can help forecast service use and the associated benefits, costs and resultant value to the health care system.

The objectives of this study were to describe the use of the MCA service between April 2007 and March 2013 by

1. determining the number of patients receiving and pharmacies delivering MCA services in Ontario in the aggregate and over time and

- describing the demographic and clinical characteristics of patients receiving MCA services.

Methods

Study design

We conducted a population-based cohort study of MCA recipients using linked administrative data housed at the Institute for Clinical Evaluative Sciences (ICES) in Toronto, Ontario, between April 1, 2007, and March 31, 2013. This study was approved by the Research Ethics Board of Sunnybrook Health Sciences Centre.

Data sources

Six ICES data holdings were accessed and linked through an encrypted patient identification number. Service recipients were identified using pharmacy claims data submitted to the provincial drug plan (ODB) and linked to health care claims (physician services, emergency department, hospitalization), provincial health plan registration data (sex, postal code and dates of birth and death) and federal citizenship and immigration data. At the time of analysis, complete pharmacy and provincial health plan registration data up to September 30, 2013, were available, as well as medical health claims up to March 31, 2013. Health conditions were derived from specific diagnostic codes or validated algorithms within the health care claims database and thus were restricted to MCA recipients receiving a service by March 31, 2013.

Study sample

We identified MCA service recipients between April 1, 2007, and March 31, 2013 using the MCA administrative code in the ODB database (PIN 93899979). The date of the first MCA was considered the index date for each individual and was used to establish recipient characteristics.

Residents of long-term care facilities, those with missing sex data or those whose death date was prior to enrolment were excluded. Residents of long-term care facilities were excluded because they were not eligible for a MedsCheck Annual. On September 13, 2010, Ontario added MedsCheck for Long-Term Home Residents, MedsCheck at Home and MedsCheck for Ontarians Living with Diabetes. Populations served by the later 2 services may have received a MedsCheck Annual before September 13, 2010.

MISE EN PRATIQUE DES CONNAISSANCES

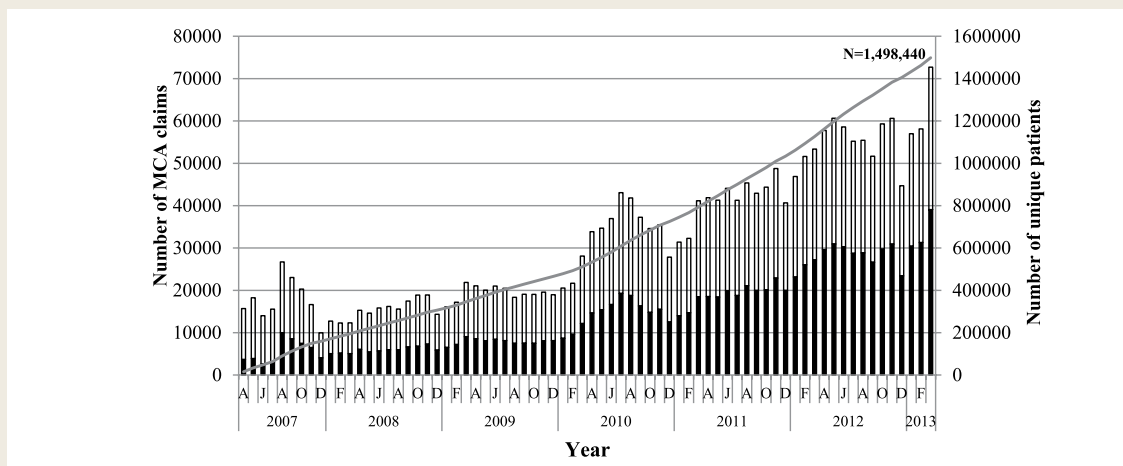


- Des services d'évaluation des traitements sont financés actuellement dans la plupart des administrations au Canada.
- Dans le cadre de cette étude, on a constaté une adoption rapide et généralisée du service annuel MedsCheck en Ontario.
- Le nombre d'évaluations annuelles effectuées a augmenté avec le temps, mais peu de personnes ont reçu ce service plus d'une fois, ce qui pourrait représenter une occasion manquée.
- Les évaluations annuelles MedsCheck correspondaient généralement aux critères d'admissibilité au programme; toutefois, certaines constatations montrent possiblement que des patients moins complexes ont bénéficié des évaluations annuelles.

Measures

The number of unique patients receiving and unique pharmacies providing MCA services over time were counted. The following characteristics of MCA service recipients were described: age, sex, region of residence, immigrant status, prior use of professional pharmacy services, comorbidities, prior prescription drug use and number of drugs dispensed; at index date, 30 days before index and 1-year before index date. Certain comorbidities (hypertension, myocardial infarction, heart failure, diabetes, chronic obstructive pulmonary disease, asthma and psychiatric disorders) were established using validated diagnosis identifiers developed at ICES. Other comorbidities (cancer, arthritis, cerebrovascular disease and fracture) were derived from combinations of OHIP billing codes used in previous ICES analyses and reviewed by the team for face validity. Evidence supporting the validation of disease algorithms or health condition coding is available by searching the ICES website (www.ices.on.ca). Level of comorbidity was defined using John Hopkins Adjusted Clinical Groups (ACG) resource utilization bands.^{20,21} ACG methodology generates a measure of an individual's medical complexity based on groups of diagnoses. Diagnostic information from the administrative databases was used to categorize MCA recipients into 1 of 6 resource utilization bands, which range from 0 (nonusers; lowest expected health care costs) to 5 (very high users; highest expected health care costs). High-cost users of medications were defined as having ODB prescription drug claims for \$4000 or more in the previous year.²²

FIGURE 1 Number of MedsCheck Annual (MCA) claims by month and cumulative number of unique recipients by month and age



White bars represent seniors (≥66 years of age), black bars represent those on social assistance (<66 years of age) and solid line is the cumulative number of MCA recipients, N = 1,498,440.

Data analyses

The frequency distribution of number of MCAs per person over the 6-year period was calculated. All other analyses were stratified by age group (<66 and ≥66 years) and sex. Since all persons older than 65 years have prescription drug coverage under the ODB plan, we had access to most if not all of their prescription drug data (i.e., all drugs covered by the plan). We therefore examined this group separately. However, to ensure that a full year of data prior to the MCA was available to measure recipient characteristics, the cohort was split at age 66. Characteristics of MCA recipients were summarized using frequency distributions and proportions for categorical variables and means, medians, ranges and standard deviations for continuous variables.

Results

Program uptake

The number of MCA claims and the cumulative number of unique patients receiving an MCA service between April 1, 2007, and March 31, 2013, are plotted monthly in Figure 1. The number of unique patients receiving an MCA reached 1,498,440 recipients by March 31, 2013. The number of MCA claims similarly increased each year, with consistent annual drops from December to February. Figure 1 also reveals a sharp increase in the number of MCA recipients beginning in the spring of 2010. Patterns of uptake were similar in both age groups.

Between April 2007 and March 2013, 64% of recipients had 1 MCA while 36% of recipients had more than 1 MCA service. Those 66 years and

TABLE 1 Frequency distribution of MCA claims per person from April 1, 2007, to March 31, 2013

Number of MCA claims per person	Age <66 years, n (%)	Age ≥66 years, n (%)	Total, N (%)
1	508,029 (69.5)	448,931 (58.5)	956,960 (63.9)
2	153,211 (21.0)	199,554 (26.0)	352,765 (23.5)
3	48,345 (6.6)	77,498 (10.1)	125,843 (8.4)
4	15,699 (2.2)	28,881 (3.8)	44,580 (3.0)
5	4980 (0.7)	10,091 (1.3)	15,071 (1.0)
6	889 (0.1)	2184 (0.3)	3073 (0.2)
7+	28 (>0.0)	120 (>0.0)	148 (>0.0)
Total number of claims	731,181 (100%)	767,259 (100%)	1,498,440 (100%)

TABLE 2 Characteristics of MCA recipients by age group at index (or otherwise indicated)

	Age <66 years, N = 731,181		Age ≥66 years, N = 767,259		Total, N = 1,498,440	
	n	%	n	%	n	%
Fiscal year						
2007/2008	64,048	8.8	130,678	17.0	194,726	13.0
2008/2009	63,051	8.6	88,305	11.5	151,356	10.1
2009/2010	73,806	10.1	91,469	11.9	165,275	11.0
2010/2011	136,086	18.6	146,231	19.1	282,317	18.8
2011/2012	172,277	23.6	160,435	20.9	332,712	22.2
2012/2013	221,913	30.3	150,141	19.6	372,054	24.8
Rurality Index of Ontario ^{*,†}						
Score 0-9 (urban)	528,282	73.8	554,741	73.2	1,083,023	73.5
Score 10-44 (nonmajor urban)	154,765	21.6	166,179	21.9	320,944	21.8
Score 45+ (rural)	40,286	5.6	41,631	5.5	81,917	5.56
Ontario drug benefit plan coverage category						
None	463,630	63.4	20.0	0.0	463,650	30.9
Seniors	44,942	6.1	594,555	77.5	639,497	42.7
Low-income seniors	4253	0.6	158,772	20.7	163,025	10.9
Disability	110,722	15.1	3231	0.4	113,953	7.6
Trillium	52,656	7.2	2330	0.3	54,986	3.7
Other (home care, Ontario Works)	54,977	7.6	8350	1.1	63,327	4.2
Adjusted clinical group resource utilization ^{†,‡}						
Nonusers	9823	1.3	5827	0.8	15,650	1.0
Healthy users	9969	1.4	5577	0.7	15,546	1.0
Low morbidity	91,040	12.5	60,521	7.9	151,561	10.1
Moderate	469,899	64.3	468,385	61.0	938,284	62.6
High	108,102	14.8	148,070	19.3	256,172	17.1
Very high	42,348	5.8	78,879	10.3	121,227	8.1
Comorbidities [†]						
Hypertension	382,329	52.3	635,419	82.8	1,017,748	67.9
Chronic obstructive pulmonary disease or asthma	216,752	29.6	243,640	31.8	460,392	30.7
Diabetes	197,580	27	256,573	33.4	454,153	30.3
Psychiatric conditions	259,542	35.5	157,647	20.5	417,189	27.8
Any osteo or inflammatory arthritis	176,980	24.2	222,784	29.0	399,764	26.7

(continued)

TABLE 2 (continued)

	Age <66 years, N = 731,181		Age ≥66 years, N = 767,259		Total, N = 1,498,440	
	n	%	n	%	n	%
Cancer	52,446	7.2	126,951	16.5	179,397	12.0
Heart failure	21,241	2.9	86,752	11.3	107,993	7.2
Cerebrovascular disease	14,820	2.0	36,895	4.8	51,715	3.5
Fracture	8171	1.1	17,048	2.2	25,219	1.7
Myocardial infarction	9168	1.3	9218	1.2	18,386	1.2

*Based on patient residence.

†One year prior to index date.

‡Adjusted clinical groups resource utilization comorbidity index = a relative measure of the individual's expected or actual consumption of health services; developed by researchers at the Johns Hopkins University School of Hygiene and Public Health in Baltimore, Maryland, USA; MCA, MedsCheck Annual.

over more frequently received multiple MCAs over the 6-year period compared with younger recipients (42% and 31%, respectively; Table 1). Less than 1% ($n = 3073$) of MCA recipients had 6 MCAs within the study period, although this finding needs to be interpreted with the consideration that not all claimants would have been eligible for an MCA during the entire 6 years of study.

Community pharmacy participation

Nearly 1500 pharmacies provided at least 1 MCA service within the first month the service was available. In the first year after launch, 3190 pharmacies provided at least 1 MCA. The number of participating pharmacies increased almost every year, with a sharper increase in 2010-2011 to 3505, followed by 3683 in 2012-2013.

Demographic characteristics of MCA recipients

Overall, 731,181 MCA recipients were younger than 66 years (7.1% were 65 years of age and 3.8% were younger than 25 years of age), and 767,259 were aged 66 years or older (Figure 1; Table 2). Fifteen percent ($n = 222,224$) of MCA recipients were 80 years of age and over. We found that 31% of MCA recipients were not covered by the public drug plan. It is noteworthy that 25% of female recipients aged 66 years or older fell into the low-income group compared with 16% of male recipients in this age group (data not shown). Of MCA recipients, 11.2% were immigrants and 5.4% had been in Canada for fewer than 15 years. Furthermore, 88.4% of MCA recipients lived in urban centres. Urban centres reporting the highest number of MCA recipients were Toronto, Ottawa and Hamilton.

Health characteristics of MCA recipients

A high or very high level of morbidity was found in 25.2% of MCA recipients, and 87.8% had at least moderate morbidity (Table 2). Specific comorbidities are identified in Table 3. Hypertension was the most common diagnosis (67.9%). There was a higher prevalence of hypertension, heart failure and cancer among those aged 66 years and older compared with the younger cohort (Table 3). Psychiatric conditions were more common in MCA recipients younger than 66 years compared with those 66 years and older. Rates of psychiatric conditions (30.9% vs 24.1%) and inflammatory conditions (29.5% vs 23.3%) were higher among women than men. Rates of cancer (13.7% vs 10.5%), heart failure (9.7% vs 6.9%) and diabetes (34.7% vs 26.7%) were higher among men vs women. Results were otherwise similar among men and women (data not shown).

Health care resource use

Ten percent of MCA recipients visited an emergency department or were hospitalized within the 30 days prior to their first MCA. Thirty-eight percent of MCA recipients visited an emergency department or were hospitalized in the year prior to their first MCA; this prevalence rate was similar in recipients younger than 66 years (38.5%) and those 66 years of age and older (37.1%).

The mean number of unique prescription drugs dispensed in the previous year for an MCA recipient 66 years of age and older was 11.3 (SD 6.3), and the mean number of unique prescription drugs dispensed on the same day as an MCA was 2.8 (SD 2.3) in those 66 years and older (data from 406,714 MCA recipients

TABLE 3 Medication use and ODB spending among MCA recipients ≥ 66 years of age* 1 year prior to first MCA service

	Age ≥ 66 years (N = 767,259)	
	n	%
Medication use		
Antihypertensives	624,587	81.4
Antilipidemics	492,655	64.2
Gastroprotectives	270,666	35.3
Narcotics	206,428	26.9
Osteoporosis medications	180,468	23.5
Benzodiazepines	165,859	21.6
Antidepressants	159,989	20.9
Oral antihyperglycemic agents	147,394	19.2
Insulin	30,375	4.0
ODB medication spending		
<\$500	105,763	13.8
\$500-999	162,140	21.1
\$1000-1999	249,500	32.5
\$2000-2999	127,118	16.6
\$3000-3999	58,522	7.6
\geq \$4000	64,216	8.4

*Not reported for MedsCheck (MC) recipients under 66 years of age since the majority of recipients in this category are not covered by the Ontario Drug Benefit (ODB) plan. MCA = MedsCheck Annual.

who had any prescription dispensed on the day an MCA claim was submitted) and 3.1 (SD 2.4) in recipients younger than 66 years (data from 160,634 MCA recipients). The majority of MCA recipients 66 years of age and older were dispensed an antihypertensive (81.4%) or an antilipidemic (64.2%) medication within the previous year before an MCA claim (Table 3).

Discussion

This is the first study of the Ontario MCA program that provides population-based data on program uptake. Over the first 6 years of the program, approximately 1 in 9 Ontarians received an MCA. The majority of recipients had hypertension or other types of cardiovascular disease. Only one-third of recipients received the medication review service more than once despite the opportunity, depending on the year of their initial

MCA, to have up to 6 MCAs within the analysis period. The low level of repeating MCA recipients reveals an important opportunity for pharmacists to better use the MCA service as a mechanism for consistently checking in with patients each year to help prevent and manage chronic disease.

The number of MCAs delivered was fairly constant for the first 3 years but sharply increased in the spring of 2010. This was concurrent with the government announcement that professional allowances paid by generic companies to pharmacy owners for purchases of their drug products (rebates) would be phased out and that reimbursement for generic drugs would drop from 50% to 25% of the brand price effective July 2010.^{14,15,23} This increase in MCA service delivery continued despite the funding of other MedsCheck services for diabetes, long-term care and homebound patients in the fall of 2010.

Almost half of Ontario pharmacies (1494/3132) made at least 1 MCA claim in the first month of the MC program (April 2007).²⁴ The rapid and widespread uptake of the service by pharmacies may be attributable to the \$950 start-up payment provided by the ODB plan upon receipt of that pharmacy's first MCA claim. This payment was meant to acknowledge the time, effort and resources needed to enable delivery of MC services.

Common chronic conditions were well represented among MCA recipients, as expected from the eligibility requirements. The finding that 68% of MCA recipients had hypertension is consistent with population-based estimates from 1998 to 2008 that about 60% of Canadian residents aged 65 to 69 years are hypertensive.²⁵ Psychiatric conditions were more common in MCA recipients younger than 66 years compared with those 66 years and older. This finding was expected because about a third of recipients in the lower age group were receiving drug plan coverage because of low income or other social needs (e.g., Trillium, Ontario Works), a situation that is associated with mental health conditions.^{26,27} Also particularly interesting, 15% of MCA recipients were 80 years of age or older, which is lower than expected given that an analysis using the same data holdings showed that 42.6% of Ontarians aged 75 to 89 years had 3 or more common chronic conditions.²⁸

MCA recipients age 66 years and older were prescribed more medications on average than 2012 rates reported by the Canadian Institute for Health Information (CIHI); however, data from CIHI included all seniors, not just those on 3 or more chronic medications, so higher rates of prescription medication would be expected in MCA recipients.²⁹ Older recipients of an MCA had less emergency department use in the prior year (35%) compared with population-based estimates from 2008-2009 (55.1%), which is possibly consistent with less complex patients despite being users of at least 3 chronic medications.³⁰

Notably, MCA recipients were dispensed approximately 3 unique prescription medications on the day they received the service, while those older than 66 years were dispensed more than 11 unique medications during the year before the service. This indicates a high likelihood that service delivery was consistent with program eligibility that dictates that recipients

take at least 3 chronic medications. However, additional preliminary analyses have identified that the median number of unique prescriptions dispensed per year to MCA recipients older than 65 years is declining over time,³¹ and further study is required to understand this trend and other changes in recipient characteristics over time.

Only 11% of MCA recipients were identified as immigrants, compared with the 28.3% of Ontarians recorded as immigrants in the 2006 census. Younger age, lower general use of health services by immigrants relative to the rest of the Canadian population^{32,33} and/or literacy barriers may be contributing to a lower rate of delivery of MCA services to immigrants.

Service specifications for publicly funded medication review programs in other provinces vary substantially. Ontario's MCA service is consistent with medication review programs in New Brunswick, Newfoundland and British Columbia (standard review) in that all include a medication reconciliation and adherence review. In contrast, programs in Saskatchewan, Alberta, Nova Scotia (advanced program) and British Columbia (consultation review) also require a pharmacotherapeutic review. Patient eligibility requirements also vary substantially across Canadian jurisdictions,¹⁰ although programs in Prince Edward Island, Nova Scotia (basic), New Brunswick and Alberta are generally comparable to Ontario in this regard. The findings generated by this study will be more applicable to jurisdictions with adherence-focused programs and similar patient eligibility criteria. Other countries, including the United States, Australia, New Zealand and the United Kingdom, also fund various forms of medication reviews; however, the only published population-based data related to uptake of medication review services similar to MedsChecks comes from the Medication Use Review (MUR) program in England. In the first 2 years (2005-2007) of that program, MURs were provided by 65% of community pharmacies in England ($n = 9872$), revealing substantial uptake yet lower than the 95% uptake in Ontario. MUR claims rose steadily, with peaks at the end of each financial year, likely due to wanting to achieve the limit of 250 (ceiling in the first year) or 400 (the limit in subsequent years) per pharmacy per year set by the UK Department of Health.³⁴ The majority (75%) of all MUR claims were made by multiple (chain) pharmacies, with ownership type found

to be the most significant determinant of MUR uptake. Unfortunately, the current study is limited by lack of access to data on pharmacy ownership type, and so we were unable to describe ownership type MC uptake in Ontario.

There are a number of strengths to this study. The study leveraged linked administrative data that allowed for a detailed examination of recipient characteristics, including health resource utilization using well-validated data fields. It included all recipients over the period of study, and the patterns observed are consistent with fluctuations that can be explained by health policy changes. However, there are also a number of limitations to this study. The drug data available for the analyses were limited to beneficiaries of the ODB program, and so drug utilization in individuals receiving an MCA service who were aged 66 years or younger is available only for social assistance recipients. In addition, comparisons of MCA recipient characteristics with external population-based estimates are unbalanced because these estimates are generally not based on people approximating MCA eligibility criteria (i.e., 3 or more chronic medications). Also, this study did not explore the uptake of

other MedsCheck services implemented in 2010 or any MedsCheck follow-up services. This will underestimate the number of people who had multiple MedsChecks over the 6-year period. Furthermore, the number of pharmacies providing MCA services is slightly overestimated, since a new pharmacy identifier is assigned when a pharmacy changes owner or location and the same pharmacy may be counted more than once. Finally, the study is also limited by the pooling of data from over a 6-year period, and consequently, the analysis does not address whether there are differences in recipient characteristics over time.

Conclusion

Over a 6-year period, approximately 1 in 9 Ontarians received an MCA, with the majority having cardiovascular disease. Service delivery increased over time; however, the number of persons receiving the service more than once was low. Results from this study have been used to inform analyses to compare MCA recipient characteristics over time and to identify predictors of use and outcomes of the MCA medication review service. ■

From the Department of Family Medicine, McMaster University, Hamilton (Dolovich); the Leslie Dan Faculty of Pharmacy (Dolovich, Consiglio, MacKeigan, Abrahamyan, Pechlivanoglou, Rac, Pojskic, Bojarski, Krahn, Cadarette) and Faculty of Medicine (Krahn), University of Toronto, Toronto; Green Shield Canada (Pojskic), Toronto; and the Institute for Clinical Evaluative Sciences, Toronto, Ontario (Su). Contact ldolovic@mcmaster.ca.

Author Contributions: L. Dolovich, L. MacKeigan and M. Krahn initiated the project and obtained funding. L. Dolovich, L. MacKeigan, G. Consiglio, L. Abrahamyan, P. Pechlivanoglou and S. M. Cadarette were responsible for the design and methodology. J. Su carried out the analyses. L. Dolovich wrote the initial draft and G. Consiglio, L. MacKeigan, L. Abrahamyan, P. Pechlivanoglou, V. E. Rac, N. Pojskic, E. A. Bojarski, J. Su, M. Krahn and S. M. Cadarette interpreted the data, provided critical input to successive manuscript drafts and reviewed the final draft.

Declaration of Conflicting Interests: The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding: This study was funded by grants from the Government of Ontario (Ministry Grant No. 06674) and the Blueprint for Pharmacy and was supported by the Ontario Pharmacy Research Collaboration (OPEN). The views expressed in this article are those of the authors and do not necessarily reflect those of the funder.

References

1. Institute of Medicine. *Preventing medication errors: quality chasm series*. Washington (DC): National Academies Press; 2007.
2. Hakkarainen KM, Andersson Sundell K, Petzold M, Hagg S. Prevalence and perceived preventability of self-reported
3. Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. *Expert Opin Drug Saf* 2014;13:57-65.
4. diverse drug events—a population-based survey of 7099 adults. *PLoS One* 2013;8:e73166.

4. Sichieri K, Rodriguez ARB, Takahashi JA. Mortality associated with the use of inappropriate drugs according to beers criteria: a systematic review. *Adv Pharmacol Pharm* 2013;1:74-84.
5. Zed PJ, Haughn C, Black KJ, et al. Medication-related emergency department visits and hospital admissions in pediatric patients: a qualitative systematic review. *J Pediatr* 2013;163:477-83.
6. Dolovich L. Developing recommendations for the reimbursement of expanded professional pharmacist's services in Ontario. *Can Pharm J (Ott)* 2011;144:19-24.e11.
7. Kwint HF, Bermingham L, Faber A, et al. The relationship between the extent of collaboration of general practitioners and pharmacists and the implementation of recommendations arising from medication review: a systematic review. *Drugs Aging* 2013;30:91-102.
8. Hatah E, Braund R, Tordoff J, Duffull SB. A systematic review and meta-analysis of pharmacist-led fee-for-services medication review. *Br J Clin Pharmacol* 2014;77:102-15.
9. Patwardhan PD, Amin ME, Chewing BA. Intervention research to enhance community pharmacists' cognitive services: a systematic review. *Res Social Adm Pharm* 2014;10:475-93.
10. Pammett R, Jorgenson D. Eligibility requirements for community pharmacy medication review services in Canada. *Can Pharm J (Ott)* 2014;147:20-4.
11. Ontario Ministry of Health and Long-Term Care. *The Meds-Check program guidebook*. 2nd edition. Available: http://tools.patientsafetyinstitute.ca/Communities/MedRec/Shared%20Documents/Provincial%20Initiatives/Ontario%20-%20Meds-Check/meds_guide_20080725.pdf (accessed Jul. 10, 2016).
12. Ontario Pharmacists' Association. The voice of pharmacists in Ontario. Update on regulatory changes. June 21, 2010. Available: <https://www.opatoday.com/Media/Default/PDF%20Publications/Policy%20Statements/2010-06-21%20Regulatory%20Update.pdf> (accessed Feb. 8, 2016).
13. Houle SKD, Grindrod KA, Chatterley T, Tsuyuki RT. Paying pharmacists for patient care: a systematic review of remunerated pharmacy clinical care services. *Can Pharm J (Ott)* 2014;147:209-32.
14. Steven L. Ontario generic drug wars, part 1: how it all began. September 2010. Available: www.longwoods.com/content/21910 (accessed Feb. 8, 2016).
15. Steven L. Ontario generic drug wars, part 2: did retail pharmacy need rebates? September 2010. Available: www.longwoods.com/content/21927 (accessed Feb. 8, 2016).
16. Poirier S, Garipey Y. Compensation in Canada for resolving drug-related problems. *J Am Pharm Assoc (Wash)* 1996;NS36:117-22.
17. Dolovich L, Gagnon A, McAiney CA, et al. Initial pharmacist experience with the Ontario-based MedsCheck program. *Can Pharm J (Ott)* 2008;141:339-45.
18. Ignacy TA, Camacho X, Mamdani MM, et al. Professional pharmacy services and patient complexity: an observational study. *J Pharm Pharm Sci* 2015;18:863-70.
19. Ontario Ministry of Health and Long-Term Care. Pharmaceutical Opinion Program. Available: www.health.gov.on.ca/en/pro/programs/drugs/pharmaopinion/ (accessed Jun. 7, 2016).
20. Starfield B, Weiner J, Mumford L, Steinwachs D. Ambulatory care groups: a categorization of diagnoses for research and management. *Health Serv Res* 1991;26:53-74.
21. Weiner JP, Starfield BH, Lieberman RN. Johns Hopkins Ambulatory Care Groups (ACGs): a case-mix system for UR, QA and capitation adjustment. *HMO Pract* 1992;6:13-9.
22. Wodchis WP, Austin PC, Henry DA. A 3-year study of high-cost users of health care. *CMAJ* 2016;188:182-8.
23. Steven L. Ontario generic drug wars, part 3: the soul of the pharmacy profession. September 2010. Available: www.longwoods.com/content/21930 (accessed Feb. 8, 2016).
24. Ontario College of Pharmacists. Annual report 2007-2008. Available: www.ocpinfo.com/library/annual-reports/download/Annual%20Report%202007-2008.pdf (accessed Feb. 8, 2016).
25. Robitaille C, Dai S, Waters C, et al. Diagnosed hypertension in Canada: incidence, prevalence and associated mortality. *CMAJ* 2012;184:E49-56.
26. Matthews D. Report to the Honourable Sandra Pupatello, Minister of Community & Social Services. Review of employment assistance programs in Ontario Works & Ontario Disability Support Program. December 2004. Available: www.mcscs.gov.on.ca/documents/en/mcscs/social/publications/EmploymentAssistanceProgram_Matthews_eng1.pdf (accessed Jun. 7, 2016).
27. Durbin A, Bondy SJ, Durbin J. The association between income source and met need among community mental health service users in Ontario, Canada. *Community Ment Health J* 2012;48:662-72.
28. Koné Pefoyo AJ, Bronskill SE, Gruneir A, et al. The increasing burden and complexity of multimorbidity. *BMC Public Health* 2015;15:1-11.
29. Canadian Institute for Health Information. Drug use among seniors on public drug programs in Canada, 2012: Revised October 2014. Available: https://secure.cihi.ca/free_products/Drug_Use_in_Seniors_on_Public_Drug_Programs_EN_web_Oct.pdf (accessed Feb. 8, 2016).
30. Canadian Institute for Health Information. Seniors' use of emergency departments in Ontario, 2004-2005 to 2008-2009. Available: https://secure.cihi.ca/free_products/seniors_ed_e.pdf (accessed Feb. 8, 2016).
31. Dolovich L, Consiglio GP, Abrahamyan L, et al. Ontario MedsCheck annual pharmacy medication review service: a comparison between initial and well established implementation periods. *Pharmacoepidemiol Drug Saf* 2015;24:88.
32. Ng ES, Sanmartin C, Tu J, Manuel D. Use of acute care hospital services by immigrant seniors in Ontario: a linkage study. *Health Rep* 2014;25(10):15-22. Available: www.statcan.gc.ca/pub/82-003-x/2014010/article/14099-eng.pdf (accessed Feb. 8, 2016).
33. McDermott SG, Gupta S, DesMeules M, et al. Health services use among immigrants and refugees to Canada. *Health Policy Res Bull* 2010;17:37-40.
34. Bradley F, Wagner AC, Elvey R, et al. Determinants of the uptake of medicines use reviews (MURs) by community pharmacies in England: a multi-method study. *Health Policy* 2008;88:258-68.