ARTICLE

Pharmacists Making House Calls: Innovative Role or Overkill?

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ABSTRACT

Background: The Medication Management Program was established at the Fraser Health Authority in 2005, in response to evidence suggesting that having pharmacists provide care to patients in their homes after discharge from hospital could reduce subsequent utilization of health service resources.

Objective: To determine the effectiveness of the Medication Management Program in its first 2 years of operation.

Methods: For patients who had received a home visit by a pharmacist, the utilization of health services (admissions to hospital, physician office visits, and dispensed medications) in the year before the home visit was compared with utilization during the year after the intervention. The net cost of the program was also determined.

Results: In the first 2 years of the Medication Management Program (2005/2006 and 2006/2007), a total of 1171 patients received a home visit from a pharmacist. Of these, 836 (71%) were included in the before-and-after analysis. The median per-patient cost for utilization of health services was $11 014 lower in the year after the intervention than in the year preceding the intervention. After the costs of the program were taken into account, this resulted in a net median cost reduction of $3047.43 per patient.

Conclusion: The Medication Management Program was effective as a clinical program in its first 2 years.

Key words: pharmacist, home visit, resource utilization

RÉSUMÉ

Contexte : Le Programme de gestion des médicaments a été mis en œuvre en 2005 à la Fraser Health Authority en Colombie-Britannique, à la lumière de données suggérant que des soins à domicile prodigués par des pharmaciens à des patients après leur congé de l'hôpital pourraient réduire l'utilisation subséquente des ressources en soins de santé.

Objectif : Déterminer l'efficacité du Programme de gestion des médicaments dans les deux premières années de son existence.

Méthodes : On a comparé l'utilisation de services de santé (hospitalisations, consultations médicales et médicaments délivrés) de patients ayant reçu des soins à domicile par un pharmacien dans l'année précédant la visite du pharmacien à domicile à l'utilisation de ces ressources dans l'année suivant l'intervention. On a également calculé le coût net du programme.

Résultats : Dans les deux premières années du Programme de gestion des médicaments (2005-2006 et 2006-2007), un total de 1171 patients ont reçu une visite à domicile d'un pharmacien. De ces patients, 836 (71 %) ont été inclus dans l'analyse pré- et post-intervention. Le coût médian par patient de l'utilisation des services de santé était inférieur de 11 014 $ dans l'année suivant l'intervention, comparativement à l'année précédant l'intervention. Après avoir tenu compte du coût du programme, la réduction du coût net médian était de 3047,43 $ par patient.

Conclusion : Le Programme de gestion des médicaments s'est avéré efficace comme intervention clinique dans ses deux premières années.

Mots clés : pharmacien, visite à domicile, utilisation des ressources

[Traduction par l'éditeur]

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INTRODUCTION

Spending on medications in Canada continues to rise dramatically. The Canadian Institute for Health Information has estimated that 16.8% of total Canadian expenditures on health care in 2007 was spent on medications, a proportion that is second only to spending on hospitals.[1] Hence, it is imperative that medications be used effectively and appropriately.

Tweedie and Jones[2] defined medicines or medication management as "the systematic provision of medicines therapy through a partnership of effort between patients and professionals to deliver best patient outcome at minimized cost." This definition encompasses the provision of pharmaceutical care and is operationalized by a pharmacist providing clinical services across care settings.[3] A recent survey of clinical pharmacy services in Canadian hospital settings suggested that there had been an increase in the provision of inpatient and outpatient clinical pharmacy services.[4] However, one care situation not mentioned in that report is the provision of clinical pharmacy services at home to those recently discharged from acute care services. Problems with medication therapy can occur during the transition between hospital and home. The reported incidence rate for adverse drug events after hospital discharge ranges from 11% to 20%, and these events can result in further use of acute care resources.[5-7] As such, medication management services in the home are needed after hospital discharge to prevent adverse drug events and avoid unnecessary use of acute care resources.

Although the provision of clinical pharmacy services is relatively new in home care, there is increasing evidence to support the role and benefit of such services in this setting.[8] Several reports have documented the provision of home care pharmacy services in supporting patients after discharge from acute care.[9-13] The High-Risk Patient Intervention Program (HRPIP), a randomized controlled trial conducted in 1999 and 2000, showed that a postdischarge visit from a pharmacist and nurse to elderly patients significantly reduced the number and duration of subsequent hospital stays (McGowan P, Green L, Beattie BL, Chappell N, Clarke H, Gayton D, et al. High-risk patient intervention program. Summary of evaluation results. Vancouver [BC]: University of British Columbia, Institute of Health Promotion Research; 2001. Unpublished). Other literature has corroborated the benefit of a home visit by a pharmacist after hospital discharge on patient outcomes such as unplanned readmissions,[10-12] out-of-hospital deaths,[10] visits to the emergency department,[10] days in hospital,[10] and bleeding events (for those discharged on warfarin).[13]

In response to this evidence, the Fraser Health Authority initiated its Medication Management Program in 2005, modelling the new program on the HRPIP. The program, which targets elderly patients (65 years of age or older) who are taking at least 6 regular medications at the time of discharge from hospital, involves pharmacists visiting the patients at home within a week of discharge. In addition, the program's pharmacists receive referrals from health care practitioners to see other home-based patients.

In contrast to the evidence illustrating the benefit of clinical pharmacy services in the home, as summarized above, several authors have reported either no benefit or increased utilization of health service resources by patients who have received home pharmacy care after discharge.[14-16] Given the equivocal nature of the evidence relating to clinical pharmacy services in the home after discharge, formal evaluations of such initiatives will help to determine the circumstances in which they are effective.

The purpose of this study was to evaluate the effectiveness of the Medication Management Program in reducing subsequent utilization of health service resources among those who received the intervention.

METHODS

The Fraser Health Authority is 1 of 6 health authorities in the province of British Columbia, serving the health care needs of about 1.5 million people. This health authority comprises 12 acute care hospitals, as well as Home Health services for the communities it serves. The Medication Management Program is provided through Home Health and was established in 4 health service delivery areas within the Fraser Health Authority.

The patients included in this evaluation were those who received the home pharmacy intervention in the first 2 fiscal years of the Medication Management Program's existence: April 1, 2005, to March 31, 2007. The intervention consisted of a visit by a pharmacist to the patient's home to assess his or her medication regimen for the purposes of identifying and resolving drug-related problems, as well as reconciling the medications the patient was taking at home with what was prescribed at the time of hospital discharge.

The following data were retrieved from program records to determine the pharmacist's activities performed as part of the intervention: the number of patients visited, the total number of visits, the amount of time per visit, and the number of recommendations made to improve drug therapy, as well as the number of other services provided as part of the pharmacist's consultation (provision of medication teaching, clearing of medicine cabinets, recommendation of compliance aids, requests for laboratory monitoring, and nonpharmacologic interventions, such as blood pressure and glucose monitoring, reporting of adverse drug reactions, or referral to another health care professional).

The following sources were consulted to obtain Ministry of Health administrative data: Discharge Abstract Database for

information about hospital stays, Medical Services Plan for fee-for-service billings for physician office visits, and PharmaCare for information about medications dispensed.

Data about the costs of running the program during the 2005/2006 and 2006/2007 fiscal years were also collected. These costs related to salary and benefits, mileage, technology, and data management and analysis.

The main outcome was resource utilization by recipients of the intervention, calculated by the following conservative formula: resource utilization ($) = length of hospital stay in days (multiplied by $1000/day) + Medical Services Plan costs + PharmaCare costs.

The data were analyzed by comparing each patient's resource utilization over the 1-year periods before and after the intervention, a method of analysis that was also used in the HRPIP. A subgroup analysis was also performed to investigate resource utilization among low resource users (those at the 30th percentile or lower on overall resource utilization) and high resource users (those at the 70th percentile or higher on overall resource utilization). Because resource utilization for the year before the intervention would include the hospital stay that precipitated the intervention, the cost of the index hospital stay was calculated and subtracted from the resource utilization for the "before" year.

Excluded from this before-and-after analysis were patients who died within a year of the intervention, since less than a full year's worth of post-intervention data was available for those patients. Patients whose referral to the Medication Management Program pharmacist was not a result of a hospital stay were also excluded from the main analysis. An additional analysis was performed for these patients to determine whether the pattern of resource utilization for this group differed from the pattern for those whose receipt of the intervention resulted from a recent hospital stay.

After initial data analysis for the main outcome, it was decided to perform a post hoc analysis to determine if the pattern of resource utilization differed for patients with care episodes (e.g., hospital stays) costing $50 000 or more. It was thought that the reason for the high-cost episodes of care might have been one-time, high-cost procedures that would not be affected by the intervention and that might have artificially skewed the data.

Statistical significance was tested with the Mann–Whitney test for nonparametric data.

A secondary outcome measure was the net cost of the Medication Management Program over the 2-year period. This calculation took into account the cost of the program for each year, which was calculated as a sum of the cost data. Also included in the calculation of net cost was the median difference in resource utilization in the 1-year periods before and after the intervention. For the purpose of the net cost calcula-tion, the median per-patient difference was multiplied by the number of patients in the analysis to generate the total median difference. The net cost of the Medication Management Program for the 2-year period was calculated with the following formula: net cost of program = total cost of program – total median difference. To calculate the net cost per patient, the net cost of the Medication Management Program was divided by the number of patients included in the evaluation.

Ethics approval for this study was granted by the Fraser Health Research Ethics Board in December 2007.

RESULTS

In the first 2 years of the program (April 1, 2005, to March 31, 2007), 1171 patients received a home visit from a Medication Management Program pharmacist. The pharmacists made a total of 1736 visits to these clients, of which 1251 (72%) were home visits. On average, the home visits took 1.05 h each, and follow-up phone calls took 19 min each. The medication assessments done during these visits generated a total of 4346 recommendations to improve medication appropriateness, of which 3244 (74.6%) were accepted. The pharmacists provided other services as part of the visits: education ($n = 1650$ visits), cabinet-clearing ($n = 400$), recommending compliance aids ($n = 502$), requesting laboratory values ($n = 269$), and performing nonpharmacologic interventions ($n = 777$).

Of the 1171 patients, 202 were excluded from the analysis of resource utilization because they died within 1 year after receiving the home visit. A further 133 patients were excluded from the main analysis because the pharmacist visit was not related to a prior hospital stay; however, these patients were included in the additional analysis. Therefore, the main evaluation of resource utilization was based on 836 patients (71.4% of the cohort). Their median age was 80.3 years, and 503 (60.2%) were female.

Median resource utilization was significantly lower (by $11 014; $p < 0.001$) in the year after the home visit by a pharmacist than in the year before (Table 1). The breakdown of resource utilization into its components showed that there were fewer hospital admissions in the year after the home visit and shorter lengths of stay for those admissions that did occur. Medical Services Plan costs were also lower, but PharmaCare costs increased.

The median cost for the index hospital stay was $7000. Subtracting this amount from the median resource utilization in the year before the intervention reduced the difference in median resource utilization to $4014.

The analysis of patients at the extremes of resource utilization showed that there was a reduction in median resource utilization for both groups (Table 2), but the reduction for the high resource utilization group (70th percentile or higher) was much greater. For both groups, PharmaCare expenditures

Table 1. Median 1-Year Resource Utilization Before and After Intervention (*n* = 836)

Variable	Before Intervention	After Intervention*	Difference (Before – After)†
Median resource utilization	$16 685	$5 671	$11 014 *p* < 0.001
Median length of hospital stay	12 days	0 days	12 days
Median no. of hospital admissions	1	0	1
Median cost of Medical Services Plan	$2 235	$1 824	$411
Median PharmaCare costs	$1 562	$2 138	–$576

*A median value of 0 means that more than half of the patients had a value of 0 for the variable, with the remainder scoring above 0.
†A negative value indicates a per-client increase in resource utilization after the intervention.

Table 2. Difference in Median Resource Utilization in Groups with Low and High Resource Utilization

Group	Per-Client Difference in Resource Utilization,* $			
	Acute Rehabilitation†	Medical Services Plan	PharmaCare	Median Overall*
Low resource utilization‡ (*n* = 251)	4 000	–203	–385	3 412 (*p* < 0.001)
High resource utilization§ (*n* = 251)	34 000	1536	–1077	34 459 (*p* < 0.001)

*Values calculated as median utilization in the 1-year period before the intervention minus median utilization in the 1-year period after the intervention. A negative value indicates an increase in resource utilization after the intervention.
†Valued at $1000 per day.
‡Patients at the 30th percentile or lower for overall resource utilization before intervention.
§Patients at the 70th percentile or higher for overall resource utilization before intervention.

increased after the intervention. Costs for the Medical Services Plan increased only for the group with low resource utilization (30th percentile or below).

Figure 1 illustrates the changes in median resource utilization for patients stratified according to their resource utilization before the intervention. As noted in Tables 1 and 2, overall costs declined after the intervention. This diagram illustrates that most of the patients had lower expenditures after the intervention; however, a small number did move to a higher expenditure category.

A separate analysis was performed to determine the median resource utilization among the 133 patients whose intervention was not the result of a hospital admission. In this group, median resource utilization increased after the pharmacist's home visit relative to the year before the intervention (Table 3).
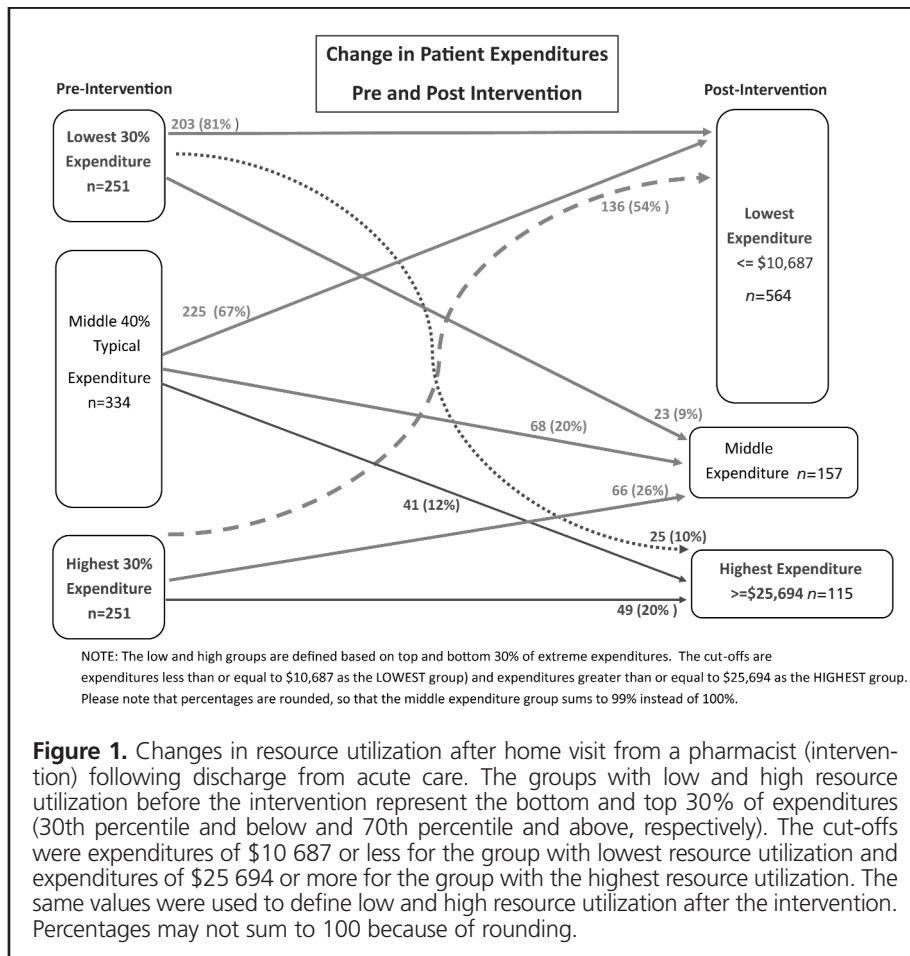
A total of 110 patients had care episodes that cost $50 000 or more. When these patients were removed, and the median resource utilization of the remaining 726 patients was re-analyzed, the overall pattern of resource utilization before and after the intervention remained the same; however, the magnitude of differences was smaller (Table 4).

The total cost of running the Medication Management Program during 2005/2006 and 2006/2007 was $808 050.14 (Table 5). During this 2-year period, 4 pharmacists worked with the program. The cost of salaries and benefits for the first year was slightly lower than the cost during the second year, because some of the pharmacists started after the beginning of the fiscal year (April 1). The net median difference for the study period was $4014 (median difference in resource utilization minus median cost of index hospital stay). Multiplied by 836, the number of patients in the analysis, this value yielded a total difference of $3 355 704. After the cost of running the program for 2 years was subtracted, there was a potential net benefit of $2 547 653.90. This translates into a potential median net benefit of $3047.43 per patient included in this analysis.

DISCUSSION

The results of this study suggest that this group of 836 patients served by the Medication Management Program used fewer health service resources in the year after a home visit from a pharmacist following discharge from hospital. The majority of this decrease appeared to result from a reduction in the number of hospital admissions. The median net reduction in resource utilization for the Medication Management Program, $3047.43 per patient, was higher than the average net saving of $680 per patient reported from the HRPIP. Our evaluation of the Medication Management Program was not a controlled trial, so we cannot conclude that the reduction was due solely to receipt of a postdischarge home visit from a pharmacist. Other factors that might explain the difference between the 2

Figure 1. Changes in resource utilization after home visit from a pharmacist (intervention) following discharge from acute care. The groups with low and high resource utilization before the intervention represent the bottom and top 30% of expenditures (30th percentile and below and 70th percentile and above, respectively). The cut-offs were expenditures of $10 687 or less for the group with lowest resource utilization and expenditures of $25 694 or more for the group with the highest resource utilization. The same values were used to define low and high resource utilization after the intervention. Percentages may not sum to 100 because of rounding.

studies are the period of analysis (costs for the HRPIP were for 1999/2000) and the personnel involved (the HRPIP involved a nurse, but the Medication Management Program did not). Also, one-time costs for setting up the program and training staff were not included in the current analysis, which would have made the savings appear greater. However, subtracting the median cost of the index hospital admission reduced the difference in overall resource utilization by $7000, which might have removed some of the bias in the calculation.

In contrast to the reduction in resource utilization subsequent to a postdischarge home visit from a Medication Management Program pharmacist, those for whom the intervention did not result from a hospital stay had an increase in utilization of health service resources after the intervention. Several hypotheses may explain these results. A recent hospital stay may be indicative of a higher-risk group for whom the benefit of an intervention is readily evident. In addition, those who have not been using health care resources, such as hospitalization, may have conditions that are not being treated, but once they are identified as needing treatment, their health care needs may increase, along with resource utilization.

Analyzing the patients with extremes of resource utilization pointed to some heterogeneity within the cohort. Overall, Medical Services Plan costs were lower after the intervention; however, Medical Services Plan costs increased among those with low resource utilization. Removing from the analysis patients with care episodes costing $50 000 or more resulted in a lower median difference, which might mean that including them in the main analysis inflated the benefit of the program.

The Medication Management Program was based on evidence from the HRPIP, which demonstrated a benefit in terms of reduced hospital admissions and reduced length of stay among those who received a home visit from a pharmacist and nurse after their index admission. Although both of these effects were documented in British Columbia, Canada, there were several differences between the 2 programs that might have altered the effect of the intervention. First, the Medication Management Program does not involve nurses, because there is an established Home Health program within the Fraser Health Authority, with nurses to whom patients can be referred if they have nursing issues. Another difference was the nonrandomized

Table 3. Analysis of Results in Relation to Prior Admissions to Hospital

| Group | Median Utilization, $ | | Median Difference,* $ |
	Before Intervention	After Intervention	
No prior admission			
Women (n = 92)	3 078	4 591	−1 513 $p < 0.001$
Men (n = 41)	1 483	2 672	−1 189 $p < 0.001$
Prior admissions			
Women (n = 503)	17 408	5 579	11 829 $p < 0.001$
Men (n = 333)	15 425	5 708	9 717 $p < 0.001$

*A negative difference indicates a per-client increase in resource utilization after the intervention.

Table 4. Median 1-Year Resource Utilization Before and After Intervention, Excluding Patients with Care Episodes Costing $50 000 or More ($n$ = 726)

Variable	Before Intervention	After Intervention*	Difference† (Before−After)
Median resource utilization	$14 657	$5 099	$9 558 $p < 0.001$
Median length of hospital stay	10 days	0 days	10 days
Median no. of hospital admissions	1	0	1
Median cost of Medical Services Plan	$2 110	$1 706	$404
Median PharmaCare costs	$1 570	$2 118	−$548

*A median value of 0 means that more than half of the patients had a value of 0 for the variable, with the remainder scoring above 0.
†A negative value indicates a per-client increase in resource utilization after the intervention.

selection of patients; instead, participation was based on the willingness of patients and caregivers to have a visit from a pharmacist and on pharmacists' workload.

Other randomized controlled trials of programs similar to the Medication Management Program have reported benefit from a home visit by a pharmacist after discharge from acute care services in Australia[10,11] and Tasmania.[12,13] Stewart and others[10] reported a significant reduction in unplanned readmissions to hospital, number of days in hospital, out-of-hospital deaths, and emergency room visits for the intervention group, who received discharge counselling before leaving hospital, followed by a home visit from a pharmacist and a nurse within a week after discharge. This outcome was also significant for the subgroup of patients with a diagnosis of congestive heart failure.[11] Naunton and Peterson[12] reported that at 90 days after hospital discharge, elderly patients who had received a home visit from a pharmacist within 5 days of discharge had significantly fewer drug-related problems and fewer unplanned readmissions, although the reduced readmission rate was only borderline significant (p = 0.05). Finally, Jackson and others[13] described an intervention in which patients received a home visit from a pharmacist and point-of-care testing of international normalized ratio (INR) on alternate days after discharge. At 8 days after discharge, significantly more patients in the intervention group had a therapeutic INR (67% versus 42%; $p < 0.002$). Three months

after discharge, 15% of patients in the intervention group and 36% of those in the control group had experienced a bleeding event ($p < 0.01$).

MacAulay and others[9] reported that patients and members of the health care team were highly satisfied with a service providing home visits to patients recently discharged from hospital in New Brunswick, Canada. Those authors reported 74% acceptance of recommendations to physicians about drug therapy, similar to the acceptance rate in this study (74.6%).

Not all studies that have evaluated an intervention involving a postdischarge home visit have reported positive results. In Tasmania, patients with a cardiovascular diagnosis who were receiving lipid-lowering drug therapy and who had a home visit from a pharmacist 6 weeks after hospital discharge had significantly improved cholesterol levels at 6-month follow-up; however, the improvement was not significantly different from that of the control group.[14]

Moreover, contrary to the favourable results reported above, the HOMER[15] and HeartMed[16] randomized controlled trials performed in the United Kingdom reported increased utilization of health services resources, such as hospital admissions[15,16] and home visits by general practitioners,[15] for those who received a home visit from a pharmacist within 2 weeks of hospital discharge. The HOMER study included patients at least 80 years of age who were discharged home on at least 2 medicines. The HeartMed study also included

Table 5. Cost of Medication Management Plan

Item	Fiscal Year; Cost, $		
	2005/2006	2006/2007	Two-year Total
Salaries and benefits	341 696.35	412 772.15	754 468.50
Mileage*	9 589.35	7 492.29	17 081.64
Technology†	10 500.00	14 000.00	24 500.00
Data management‡	6 000.00	6 000.00	12 000.00
Total	367 785.70	440 264.44	808 050.14

*Amount reimbursed to staff for travel related to home visits.
†Costs of computers and cellular phones.
‡Costs for securing and managing the data.

patients taking at least 2 medicines at the time of discharge but targeted those with heart failure.

It is unclear why these studies showed no benefit from the intervention, given previous literature demonstrating positive effects. Perhaps the patient populations differed from those in studies reporting benefit. For example, in the HRPIP and the Medication Management Program, patients had to be taking at least 6 regularly scheduled medicines at the time of discharge, which might indicate a greater need for medication management. Another difference is the timing of the initial home visit: in the studies that demonstrated a benefit and in the Medication Management Program, the initial visit was targeted to occur within the first week after discharge, whereas in the HOMER and HeartMed studies, the initial visit was targeted to occur within the first 2 weeks after discharge. Although the significance of this difference is unclear, it is known that the period immediately after discharge from hospital can be complicated for elderly patients, and earlier intervention may therefore be more beneficial.[17] Also, the focus of the interventions may have differed. Knowledge about medicines and compliance has not been found to be predictive of hospital admissions.[18] Therefore, home-based interventions directed more toward teaching and ensuring compliance with medications may not reduce the number of hospital admissions. Finally, differences among health care systems may have contributed to differences in results.

One of the limitations of the evaluation reported here was the absence of a control group. In this type of study, a control group could help to determine if changes in resource utilization were attributable to the intervention. Selection bias was another limitation. Clinical judgement was used to determine who might benefit from the intervention; in addition, patients' and caregivers' willingness to receive the service might have contributed to bias in creating the cohort. Also, because the Medication Management Program is a clinical program and not purely a study, the study population was probably more heterogeneous. The difference in resource utilization between those admitted to hospital before the intervention and those not recently admitted is indicative of the effect of such hetero-geneity on resource utilization. Data on the type of hospital bed used by those who were admitted to hospital was not available; therefore, the fixed hospital cost of $1000 per day limited our ability to determine the exact impact of the intervention on costs of hospitalization. Another limitation was that administrative data for health service resource utilization outside of the region's geographic boundaries were not released by the Ministry of Health. This might have resulted in an underestimation of total resource utilization in the cohort, both before and after the intervention. Finally, complete information on resource utilization in the emergency department was not available because of the mix of salaried and fee-for-service physicians, so this measure of resource utilization was not included in the study. For future studies, a different data source that includes emergency department utilization will be sought.

As the program continues, mechanisms to reduce selection bias and to establish a comparison group according to selection criteria identical with those used for the intervention group will be sought. Also, data from subsequent years will be evaluated to add further information about the effectiveness of the Medication Management Program.

CONCLUSIONS

The results of this study, together with previous scientific evidence indicating a benefit of this type of intervention, suggest that a home visit from a pharmacist reduced the utilization and cost of health services in the period after the intervention.

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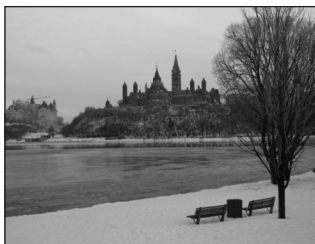
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ON THE FRONT COVER

Parliament Hill, Ottawa, Ontario

This picture shows photographer Caroline Cheng's favourite view of the Parliament Buildings. The image was taken on a dull day in late December from the Canadian Museum of Civilization in Gatineau, Quebec. The blandness of the snow, the river, and the sky provide a neutral background, allowing the subtle colours of the buildings to become the focus of the picture. The photograph was taken with a Canon Power Shot SX110.

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