

Current perspectives on pharmacist home visits: do we keep reinventing the wheel?

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Abstract: The scope of clinical pharmacy services available in outpatient settings, including home care, continues to expand. This review sought to identify the evidence to support pharmacist provision of clinical pharmacy services in a home care setting. Seventy-five reports were identified in the literature that provided evaluation and description of clinical pharmacy home visit services available around the world. Based on results from randomized controlled trials, pharmacist home visit interventions can improve patient medication adherence and knowledge, but have little impact on health care resource utilization. Other literature reported benefits of a pharmacist home visit service such as patient satisfaction, improved medication appropriateness, increased persistence with warfarin therapy, and increased medication discrepancy resolution. Current perspectives to consider in establishing or evaluating clinical pharmacy services offered in a home care setting include: staff competency, ideal target patient population, staff safety, use of technology, collaborative relationships with other health care providers, activities performed during a home visit, and pharmacist autonomy.

Keywords: clinical pharmacy, home care, home visit, medication review, pharmacist

Introduction

Over the past several decades, the scope of clinical pharmacy services has expanded both in terms of skills and areas in which services are offered. Traditionally, the availability of clinical pharmacy services has been in the purview of hospitals where increased clinical pharmacy services has been associated with reduced length of stay and mortality.¹ Recognition of the value of the role of the pharmacist has resulted in expansion of clinical services into outpatient settings, including patient homes. For example, the Home Medicines Review (HMR) program that was established in Australia in 2001 provides funding for pharmacists to visit patients at home to assess their medication regimens.² In Canada, provincial governments are compensating pharmacists for providing medication reviews (MRs) for non-hospitalized patients³ and also authorizing pharmacists to prescribe.⁴

While there is evidence to suggest that pharmacist prescribing activities can improve patient outcomes in outpatient settings,⁵⁻⁷ the evidence to support the benefit of MRs in outpatient settings is equivocal. Holland et al conducted a systematic review and meta-analysis to evaluate the impact of pharmacist-led MR in older adults and reported that there was no effect on reducing mortality or hospital admissions, but that the intervention may reduce the number of prescribed drugs and improve

drug knowledge and adherence.⁸ More recently, an evaluation of the MR service available in the province of British Columbia, Canada, reported that there had been little impact on prescription drug use in the province as a result of this program.⁹ In contrast, a systematic review and meta-analysis that evaluated medication reconciliation programs at hospital transitions and included pre- and post-discharge pharmacist visits reported significantly reduced adverse drug event (ADE)-related hospital revisits attributable to the interventions, which included pharmacist home visits (HVs).¹⁰ A recent randomized-controlled trial (RCT) determined that an extended intervention that included both a pharmacist-led pre-hospital discharge MR and post-discharge follow-up significantly reduced readmissions within 30 or 180 days compared with usual care; however, the MR alone did not.¹¹

These studies were not focused solely on clinical pharmacy services in home care and so applicability to this setting is limited. A review of clinical pharmacy services offered in the home concluded that more rigorous evaluation is needed to support the value of these services and highlighted that questions remain about optimal practice models and target patient populations.¹² In our health authority, home care clinical pharmacy services have matured to the point where they are an established component of home care in locations where they are available, with ongoing requests for more. The maturation of these services has seen the pharmacist involved in increasingly more aspects of home care services, beyond what was initially supported by evidence.¹³ Determining best practices for clinical pharmacy services offered in the home, as well as other settings, is important to guide practice that will ensure maximum patient benefit. Furthermore, changes in technology, patient and provider experience, safety, and expectations for pharmacy services are possible influencers of how services are delivered or valued.

The purpose of this review is to identify outcomes associated with clinical pharmacy services provided in the home, as well as to describe current perspectives of practice described in the literature.

Literature search

Two separate literature searches were undertaken to identify articles published for the time period from January 2007 to December 2017. This time frame was chosen to follow up on a previous review published in 2008.¹² Using the key terms “Pharmacist” and “home visit”, EMBASE, Medline, OVID, CINAHL, Biomedical Reference Collection, EBMR, and Google Scholar were searched. The search was limited to the citations published in the English language and involved

human subjects. Additionally, the gray literature and reference lists of articles found were searched for additional records. One hundred and fifty-six unique records were found, of which 54 were excluded as they were conference abstracts or the full article access was not possible. In addition, a further 27 were excluded as they did not describe pharmacists doing HVs in a unique study published in 2007 or onward, leaving 75 articles that were included in this review.

Different programs and authors use different terminology to refer to similar concepts. We will be referring to medication reconciliation (MRec) as the act of comparing all medication lists in order to reconcile and create a master list of what the patient should be taking. MR refers to the act of compiling a list of medications the patient is taking and assessing the appropriateness of each medication and the regimen as a whole. MRec may be included in the process of MR. We will refer to medication, therapy, or drug-related problems as drug-related problems (DRPs).

Evaluation of pharmacist home visit initiatives

Pharmacist HV initiatives in 11 countries were found described in the literature: Australia, Brazil, Canada, Japan, Jordan, the Netherlands, New Zealand, Singapore, Thailand, the UK, and the USA.

Randomized-controlled trials

The nine RCTs and two cost-effectiveness analyses of pharmacist HV initiatives are outlined in Table 1.^{14–25} In general, the programs included those older than 60 years and who were expected to be at increased risk of medication misadventure. Five studied patients being discharged from hospital^{14,16,18,19,22} and four recruited from outpatient settings.^{15,20,23,24} Souter et al recruited from both an inpatient and outpatient setting.²⁵ Additional eligibility criteria used to define the target study population included number of medications (≥ 2 to ≥ 5); functional decline, frailty, or disease-specific (CHF/stroke). Six of the studies described the qualifications of the pharmacists conducting the intervention, indicating training or experience beyond an entry to practice degree.^{14–16,18,19,23}

Two studies reported reduced health care utilization attributable to the pharmacist HV intervention: reduced prescribed medications¹⁵ and reduced non-heart failure hospital days.²² The cost-effectiveness analyses of the Anticipatory and Preventative Team Care (APTcare) trial and the HOMER trial (published in 2005) did not support cost-effectiveness of the pharmacist HVs.^{16,17,21} The HOMER trial intervention group experienced significantly increased emergency

Table 1 Randomized controlled trials (RCTs) of pharmacist home visit services

Study details	Patient characteristics	Mean/ median age	Patient numbers and gender	Pharmacist characteristics	Intervention	Evaluation period	Outcomes
Holland et al ¹⁴ 2007 UK HeartMed	Age >18 years Discharge home after an emergency hospitalization for HF ≥ 2 medications on discharge	76.9	149/144 36.5% Female	Postgraduate qualification or recent CE in therapeutics 7 hours training in HF 4 hours communication training (1/2 group) 17 pharmacists	RX provided copy of discharge letter HV × 2 (within 2 and 8 weeks of discharge) Med Review HF Education PCP Adherence RX received current medication and medical history Med Review Education PCP Adherence Remove meds HV × 2 within 2 months of discharge Med Review Education Remove meds PCP Adherence (CommRX) HV within 1 week, plus 7–10 and 18–21 days later Med Review (HF and non-HF) Education HV within 5 days of discharge Med Review Adherence Remove meds	6 months	↔ emergency hospital admissions ↔ mortality
Lenaghan et al ¹⁵ 2007 UK POLYMED	Age >80 years ≥4 medications ≥1 medication risk factor Registered with GP practice	84.3	68/66 65.6% Female	Postgraduate qualification Experience with home-based medication review 1 pharmacist		6 months	↔ non-elective hospital admissions ↔ care home admissions ↔ mortality ↓ medications prescribed ↔ quality of life
Pacini et al ¹⁶ 2007 UK Cost- effectiveness analysis of HOMER ¹⁷	Age >80 years Discharge home from hospital ≥2 medications	85.4	415/414 62.4% Female	Postgraduate qualification or Recent CE in therapeutics 2-day training course on prescribing in the elderly 22 pharmacists		6 months	Low probability the intervention was cost- effective
Triller and Hamilton ¹⁸ 2007 USA	Age ≥21 years Diagnosis of HF Referred from hospital for home care nursing	79.7	77/77 72% Female	Doctor of Pharmacy degree Residency in home care 20+ years of clinical experience 1 pharmacist		6 months	↔ all-cause hospitalization ↔ HF hospitalization ↔ all-cause mortality
Vuong et al ¹⁹ 2008 Australia	Age ≥55 years Discharge home from hospital Hospital admit for medication misadventure/misuse ≥3 medications Medication regimen change during hospitalization Newly trained on use of appliance	71.8	152/164 47.4% Female	Bachelor of Pharmacy Postgraduate diploma in clinical pharmacy 2 pharmacists		8–12 weeks	↑ self-perceived medication understanding ↑ medication knowledge score ↑ self-reported adherence

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Table 1 (Continued)

Study details	Patient characteristics	Mean/ median age	Patient numbers and gender	Pharmacist characteristics	Intervention	Evaluation period	Outcomes
	Required medication monitoring with 7 days of discharge Dexterity, vision, hearing, or other impairment that may impact medication taking Chronic condition Language difficulties Imminent loss of independence, housebound, or living alone						
Hogg et al ²⁰ 2009 Canada	Age ≥50 years On GP practice roster	71.3	64/56	1 pharmacist	Anticipatory and Preventive Team Care (APT Care)	12–18 months	↑ quality of care (QOC) for chronic disease management
Gray et al 2010 ²¹ Cost-effectiveness analysis	Risk of functional decline, or physical deterioration, or emergency services Good candidate for additional medical resources		57.5% Female		Addition of RX and 3 NP to practice Med Review PCP		↑ QOC for disease prevention Not cost-effective
Barker et al ²² 2011 Australia	≥4 medications Meets Framingham criteria for HF Hospital stay >48 hours	72.5	64/56 54% Female	Hospital based pharmacists	HV within 96 hours of discharge, at 1 and 6 months Adherence Education Remove meds CommRX	6 months	↔ mortality ↔ hospitalizations ↑ all-cause and HF hospital days ↓ non-HF hospital days ↔ Quality of life
Elliott et al ²³ 2012 Australia	≥2 medications Referred to Aged Care Assessment Team (ACAT)	84	40/40 63.8% Female	≥5 years clinical pharmacy experience including subacute aged care and hospital outreach medication management Not accredited to conduct HMR 3 pharmacists	HV within 28 days of referral Med Review Discuss with geriatrician PCP Remove meds	6 weeks up to 20 weeks	↑ HV within 28 days of referral (100% vs 35%) ↑ medication regimen changes ↑ use of adherence aid ↑ reported easier to manage medications

Basheti et al ²⁴ 2016 Jordan	Age >18 years Outpatient clinic roster At least one of: ≥5 medications ≥12 doses/day Discharge from hospital (within 4 weeks) Medication regimen changes in previous 3 months Symptoms suggestive of ADR Subtherapeutic response to medication	60.6	48/49 70% Female	1 pharmacist	Med review (HV or clinic) for all patients Intervention received: Education PCP	3 months	↑ DRP resolution ↓ DRP ↑ medication adherence ↔ quality of life
Souter et al ²⁵ 2017 Scotland	Stroke diagnosis Discharged home from hospital or attends outpatient neurology clinic	73	18/17 40% Female		Med review in hospital or clinic Education HV at 1,3 and 6 months after hospital discharge or clinic visit PCP CommRX	6 months	5.8 DRPs/patient 19/23 recommendations accepted by GP

Abbreviations: Adherence, adherence assessment and/or aids provided; ADR, adverse drug reaction; CE, continuing education; CommRX, communicate with community pharmacy; DRP, drug-related problem; GP, general practitioner; HF, heart failure; HMR, Home Medicines Review; HV, home visit; MD, medical doctor; Med Review, assessment of medication regimen for the purpose of identifying and resolving drug-related problems; RX, pharmacist; NP, nurse practitioner; PCP, contact primary care physician to resolve DRPs; Remove meds, removal of discontinued or expired medications.

readmissions.¹⁷ APTcare, a multidisciplinary collaboration focused on patients with chronic disease, despite providing increased quality of care was not cost-effective, this may have been reflective of it being in the implementation stage, rather than established.^{16,17}

The clinical outcomes reported from these RCTs indicated that these programs can improve medication understanding, knowledge, and adherence and result in increased resolution of DRPs. No benefit on quality of life was reported.

While not all of the RCTs evaluated economic outcomes, it is hard to explain the limited impact of the pharmacist interventions on health care costs. The interventions undertaken in these trials all appeared to involve pharmacists conducting MR for the purpose of identifying DRPs with subsequent communication to a physician. What is unclear is the depth of the medication regimen assessment, for example, were the recommendations in line with evidence to support reducing morbidity and mortality? Also, the acceptance of recommendations made by the pharmacist was not always reported. Moreover, the extent of access the pharmacists had to medical and laboratory information was sometimes limited and may not have allowed for a comprehensive MR.^{14–16,19} Maturation of clinical pharmacy services may have occurred over the course of years these studies were undertaken, and later studies appeared to involve pharmacists doing more detailed reviews with greater prescriber collaboration,^{24,25} but did not evaluate economic outcomes. The most recent trial to evaluate economic outcomes was conducted by Barker et al; however, the usual care group received an extensive intervention which may have limited the impact of the study intervention.²²

Other activities performed by the pharmacists included removing expired or discontinued medications,^{15,16,18,22,23} education,^{14–16,18,22,24,25} and adherence assessment.^{14–16,18,20,22} While these activities alone or together may be of benefit to patients, unless the medication regimen is optimized to ensure maximal efficacy and minimal harm, they might not be enough to significantly improve patient outcomes.

Comparison studies

The 17 studies using a comparison design for evaluation of a pharmacist HV intervention are outlined in Table 2.^{26–42} The majority of these studies evaluated the pharmacist HV intervention in a population of those recently discharged (acute care or skilled nursing facility).^{27–31,33,34,36–38,40,41,42} Some specified patients from a primary care setting,^{35,39} while two studies sourced patients from administrative claims data.^{26,32}

The largest proportion of studies were evaluations of the HMR in Australia.^{26,30,31–34} Through the HMR program,

accredited pharmacists are funded to provide home-based MR services for community-based patients at risk of medication misadventure.² In addition to conducting a comprehensive MR, pharmacists provide patients with education, assess and aid in adherence and removal of old medications. A report documenting findings and recommendations must be sent to the patient's physician and community pharmacy.

Most of the other studies were evaluations of pharmacists conducting an HV intervention similar to the HMR,^{29,40} except that not all reported pharmacists removed expired or discontinued medications.^{26,35,38,40,42} Some authors described a MRec intervention rather than a MR.^{27,28,41}

The outcomes evaluated and reported in these studies are outlined in Table 3. In contrast to the RCT data, more of these studies reported reduced health care costs. The exception to this was Hanna et al, who reported an overall increase in hospital admissions; however, when they broke the study population down by age, there was a benefit of reduced hospitalizations among those aged 51–65 years.³⁸ Improvements in clinical and humanistic outcomes were also reported in these studies. The difference in impact of the pharmacist interventions on health care costs reported in these studies, compared with the RCTs, may be attributable to study design. The patients and settings were similar, as well as the extent of pharmacist training, to those described in the RCTs. The evaluation time periods in the RCTs were at least 6 months or longer, whereas these studies reported economic benefits over 30 days^{36,40} and at 6 months.^{35,42}

Program reports

Table 4 outlines the 23 articles describing evaluations of clinical pharmacy home care services in which no comparison group was used.^{43–65} The post-hospital discharge patient population was the most represented in these articles.^{44,46,48,52–54,59,60,63,64} Other authors describe programs established in community settings^{43,47,49,56,58,61,65} and clinics.^{45,50,55,57,62} Other patient characteristics included being elderly, presence of a chronic disease, or number of medications.

The majority of these articles describe a program in which a HV was conducted to undertake a MR.^{43–50,52–65} The HVs were typically conducted by a pharmacist, with some authors describing the use of pharmacy technicians,^{63,64} pharmacy students,⁵⁰ pharmacy residents/students accompanying a nurse practitioner⁵⁷ or a pharmacy resident, or a pharmacist.⁵⁹ Onda et al do not specifically describe an intervention; however, a pharmacist-conducted MR is assumed.⁵⁸ These authors sent a survey to pharmacists who conducted HVs, the purpose of

Table 2 Comparison studies of pharmacist home visit services

Study	Study intervention population			Pharmacist HV intervention	Comparison strategy	Comparison number	Evaluation period
	Characteristics	Age	% Female				
Roughhead et al ²⁶ 2009 Australia	Veterans or war widows	81.6	30	HMR	Matched controls 20:1 from administrative claims	5444	1 year post
	Age ≥65 years Dispensed beta-blocker for heart failure						
Hugtenburg et al ²⁷ 2009 The Netherlands	Registered at 1 of 37 study pharmacies	69.7	51.2	HV within 1 week of discharge MRec	Delivery of medication at discharge, usual care according to Dutch Pharmacy Standard	379	6–9 months
	Discharged home from hospital ≥5 prescribed medications			Medication overview for patient and GP Education Check of home supplies Synchronized medication dispensing			
Setter et al ²⁸ 2009 USA	Age ≥50 years	74.9	57	Medication discrepancies identified and documented (all patients). Intervention received: MRec facilitated	Eligible patients assigned to a geographically separate nursing team	110	8 weeks
	Discharged from hospital to home care ≥1 selected diagnosis						
Flanagan et al ²⁹ 2010 Canada	Age ≥65 years ≥6 medications	80	60.2	Medication Management Program (MMP) HV within 1 week of discharge Med Review Education PCP Adherence Remove meds	Before and after	836	1 year
	Discharge home						
Castelino et al ³⁰ 2010 Australia	Age ≥65 years Referred for HMR	76.1	55	HMR	Before and after	372	n/a
	Criteria examples: ≥5 medications >12 doses/day Significant medication changes in previous 3 months Medicine with narrow therapeutic index	75.3	55	HMR	Before and after	270	n/a
Roughhead et al ³² 2011 Australia	Discharged from an institution within previous 4 weeks Veterans or war widows	81.6	36	HMR	Matched controls 20:1 from administrative claims	16,320	>1 year
	Age ≥65 years Warfarin use						

(Continued)

Table 2 (Continued)

Study	Study intervention population		Pharmacist HV intervention		Comparison strategy	Comparison number	Evaluation period
	Characteristics	Age	% Female	Number			
Stafford et al ³³ 2011 Australia	Age >18 years Discharged from hospital Warfarin	67.7	38	129	Usual care	139	90 days
Stafford et al ³⁴ 2012 Australia	Age >18 years Discharged from hospital Warfarin	67.7	40	129	Usual care	139	90 days
Desborough et al ³⁵ 2012 UK	Age >65 years On GP roster Living at home Difficulty managing medications	n/a	n/a	117	Before and after Cost-consequence analysis	92 (16 lost to follow-up, 9 died)	6 months
Reidt et al ³⁶ 2014 USA	Discharged from acute care Referred for home care nursing ≥9 medications	60	67	153	Matched controls 1:1–3	380	30 days
Kogut et al ³⁷ 2014 USA	Discharged from hospital Age ≥50 years Chronic medical condition	n/a	46.7 (entire cohort)	20	HV within 1 week of home care admission Med Review MRec PCP Those who declined the ePHR system	10	≥30 days
Hanna et al ³⁸ 2016 Australia	Patients discharged from hospital at high risk of medication misadventure, eg, history of non-adherence, chronic disease, language/cultural barriers, ≥4 medications/day	72.1	51	398	HOMR (Hospital Outreach Medication Review) service provided by a Health Authority pharmacist Med Review PCP Eligible patients who declined the service	118	12 months
Hamano et al ³⁹ 2015 Japan	Age ≥65 years Prescribed medications by one of five primary care clinics Received HV by MD	84.7	59.3	182	Consults for patients about effects of drugs and monitor adherence	248	Cross sectional 8 months
Reidt et al ⁴⁰ 2016 USA	Discharged home from skilled nursing facility	70.8	57	87	Pre-discharge Med Review Education Adherence HV (or by phone) one week after discharge	189	30 days

Shcherbakov and Tereso ⁴¹	Medicare advantage enrollees	78.4	43.6	156	MRec	Those who declined the intervention or did not respond to phone call	89	30 days
2016 USA	Discharged from acute care or skilled nursing facility				Education	Care coordinator HV		
Cheen et al ⁴²	Age ≥60 years	73.6	50.5	99	PCP	Care coordinator HV	402	6 months
2017 Singapore	>5 medications				Home Based Medication Review (HBMR):			
	≥2 unplanned admissions within previous 3 months				Med Review			
	Discharge from acute care				Education			
					PCP			

Abbreviations: Adherence, adherence assessment and/or aids provided; GP, general practitioner; HMR, Home Medicines Review; HV, home visit; IV, intravenous; MD, medical doctor; Med Review, assessment of medication regimen for the purpose of identifying and resolving drug-related problems; MRec, medication reconciliation; RX, pharmacist; PCP, contact primary care physician to resolve DRPs; Remove meds, removal of discontinued or expired medications; n/a, not available.

Table 3 Outcomes reported from non-randomized comparison studies

Economic	↓ Emergency department visits ^{36,40,42} ↓ Hospitalization ^{26,29,32a,35,42} ↑ Hospitalization ³⁸ ↑ Medication costs ^{39b} ↓ Hospital and medication costs ³⁵
Clinical	↓ Drug Burden Index (DBI) ³⁰ ↑ Medication appropriateness ³¹ ↑ Medication discrepancy resolution ²⁸ ↑ Oral anticoagulation knowledge (OAK) ^{34c} ↓ Major and minor hemorrhagic events ³³ ↑ Warfarin persistence ³³ ↑ Medication adherence ³⁵ ↑ DRP identification ³⁶
Humanistic	↑ Satisfaction ^{27,37d,41d}

Notes: ^aFor the time period 2–6 months after RX intervention. No difference for <2 months, 6–12 months; [↑]hospitalization >12 months. ^bSignificantly higher costs of potentially inappropriate medications (PIMs) compared to those who received a home visit from a nurse and no pharmacist home visit. ^cSignificantly higher than usual care at 8 days post-intervention, but not at 90 days. ^dFor intervention group only.

Abbreviations: DRP, drug-related problem; RX, pharmacist.

which was to determine the prevalence of ADEs and potentially inappropriate medication use among the population.

The impact of the HV programs described in these reports were mainly related to identification of DRPs, recommendations made, or medication changes that occurred as a result of the pharmacist's actions.^{44–50,53,55,62–65} A variety of other impacts were also reported: satisfaction,^{43,44,48,52,54,60} time reduction for other disciplines,⁴⁵ ADE identification,^{47,58} perceptions of program,⁵¹ experience,⁶¹ adherence,^{56,59} clinical parameters,^{55,56} and knowledge.^{48,56,60,61} Three programs reported economic outcomes including reduced readmission rate^{52,59} and cost-avoidance.⁶³

National surveys

Five nationwide surveys evaluating pharmacist HV services were identified.^{66–70} An evaluation of general practitioner (GP) engagement in HMR in Australia received 376 (33%) respondents, of which 180 had participated in HMR.⁶⁶ The authors reported that of those who had participated in the HMR, over half did not provide written feedback on the HMR report to the pharmacist or discuss it with the pharmacist. Further, only 10.6% provided the pharmacists with patient information such as recent laboratory results and 6.7% accepted the pharmacist's recommendations, yet over half agreed or strongly agreed that the HMR benefits their patients.

A Canadian survey received 17 responses from pharmacists who provided HVs.⁶⁷ Services provided include: medication reconciliation, adherence assessment, education for

Table 4 Program evaluations of clinical pharmacy home visit services

Study	Patient characteristics	Service description	Evaluation details
Moultry and Poon ⁴³ 2008 USA	Isolated, elderly needing assistance managing medications Referred by community agency N=30 recipients over 1 year	HV 15–60 minutes Med Review MRec Education emergency preparedness Disaster proof medication storage Remove meds Documentation: action plan with DRPs to take to MD Referral to other services as needed	30-item survey completed by 18/30 96% felt knowledgeable about medications after HV 73% felt HV would reduce visits to MD 94% satisfied/somewhat satisfied 100% would recommend program to others
MacAulay et al ⁴⁴ 2008 Canada	Discharged from hospital to home care and one of the following: Age ≥ 80 years ≥ 5 medications Use of high risk medication Chronic condition Suboptimal adherence Benefit from medication education Medication changes during hospitalization Unresolved DRPs at discharge N=27 Average age=81.1 years 67% Female	HV on average 11.7 days after hospital discharge Follow-up HV or by telephone Med Review Adherence Education PCP	98 DRPs: 3.6 DRPs/patient ↓ DRPs from visit #1 to visit #2 116 recommendations: 4.3 recommendations/patient Recommendation significance 17% very significant 71% significant 11% somewhat significant Satisfaction survey (n=16) Overall satisfaction 9.9/10 Importance of HV 9.8/10 Usefulness of HV 9.5/10
Stell et al ⁴⁵ 2008 Australia	Outpatient Disease Management Unit Referrals to RX from unit coordinator for those who may benefit from RX review eg, patients taking multiple medications they organized themselves, new patients, available patients N=24 patients received HV Average age =79 years 42% Female	Med Review PCP	20 medication recommendations 17 medication issues identified for further clinician review N=34 MD responses Perceived medication list more accurate when completed by RX ↓ Time for other clinicians to obtain medication list 5.4 minutes/patient not seen by RX vs 1.8 minutes/ patient seen by RX
Flanagan et al ⁴⁶ 2010 Canada	Age ≥65 years ≥6 Medications Discharge home N=110 Average age =84 years 56% Female	Medication Management Program (MMP) HV within 1 week of discharge Med Review Education Adherence PCP Remove meds	259 DRPs: median 2 DRPs/patient 135 Medication discrepancies: median 1 discrepancy/patient
Eichenberger et al ⁴⁷ 2011 Switzerland	Medication history available at community pharmacy (n=79 pharmacies) with fifth year pharmacy master student interns N=54 Diabetic and age ≥60 years Average age =71.4 years 37% Female N=22 Transplant patient and age ≥18 years Average age =52.6 years 50% Female	76 HVs by students Med Review Adherence Recommendations summarized for supervising RX who could decide on intervention	7.4 DRPs/patient identified vs 3.6 DRPs/patient if HV not conducted Experience of an ADE 19 (86.4%) of transplant patients 26 (48.1%) of diabetes patients
Hussainy et al ⁴⁸ 2011 Australia	Patients referred to palliative care (medication screening by pharmacist) Patients discharged home from hospital: hospital visit prior to discharge and HV 7–10 days thereafter or HV if from a different hospital	HMR Ensuring medication access Team member education	N=422 N=52 HV average 54.4 minutes n=113 DRP interventions n=120 recommendations

(Continued)

Table 4 (Continued)

Study	Patient characteristics	Service description	Evaluation details
Castelino et al ⁴⁹ 2011 Australia	Age ≥ 65 years HMR conducted by seven accredited pharmacists N=224 Average age =74.6 years 53% Female	Consult and collaboration with team Liaison with other health providers (continuity of care) Implementation through education of symptom management protocol (education) HMR	Survey n=20/32 (63%) response 100% role was helpful 90% improved medication knowledge 60% changed practice 95% more likely to discuss medication issues with the pharmacist 1110 DRPs: Average 4.9 DRPs/patient 1114 recommendations to GP 964 recommendations required evidence support; 94% evidence based
Willis et al ⁵⁰ 2011 USA	Age ≥65 years Registered at primary care N=118	Undergraduate pharmacy students performing HV, n=75 Activities: Best possible medication history Falls risk evaluation Blood pressure check Reviewed by pharmacist afterwards No RX HV or intervention	57 (48%) patients had a change in therapy 102 (86%) prescribed a falls risk medication
White and Kliner ⁵¹ 2012 Australia	Chinese and Vietnamese immigrants eligible for, but who have not received HMR N=17 (6 Chinese, 11 Vietnamese)		Two focus groups to assess perceptions of HMR among immigrants Had not heard of HMR, but welcomed it Concern that HMR would upset MD or lack of cooperation Concerns and confusion about medicines RX role is medicine supply GP role is medication decisions Neither GP nor RX helpful in responding to detailed medication questions Difference between ethnicities in trust for MD Language barrier for accessing medication information
Novak et al ⁵² 2012 USA	Medicare patients recently discharged from acute or subacute care High risk for readmission, eg, multiple chronic conditions, multiple medications, multiple hospitalizations in the previous 12 months	Pharmacist Care Manager (PCM) HV 2–3 hours followed by at least weekly telephone calls Med Review MRec Adherence Education Assessment of falls risk, cognition, mental health, nutrition and caregiver needs PCP	30% reduction in readmissions PCM job satisfaction
Kwint et al ⁵³ 2012 The Netherlands	Age ≥65 years ≥5 oral medications Discharge from hospital Use one of 10 community pharmacies N=155 Median age =76 years 54% Female	HV conducted by trained community pharmacists Med Review adjusted and completed by two independent reviewers pharmacists. Reviewer pharmacists prioritized DRPs and sent back to pharmacists to discuss with MD within 4 weeks	DRPs 1565 (10/patient) DRPs based on pre-visit review 415 DRPs identified through HV 905 (58%) DRPs resulted in a recommendation 264/905 (29%) recommendations implemented DRPs identified during HV more likely to have a higher priority and recommendations implemented

(Continued)

Table 4 (Continued)

Study	Patient characteristics	Service description	Evaluation details
Flanagan et al ⁵⁴ 2013 Canada	Age ≥65 years ≥6 medications Discharge from hospital 103/175 (58.9%) respondents Average age = 79.1 years 54.4% Female	Medication Management Program (MMP) HV within 1 week of discharge Med Review Education Adherence Remove meds PCP	Satisfaction survey (telephone) High level of satisfaction Pharmacists easy to understand Appreciation for resources pharmacist provided Recommendations to have more pharmacist home visits and offer phone visits
Martins et al ⁵⁵ 2013 Brazil	Patients with hypertension referred for pharmaceutical care Age 30–74 years Plus 2 of the following: Blood pressure ≥140×90 mmHg Using ≥3 medications Regimen changed ≥ twice in previous year Comorbidity Non-compliance N=14 Average age = 61.6 years 85.7% Female	6 HV × 1 hour/HV, average 30 days between visits Med Review Blood pressure measurement Cardiovascular risk assessment Adherence PCP	142 DRPs (mean=10.1/patient) identified 66/135 (48.8%) pharmaceutical interventions implemented: – pharmacological intervention to optimize treatment: n=27 – preventive pharmacological intervention: n=23 – non-pharmacological intervention: n=16 Cardiovascular risk ↓ n=3 patients ↑ n=1 patient ↔ n=9
Moultry et al ⁵⁶ 2015 USA	African-American patients Age ≥65 years ≥1 anti-hypertensive Living independently N=306 Average age = 74 years 83% Female	Managing Your blood pressure (MY BP) program 2 HV with RX, 1 hour each at baseline and 6 months Biweekly telephone calls by pharmacy student Med Review Medication record and action plan PCP	At 6 months ↓ SBP (mean 140 vs 137 mmHg) ↔ DBP 90% using home BP machine ↓ nonadherence ↑ hypertension knowledge
Poon et al ⁵⁷ 2015 USA	Home-Base Primary Care Veterans' Affairs Patients likely to benefit from a HV N=49 Average age =81 years 12% Female	Drug Regimen Review (DRR) initially and quarterly via chart review by a pharmacist Addition of HV by pharmacy residents and students (accompanying nurse practitioners)	53 DRR and 56 HV 133 recommendations→93(70%) accepted 44(33%) from DRR→27 accepted 89(67%) from HV→66 accepted ↑ DRPs identified and recommendations accepted with HV vs DRR
Onda et al ⁵⁸ 2015 Japan	Age ≥65 years Had received a pharmacist HV N=4243 Average age =82.7 years 73% Female	Survey to pharmacists who did HVs to identify prevalence of adverse drug events (ADEs) and PIM (potentially inappropriate medication)	2053 (48.4%) prescribed a PIM 165/2053 (8%) suspected PIM-induced ADE Top 5 PIMs: H2 blockers, short-acting benzodiazepines, chronic stimulant laxative use, long-acting benzodiazepine, digoxin Top 5 medications associated with ADEs: anticholinergic antihistamines, ultra-long-acting benzodiazepines, sulpiride, short-acting benzodiazepines, digoxin
Kalista et al ⁵⁹ 2015 USA	Recently discharged from hospital to Visiting Nurse Service (VNS) with a primary diagnosis of heart failure N=10 Average age =81.3 years 60% Female	HV by pharmacist/pharmacy resident within 1 week of VNS admission and two telephone calls (at weeks 1 and 4) Med Review Adherence Education	At 28 days: ↑ Adherence 2 patients readmitted vs 38% readmission rate for VNS heart failure patients 1 patient died
Hanna et al ⁶⁰ 2015 Australia	Patients discharged from hospital at high risk of medication misadventure N=487 Average age =72.8 years 50.3% Female	HOMR (Hospital Outreach Medication Review) service provided by a Health Authority pharmacist Med Review Adherence Education PCP	N=217 (45%) patient questionnaire response HV worthwhile ↑ Medication knowledge and understanding of how medications helped medical conditions

(Continued)

Table 4 (Continued)

Study	Patient characteristics	Service description	Evaluation details
			↑ Confidence and ↓ confusion about medications Pharmacist was helpful and suggestions would help them take medications properly N=105/487 (21.6%) MD questionnaire response 96% (n=101) agreed with recommendations 92% would adopt some or all of recommendations 81% (n=85) review provided greater understanding of patients' medication management abilities Semi-structured interviews Participants had limited understanding of HMR Benefits: ↑ knowledge, holistic review, medication improvement, ↑ health seeking behavior, strengthened self-management, encouraged others to have HMR Difficulties: limited information and engagement from pharmacist; delays in process; limited GP follow-up and support for program
Ahn et al ⁶¹ 2015 Australia	Patients who had received HMR N=15	HMR	
Reidt et al ⁶² 2016 USA	Ambulatory care clinic patients Transportation barriers to clinic attendance Unwilling to bring medications to clinic Concerns about environmental factors affecting medication use N=53 patients (74 HV) 55% age ≥65 years 57% Female	Home-based Medication Therapy Management (MTM) HV 30–60 minutes Med Review Education Adherence PCP	62% referrals from internal medicine clinic 51% referrals from MD Top referral reasons: 17% each Nonadherence Transportation barriers Medication reconciliation with public health nurse Median 3 DRPs/patient 40% compliance related
Bailey et al ⁶³ 2016 Surbhi et al ⁶⁴ 2016 USA	≥2 Chronic conditions ≥2 Hospitalizations or 1 hospitalization and ≥2 emergency department visits in previous 6 months Target condition driving diagnosis for index hospitalization Medicaid/Medicare enrollee Age ≥18 years ≥6 medications or 1 high-risk medication N=374	Pre-hospital discharge: Med Review Education Medication list SafeMed: Pharmacy technician conducted post-discharge HV, within 72 hours, and follow-up by telephone calls Assist with MRec and Med Review Reinforce Education Pharmacist: resolve DRPs through targeted MTM via telephone or clinic visit	1264 DRPs: Average 3.4 DRPs/patient 642 DRPs resolved 50.8% of pharmacist recommendations accepted Estimated cost-avoidance =US\$370,681 Cost-avoidance/DRP identified =US\$293.30
Walus et al ⁶⁵ 2017 Canada	Patient referrals sourced from: Home care intakes Patients waiting in acute care for home care service Direct referrals N=122 (135 referrals) Average age =71 years 63.1% Female	HV or telephone appointment with pharmacist N=40 comprehensive Med Review N=95 targeted Med Review or education Documentation and communication in chart, phone calls, fax.	271 DRPs identified: average 2.1/referral 250 recommendations 36/81 (44%) accepted by prescriber 37/43 36/40 pharmacist 19/36 patient Average of 1.5 clinical pharmacy key performance indicators (cpKPIs) identified/referral: DRP resolution, education, development of pharmaceutical care plan

Abbreviations: Adherence, adherence assessment and/or aids provided; DRP, drug-related problem; GP, general practitioner; HV, home visit; MD, medical doctor; Med Review, assessment of medication regimen for the purpose of identifying and resolving drug-related problems; MRec, medication Reconciliation; RX, pharmacist; PCP, contact primary care physician to resolve DRPs; Remove meds, removal of discontinued or expired medications; HMR, Home Medicines Review; ADE, adverse drug event.

patients/caregivers and health professionals, chronic disease monitoring, and assessing acute health concerns. None of the programs was government funded, and three of the pharmacists reported charging a private home care agency for their services. Facilitators for HVs identified in the survey were referrals from physicians and support from management. The barriers cited by respondents were insufficient remuneration and lack of time for completing visits.

A similar survey undertaken among British pharmacists received 247 respondents (81.5% response rate).⁶⁸ The authors reported that 74% of respondents had specific but undefined training, and 81% of the services were funded through Primary Care Trusts. HV services operational beyond a year were those that included social services, GPs, and community nurses in the service protocol of operations and those that received more of their referrals from GPs (90% vs 50%).

Patient preference for medication therapy management was evaluated in Thailand.⁶⁹ Based on the 265 respondents, the authors reported that patients valued this service and preferred pharmacist visits to occur in the pharmacy rather than their home and that the preferred visit length was 20 minutes rather than 1 hour.

In the Netherlands, an evaluation of implementing a HV service to patients after hospital discharge was undertaken using a focus group (22 pharmacists) to identify barriers and facilitators, followed by a survey (20 pharmacist respondents) to score the relevance and feasibility of items identified during the focus groups.⁷⁰ The pharmacists included in this evaluation conducted on average 5.4 HVs/year. The authors reported that both the need for reimbursement and the readiness of community pharmacy to adapt daily routines to implement such a service as two barriers to implementation.

Current perspectives

In addition to the aforementioned reports, 18 articles describing clinical pharmacy services in a home care setting were identified in the literature.^{71–88} In these reports, the pharmacist HV intervention was not evaluated. The following section highlights some current perspectives based on these articles, together with those articles previously described that provided an evaluation of clinical pharmacy HV services.

Competency

Training and qualifications for pharmacists, pharmacy residents and students, and pharmacy technicians involved in HV programs varied. The HMR program in Australia requires pharmacists to be accredited.² In some initiatives training was provided to pharmacists, pharmacy students,

or pharmacy technicians who would be providing the service.^{14–16,33,35,41,42,50,51,53} In other reports, background education or experience of the pharmacists was mentioned.^{14–16,18,19,22,23,38,42,45,60,72,73} No comparison was done at the level of qualifications, experience, or training to outcomes. In our health authority, the pharmacists working in a home care setting as part of the Medication Management Program (MMP) must have completed an Accredited Canadian Pharmacy Residency or equivalent in order to be hired. They receive orientation on conducting HVs and documentation thereafter.

Use of pharmacy students, residents, and pharmacy technicians highlights the use of resources to both provide learning opportunities and also extend the scope of clinical pharmacy services.

Competency of personnel to provide the service influences the extent to which DRPs and issues preventing patients from achieving optimal health can be identified and resolved. It includes clinical knowledge about disease states and drug therapy and the ability to communicate to extract and provide information.

Patients

The most commonly studied patient population was patients who had recently been discharged from hospital.^{14,16,18,19,22,24,25,27–29,33,34,37,38,41,42,44,46,48,52,54,59,60,62,63,74–76} Heart failure was the most commonly mentioned diagnosis.^{14,16,18,22,26,59,74,77} While HVs can be more convenient, not all patients may want or need a HV MR.⁶⁹ Furthermore, they may have preferences for how long it should take.⁶⁹ Several authors commented on the length of time spent at a HV, ranging from 15 minutes to 2 hours.^{14,19,29,37,38,43,47,48,55,56,59,74,78} In addition to HV time, travel time must be considered and these together can prevent HVs from being a broadly available service and highlight the need to restrict the service to those for whom it is necessary.

Several authors reported an increased identification of DRPs as a result of a HV compared with medication list review⁴⁷ or chart review^{53,57} and that the DRPs identified during a HV may be more likely to result in a medication change.^{24,28,64} Patients included in these studies were those who might be expected to have many medications: diabetes,⁴⁷ transplant,⁴⁷ older patients,⁵⁷ and older patients discharged from hospital.⁵³ Poon et al identified veterans who were likely to benefit from a HV service; however, they do not further articulate this criteria.⁵⁷ Age was often a consideration in the articles included in this review and may impact the outcome; although this was reported by Hanna et al, the numbers in

each age group were too small to make conclusions about the impact of age.³⁸ Vuong et al described inclusion criteria indicative of frailty in their study that selected individuals beyond age, number of medications, and discharge from hospital.¹⁹ Frailty may be a criteria to use in deciding for whom outpatient clinical pharmacy services be delivered, including HVs, as medications can impact both physical and cognitive functioning.⁸⁹

Safety

Safety for pharmacists conducting HVs was discussed in five articles.^{36,60,76,79,80} Safety strategies reported include: conducting HVs in pairs;⁷⁶ texting to inform of arrival and departure times⁷⁶ calling patients not previously met prior to arrival;⁸⁰ and wearing a uniform or badge.⁸⁰ Pre-screening of patients with a safety risk assessment was described, with those patients believed to be a safety risk to staff ineligible for a HV.⁶⁰ Similarly, in our health authority, a pre-visit telephone risk assessment screen is conducted, with follow-up items to be assessed during the HV. Depending upon the risk identified and whether or not it can be mitigated for the HV, either staff do not conduct the HV or conduct it with a security personnel.

As patients for whom HVs are provided are typically more frail, staff safety may be overlooked in HV initiatives. However, the safety of the neighborhood, the residence, the presence of pets and other inhabitants, as well as patient/caregiver/cohabitant illness and recreational drug use must also be considered.

Technology

Ten articles discussed the use of technology to aid in pharmacist HVs.^{27,36,37,40,50,62,74,76,81,83} The majority described using an electronic medical record (EMR) as a way for the pharmacist to get information about the patient's medical conditions and/or communicate with the primary care provider.^{27,36,40,50,62,74,76,81} Access to medical records, whether EMR or not, is essential to aid a pharmacist to better assess a medication regimen.¹² The use of an electronic personal health record (ePHR) that allows patients or caregivers to maintain medical information and a medication list and exchange this information with health professionals was reported to result in identification of DRPs in significantly more patients during a HV compared to patients who did not use the ePHR.³⁷ Use of a clinical information system to assess patient genomics and support a pharmacist's assessment of drug interactions among home care clients resulted in significantly reduced re-hospitalizations compared to

those whose drug interactions were assessed using clinical judgment and a drug information resource.⁸² This RCT was not an evaluation of a pharmacist HV service; some HVs were provided, but illustrates a resource that could be used to enhance MR services provided in the home.

Besides the ePHR system, all the technology described was for use by pharmacists prior to and/or after a HV, and the need for Internet connectivity in patient homes was not discussed. The ePHR system would necessitate patient access to the Internet. Pharmacist access to the Internet at patient homes is an important aspect to consider in expanding the use of technology for HV clinical pharmacy services.

Collaboration

The majority of HV programs described in the literature involved pharmacists providing the service and connecting with other health care professionals, such as physicians in order to communicate the findings from their assessment and make suggestions for changes. The reported physician acceptance of recommendations varied from 18% to 95%.^{14,18,23,24,28,29,42,44,65} The extent to which communication with prescribers occurred or the suggestions for change that were implemented was not always detailed. Furthermore, pharmacist and physician collaboration may not happen, even if it was the expectation of a program.⁶⁶ Authors of an evaluation of pharmacist recommendation implementation and the extent of collaboration between pharmacists and GPs reported on average 50% (range 17%–86%) of pharmacist recommendations were implemented in the 12 RCTs included in the review.⁹⁰ Implementation rate was higher with increased presence of elements reflective of collaboration, such as pharmacist with clinical experience; patient's regular pharmacist providing the intervention; sharing of medical records; patient interview by a pharmacist; referral by GP; case conference; formulation of an action plan; and follow-up on actions.

As many of the programs described and evaluated in this review were new initiatives, the time needed for relationship building for collaborative practice with other health care professionals may not have been sufficient to be able to effect changes to patients' medications and consequently health outcomes. Strategies to leverage existing relationships or create the opportunity for relationship building described in the studies include involving community pharmacists in providing HV programs,^{27,47,53,67} inserting a pharmacist as part of a multidisciplinary team,^{23,42,48,77,81,82} or adding the HV component to an existing clinical pharmacy service.⁵⁷

The extent of collaboration can also depend upon the setting from which HV services are offered. Settings identified in the HV literature include: dispensing pharmacy,^{24,44,53,58,69,71,76,77,78,84} home care,^{28,29,36,46,54,59,65,81,83} chronic disease management or specialty service,^{23,25,43,45,48,54,62,75,79,82} institutional transition service,^{22,37,38,40,42,44,63,64,73,74} health care agency,^{41,52,57,70,72} and primary care.^{15,20,24,35,39,50,55} Pharmacists working in health authority or multidisciplinary teams may have more opportunity to establish collaborative relationships; however, collaborative partnerships can also be established in community settings. A downside of HV services being offered from a community pharmacy can be limited time to conduct HVs and lack of funding.^{65,66,68}

Several authors described pharmacists providing HV services with other health care providers: paramedics,⁷⁴ nurses,^{28,42} social workers,⁸⁴ multidisciplinary teams,^{36,48,68,77,81} and with a nurse practitioner and primary care physician.^{21,40,85} Co-visiting patients with other health care providers is not only an opportunity to strengthen the team relationships but can enhance collaboration at the point of patient care through the opportunity for complementary skill sets. For example, a pharmacist working in a palliative care team reportedly increased medication-related knowledge of team members and patients.⁴⁸

Another important aspect of relationship and collaboration is referral. Receiving referrals from a physician may not only impact the longevity of a HV program,⁶⁸ but also may result in more collaboration for making medication changes through case conferences.^{15,53,71} However, receiving referrals for a pharmacist HV intervention may not occur, despite being recommended.²³

HV activities

MR and MRec were the two most commonly reported HV activities, with education, adherence assessment, and removal of medications no longer used occurring often. Other activities reported less frequently were: pharmacist performing physical assessments;^{36,50} chronic disease monitoring;^{20,25,50,55,56,67} education for lifestyle changes;⁸⁷ falls assessment;^{50,52} and assessment of cognition,⁵² mental health,⁵² nutrition,⁵² and caregiver needs.⁵² A HV is an ideal opportunity to assess many aspects of a patient's health status, balancing that with what is the best use of a pharmacist during the HVs needs to be considered.

Autonomy

The impact of pharmacists being able to enact their medication recommendations was not reported; rather pharmacists

relied on prescriber acceptance of their recommendations. For example, unlike hospital settings where anticoagulation protocols have been established to allow pharmacists to dose adjust warfarin, HMR pharmacists discussed warfarin dosing changes with a physician.⁷³ Prescribing authority for pharmacists is likely to impact this. Matthies describes his role conducting HVs to patients discharged from an emergency department and his ability to initiate or alter patients' medications.⁸⁸ His collaboration with a primary care physician and health authority position allows him access to both EMRs, as well as a collaborative working environment. Collaborative working relationships with other health care professionals and access to information necessary to properly assess drug therapy should not be considered less important if pharmacists have prescribing authority.

Limitations

It is likely that there are more home care clinical pharmacy services occurring than have been reported in the literature and identified for this review. Surveys done in Canada and the UK illustrate the breadth of services available in these jurisdictions; however, individual reports of all services included in the surveys were not found. Furthermore, it is likely that not all publications were found as the two separate literature searches conducted had only 22 citations in common.^{11,14,15,22,26,27,29,32,39–42,50,59,60,66,67,73,75–78} In addition, one evaluation of the MMP, that exists in our health authority, failed to show up in either search.⁴⁶ No comparison to inpatient clinical pharmacy literature was conducted to evaluate whether elements that contributed to positive outcomes in the inpatient setting can or do exist in the HV clinical pharmacy services literature.

Conclusion

Pharmacist HV services are available in many countries throughout the world. Unlike literature from inpatient settings, the outcomes reported are equivocal, particularly related to the impact of a pharmacist HV intervention on subsequent health care costs. Mirroring the conclusions of a previous review of clinical pharmacy services in the home, further refinement of how pharmacist HV services should exist is needed, including the patient population ideally served by a HV and a practice model that best contributes to collaborative practice.¹² Other important elements to consider in both establishing and evaluating a HV program, and which may be applicable to other settings in which clinical pharmacy services are offered, were identified. These include: staff competency, use of technology, staff safety,

activities to be performed during a clinical pharmacy intervention (eg, HV), and pharmacist autonomy. Consideration of these elements could help to generate further substantiation of the role of pharmacists providing clinical services in a home care setting.

Disclosure

The authors report no conflicts of interest in this work.

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