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RESEARCH ARTICLE

An evaluation of medication review reports across different settings

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Abstract *Background* There is a growing body of evidence which supports that a pharmacist conducted medication review increases the health outcomes for patients. A pharmacist integrated into a primary care medical centre may offer many potential advantages in conducting medication reviews in this setting however research describing this is presently limited. *Objective* To compare medication review reports conducted by pharmacists practicing externally to a medical centre to those medication review reports conducted by an integrated practice pharmacist. The secondary objective was to compare medication review reports conducted by pharmacists in the patient's home to those conducted in the medical centre. *Setting* A primary care medical centre, Brisbane, Australia *Method* A retrospective analysis of pharmacist conducted medication reviews prior to and after the integration of a pharmacist into a medical centre. *Main outcome measures* Types of drug related problems identified by the Pharma cists, recommended intervention for drug related problems made by the pharmacist, and the extent of implementation of pharmacist recommendations by the general practitioner. *Results* The primary drug related problem reported in the practice pharmacist phase was Additional therapy required as compared to Precautions in the external pharmacist phase. The practice pharmacist most frequently recommended to add drug with Additional monitoring recommended most often in the external pharmacists. During the practice pharmacist phase 71 % of recommendations were implemented and was significantly higher than the external pharmacist phase with 53 % of recommendations implemented ($p < 0.0001$). Two of the 23 drug related problem domains differed significantly when comparing medication reviews conducted in the patient's home to those conducted in the medical centre.

Keywords Australia · Drug related problems · General Practice · HMR · Medication review · Pharmacist

Impact of findings on practice

- General practice medical centres can provide an opportune setting to extend pharmacist led quality use of medicine services such as medication review.
- Integrating a pharmacist into a general practice medical centre may significantly increase the implementation rate of pharmacist recommendations made to general practitioners from medication reviews.
- There are small differences in drug related problems identified by pharmacists during medication reviews conducted in the patient's home compared with those conducted at a medical centre.
- The ability for the pharmacist to access the patient's medical file for the purpose of conducting a medication review allows opportunity to obtain further relevant clinical information potentially facilitating more targeted and less conjectural recommendations to general practitioners.

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Introduction

The home medicines review (HMR) program was introduced into the Australian setting to enable individuals residing in the community to maximize the benefits of their medication regimen and to help prevent drug related problems (DRPs) [1]. Pharmacists wishing to conduct HMRs must first undergo further training to achieve accreditation. During the HMR consultation the accredited pharmacist interviews the patient and reviews their medicines to identify DRPs. Preferably the interview is conducted at the patients home however may also be conducted in another setting based on patient preference or extenuating circumstances. A report is then provided to the general practitioner (GP) outlining the DRPs identified during the consultation. The pharmacist will also make recommendations to the GP on potential solutions to the DRPs.

The HMR process, in Australia, involves a referral from the GP to the individuals preferred community pharmacy, which in turn would organise an accredited pharmacist to provide the service. A direct referral model (from GP to accredited pharmacist) was established in October 2011, in addition to the previously mentioned pathway, to help overcome some of the barriers identified with the program, namely timeliness and uptake of the service [2]. The change in the HMR model may help facilitate a closer working relationship between pharmacists and GPs. It may also provide impetus for the development of a model where the pharmacist can integrate into general practice medical centres alongside GPs and other health practitioners. [3].

There is a mixed and growing body of evidence that HMRs (and more globally, medication review) conducted by a pharmacist increases the health outcomes for patients and may have positive economic outcomes (for patients at high risk of medicine misadventure). [4–7] Furthermore, a reduction in DRPs may be considered a surrogate maker for improved health outcomes for patients [8]. However, only a proportion of recommendations made by pharmacists to GPs are implemented, potentially reducing the impact of the HMR. [9–12].

The Australian HMR guidelines states that the consultation between the patient and pharmacist is conducted at the patient's home except in exceptional circumstances [13]. This makes the assumption that the ability for the pharmacist to examine a patient's medication regimen and management is improved in the home environment and while this is logical, there is no published research to support this statement. A pharmacist integrated into a medical centre may offer potential advantages in conducting HMRs. These may include but are not limited to the integrated pharmacist having access to the shared patient medical file, improved rapport between the GPs and the pharmacist, and increased opportunities for communication and collaboration between health care providers. Evidence suggests that an integrated pharmacist conducting HMRs increases the timeliness, uptake, and completion of HMRs [14] however it is not known what impact this has on identification of DRPs, recommendations made by the pharmacist, or recommendation implementation rates.

Aim of the study

The primary aim of this project was to compare HMR reports conducted by pharmacists practicing externally to a medical centre to those HMR reports conducted by an integrated pharmacist in relation to DRPs identified, recommendations made and GP uptake of the recommendations.

The secondary aim was to compare HMRs conducted by the integrated pharmacist in the patient home with those conducted by the integrated pharmacist in the medical centre.

Method

The study involved a retrospective analysis of HMRs prior to and after the integration of a pharmacist into a general practice medical centre.

In April 2009, a pharmacist (CF) commenced practicing in a general practice medical centre located in a metropolitan suburb of Australia. The pharmacist was provided with a consultation room and had access to the patient's electronic medical file. Initially, the primary role of the pharmacist was the provision of HMRs. A description of the practice model can be found elsewhere [14, 15].

To address the primary aim, HMRs conducted in two time periods were compared:

1. October 2001 to March 2009—reflecting the time between the start of the HMR program in Australia to the date when the pharmacist joined the practice. This time period was labelled the external pharmacist phase;
2. April 2009 to March 2010—reflecting the first 12 months of the pharmacist practicing from the medical centre. This time period was labelled the practice pharmacist phase.

During the external pharmacist phase, HMRs were conducted by thirteen accredited pharmacists with no association to the medical centre, engaged by the patients preferred community pharmacy. The external pharmacists had undergone the same credentialing to provide HMRs as the pharmacist in the practice pharmacist phase. Patients in the external pharmacist phase were identified and selected for HMR using the same process as in the

practice pharmacist phase. A longer time frame was used in the external pharmacist phase to provide opportunity for greater numbers of HMRs to be compared.

To address the secondary aim the location of the HMRs during the practice pharmacist phase were identified and compared (Fig. 1).

The HMR reports were compared using three outcome measures:

1. Types of DRPs identified by the pharmacist,
2. Recommended intervention for identified DRPs made by the pharmacist, and
3. The extent of implementation of pharmacist recommendations by the GP.

Data collection and extraction

The electronic database held within the medical centre was searched for referrals for HMRs as a means of identifying patients who may have had a HMR conducted. Once identified, the patient's individual medical file was manually examined for the HMR report and the subsequent GP consultation entries over a 12 month period to determine if recommendations had been implemented by the GP. To address the secondary aim, the location of the pharmacist consultation was also recorded as either at the medical centre or in the patient's place of residence (Fig. 1). The external pharmacist phase was excluded from the secondary analysis as it was not clear from the report where the HMR consultation was conducted. The same outcome measures were used in both the primary and secondary analysis.

To categorise and code the HMR reports findings (DRPs identified by the pharmacist) and recommendations (made by the pharmacist to the GP) an adapted version of the St George Canterbury Medico/Pharmacy Project coding system was used [16]. The modification involved removing codes which the authors deemed not to be DRPs including *information not found*, *no intervention necessary*, *information missing* and *no finding*. This coding system is composed of twenty-three domains to classify DRPs and 19 domains to classify recommendations made by the pharmacist to the GP. To code the respective recommendation outcomes (implementation of pharmacist recommendations by GP) an adapted version of the Pharmaceutical Care Network Europe (PCNE) classification scheme for DRPs (version 6.2) was utilised [17]. The PCNE was adapted such that there are three primary domains with six sub domains to classify the extent of recommendation implementation. To ensure consistency and accuracy of coding each HMR report and extent of recommendation implementation was categorized by two research assistants with any discrepancies resolved by one of the authors (CF).

Statistical analysis

Fischer's exact tests were used to compare the number of DRPs, pharmacist recommendations, and recommendation outcomes between the practice pharmacist phase and the external pharmacist phase. The same test was also employed to compare the number of DRPs, pharmacist recommendation, and recommendation outcomes between HMRs conducted in the patient's home and those conducted in the medical centre during the practice pharmacist phase. As there were multiple tests performed, Bonferroni corrections were applied.

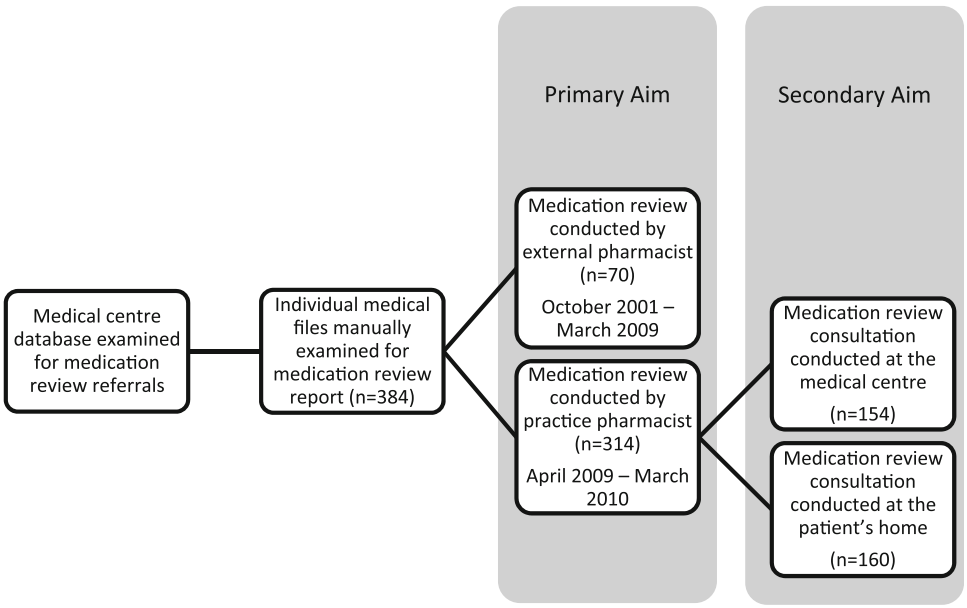

Fig. 1 Diagrammatic representation of the study design and analysis

Table 1 Demographic Data

	Practice pharmacist phase $n = 314$	External pharmacist phase $n = 70$	p
Female gender (%)	208 (66 %)	43 (61 %)	0.44
Median age at time of referral (age range)	81 years (9–97)	81 years (56–93)	0.3
Living within post code of medical centre (%)	195 (62 %)	40 (57 %)	0.44

Mann–Whitney U test was used to compare the median age of patients

This study was approved by the Human Research Ethics Committee of the University of Queensland in accordance with the National Health and Medical Research Council's guidelines, approval number 2011/1.

Results

A total of 384 HMR referrals were identified between October 2001 and March 2010 from the medical centre's data base. Of these 70 HMRs were referred during the external pharmacist phase while the remaining 314 HMRs were referred during the practice pharmacist phase.

Demographic data between the two phases was not significantly different (Table 1). During the external pharmacist phase 377 drug related problems were identified with 5.4 DRPs per HMR [range 0–15]. This compared to 1,119 DRPs in the practice pharmacist phase with 3.6 DRPs per HMR [range 1–11].

Types of drug related problems identified

Comparing the types DRPs identified in the external pharmacist and practice pharmacist phases shows seven of the twenty-three domains were significantly different (Table 2). In comparing the types of DRPs between HMRs conducted in the home with those conducted in the practice, two of the twenty-three domains were significantly different.

Recommendation made by the pharmacist

Recommendations made by the pharmacist to the referring GP were also compared. Between the external and practice pharmacist phases two of the nineteen domains differed significantly. The pharmacist recommended to *add drug* significantly more often in the practice pharmacist phase while in the external pharmacist phase *additional monitoring* was recommended significantly more often by the pharmacists.

The secondary analysis also had two of the nineteen domains differ significantly. When the consultation was held in the patient's home the pharmacist was more likely to recommend *monitoring of compliance* and to *suggest a medication aid/device*.

Extent of pharmacist recommendation implementation

The practice pharmacist phase had a significantly greater uptake of recommendations compared to the external pharmacist phase (71 % compared to 53 %, $p = < 0.0001$), Table 4. No outcome domains significantly differed when comparing consultations under taken in the patient home or medical centre during the practice pharmacist phase.

The number of DRPs (Table 2) does not align with the number of recommendations made (Table 3) and the number of review outcomes (Table 4). This resulted from the modification made to the DRP coding system.

Discussion

The results from this study establish that the types of DRPs identified and associated recommendations made by a pharmacist integrated into a medical centre were mostly similar to those identified by an external pharmacist. However there were some important differences seen within these measures which are discussed below.

A key difference between the external pharmacist and practice pharmacist phases was the implementation rate of the pharmacist recommendations with a greater uptake found with an integrated pharmacist model. However, when comparing the implemented recommendations per HMR between the external and practice pharmacist phases, there appears to be no difference (2.9 actions/HMR and 2.6 actions/HMR respectively). This is due to more DRPs identified per HMR in the external pharmacist phase. This study also demonstrates that there were minimal differences between conducting the HMR consultation in the patient's home compared with the medical centre with respect to the types or numbers of DRPs identified, recommendations made, and recommendation implementation rates.

The patient demographics and number of drug related problems identified in this study are consistent to those seen in other studies examining pharmacist conducted HMRs [10, 18]. Stafford et al. reported a mean 4.8 DRPs per patient and Sorensen et al. reported an average of 5.5 DRPs per patient which closely aligns with our figures [10, 18].

Primary analysis—practice versus external pharmacist phases

The top three DRPs identified in the practice pharmacist phase included *Additional therapy required*, *ADR observed*,

Table 2 Differences in drug related problems identified within HMRs

Review finding	Primary analysis			Secondary analysis		
	practice pharmacist phase (%) $n = 1119$	External pharmacist Phase (%) $n = 377$	p	Interview conducted in patient's home (%) $n = 541$	Interview conducted in medical centre (%) $n = 578$	p
Additional monitoring	30 (3)	5 (1)	0.1679	12 (2)	18 (3)	0.4595
Additional therapy required	194 (17)	25 (7)	<0.0001‡†	99 (18)	95 (16)	0.43
ADR observed	132 (12)	52 (14)	0.321	60 (11)	72 (12)	0.5169
Risk of ADR	12 (1)	22 (6)	<0.0001‡†	8 (1)	4 (1)	0.2511
Compliance issue	91 (8)	35 (9)	0.5211	45 (8)	46 (8)	0.8277
Contra-indications	9 (1)	1 (0)	0.4670	7 (1)	2 (0)	0.0978
Dose too high	34 (3)	9 (2)	0.5957	18 (3)	16 (3)	0.6054
Dose too low	30 (3)	2 (1)	0.0119‡	12 (2)	18 (3)	0.4595
Drug interaction[a]	67 (6)	26 (7)	0.5396	27 (5)	40 (7)	0.3123
Duration of regimen	1 (0)	1 (0)	0.4423	1 (0)	0 (0)	0.4831
Incorrect strength	0 (0)	1 (0)	0.2532	0 (0)	0 (0)	[c]
Laboratory test monitoring	101 (9)	19 (5)	0.0117‡	54 (10)	47 (8)	0.2975
No diagnosis documented	1 (0)	0 (0)	1.0000	1 (0)	0 (0)	0.4831
Order clarification/ omission	27 (2)	6 (2)	0.4213	13 (2)	14 (2)	1.0000
Pathology test abnormal	9 (1)	0 (0)	0.1226	4 (1)	5 (1)	1.0000
Precautions	87 (8)	58 (15)	<0.0001‡†	40 (7)	47 (8)	0.6572
Sub-optimal[b]	108 (10)	36 (10)	1.0000	59 (11)	49 (8)	0.1881
Therapeutic duplication	4 (0)	9 (2)	0.0010‡†	0 (0)	4 (1)	0.1252
Unnecessary drug therapy	52 (5)	22 (6)	0.4104	21 (4)	31 (5)	0.2584
Unused/unnecessary PRN drug therapy	4 (0)	2 (1)	0.6467	1 (0)	3 (1)	0.6252
Would benefit from medication aid/ device	22 (2)	2 (1)	0.0584	19 (4)	3 (1)	0.0003‡†
Untreated indication	15 (1)	17 (5)	0.0007‡†	9 (2)	6 (1)	0.4397
Sub optimal response to therapy	89 (8)	27 (7)	0.6575	31 (6)	58 (10)	0.0080‡

n number of DRPs identified

[a] *Drug Interaction* drug/allergy; drug/drug; drug induced therapy; drug/disease; drug/food; drug lab-test interactions

[b] *Sub-optimal* dose form; dose regimen; drug; duration of use; route; storage; administration technique

[c] Unable to calculate *p* value

‡ Statistically significant ($p < 0.05$)

† Statistically significant after Bonferroni correction ($p < 0.0021$)

and *Sub-optimal* (see key in Table 2). *Precautions*, *ADR observed*, and *Sub-optimal* (see key in Table 1) where found to be the top three DRPs identified in the external pharmacist phase. These findings closely align with results from Australian research on identified DRPs from HMRs [19].

Significant differences in the DRPs domains between the practice and external pharmacist phases included *additional therapy required*, *risk of ADR*, *dose too low*, *laboratory test monitoring*, *precautions*, *therapeutic duplication*, and *untreated indication*. Many of these differences may be

Table 3 Differences in HMR recommendations

Review recommendation	Primary analysis			Secondary analysis		
	Practice pharmacist phase (%) $n = 1133$	External pharmacist phase (%) $n = 384$	p	Interview conducted in patient's home (%) $n = 547$	Interview conducted in medical centre (%) $n = 586$	p
Add drug	226 (20)	52 (14)	0.0047‡	96 (18)	130 (22)	0.0533
Additional monitoring	170 (15)	88 (23)	0.0005‡†	82 (15)	88 (15)	1.0000
Advise administration techniques	33 (3)	6 (2)	0.1912	14 (3)	19 (3)	0.5967
Change dosage form	35 (3)	13 (3)	0.7383	16 (3)	19 (3)	0.8460
Change dose	128 (11)	44 (11)	0.9260	55 (10)	73 (12)	0.2224
Change drug	96 (8)	23 (6)	0.1251	47 (9)	49 (8)	0.9153
Change duration	0 (0)	0 (0)	[a]	0 (0)	0 (0)	[a]
Change route	0 (0)	0 (0)	[a]	0 (0)	0 (0)	[a]
Change schedule	68 (6)	21 (5)	0.8018	33 (6)	35 (6)	1.0000
Change timing	3 (0)	2 (1)	0.6057	1 (0)	2 (0)	1.0000
Confirm diagnosis	1 (0)	0 (0)	1.0000	1 (0)	0 (0)	0.4828
Confirm dose	11 (1)	8 (2)	0.1095	5 (1)	6 (1)	1.0000
Discontinue drug	98 (9)	28 (7)	0.4545	49 (9)	49 (8)	0.7517
Investigate further	111 (10)	47 (12)	0.1770	55 (10)	56 (10)	0.8416
Monitor compliance	30 (3)	6 (2)	0.3308	20 (4)	10 (2)	0.0434‡
No recommendation	53 (5)	12 (3)	0.2430	22 (4)	31 (5)	0.3279
Patient documentation of disease state	1 (0)	2 (1)	0.1596	1 (0)	0 (0)	0.4828
Suggest medication aid/device	28 (2)	11 (3)	0.7093	24 (4)	4 (1)	<0.0001‡†
Use non-drug therapy	41 (4)	21 (5)	0.1348	26 (5)	15 (3)	0.0560

n number of recommendations made by the pharmacist

[a] Unable to calculate p value

‡ Statistically significant ($p < 0.05$)

† Statistically significant after Bonferroni correction ($p < 0.0026$)

explained by the access (or lack thereof) to the patient's medical file. Having access to the medical file would provide insight into the medical care (management plan) of the patient (including that from specialist physicians), otherwise not gathered. This logic could also be applied to many of the other domains which differed significantly between the two phases. For example, having access to specialist physician correspondence may provide reasoning for a potential DRPs coded as *therapeutic duplication*. Access to the medical file may also provide an explanation as to the difference in the number of DRPs per HMR between the two groups. The higher DRPs/HMR rate in the external pharmacist phase may have resulted from insufficient patient data.

The top three recommendations made by the pharmacist to the GP in the practice pharmacist phase included *Add drug*, *Additional monitoring*, and *Change dose*. Similar findings were reported in the external pharmacist phase with *Add drug*, *Additional monitoring*, and *Investigate further* the three most common recommendations. Castelino et al. reported the need for *additional medication*, *any form of monitoring*, and *investigation tests recommended* as the top three recommendations made by pharmacists to GPs on HMRs which closely correspond to our results [19].

Although *Add drug* and *Additional monitoring* domains were in the top three recommendations of both phases, there was significantly greater proportion of *Add drug*

Table 4 Differences in HMR recommendation outcomes

Review outcome	Primary analysis			Secondary analysis		
	Practice pharmacist phase (%) $n = 1133$	External pharmacist phase (%) $n = 401$	p	Interview conducted in patient's home (%) $n = 547$	Interview conducted in medical centre (%) $n = 586$	p
Outcome of intervention not known	25 (2)	34 (9)	<0.0001‡†○	9 (2)	16 (3)	0.2313
Problem totally solved	613 (54)	121 (32)	<0.0001‡†	299 (55)	314 (54)	0.7208
Problem partially solved	57 (5)	55 (14)	<0.0001‡†	21 (4)	36 (6)	0.0788
Pharmacist supplied advice to patient	133 (12)	26 (7)	0.0051‡†	67 (12)	66 (11)	0.6446
Action taken due to pharmacist medication review	803 (71)	202 (53)	<0.0001‡†○	387 (71)	416 (71)	0.9479
Problem not solved, lack of cooperation from patient	44 (4)	8 (2)	0.1053	25 (5)	19 (3)	0.2826
Problem not solved, lack of cooperation from prescriber	245 (22)	137 (36)	<0.0001‡†	120 (22)	125 (21)	0.8287
Problem not solved, intervention not effective	2 (0)	2 (1)	0.2677	0 (0)	2 (0)	0.5002
No need or possibility to solve the problem	14 (1)	1 (0)	0.1346	6 (1)	8 (1)	0.7910
No action taken due to pharmacist medication review	305 (27)	148 (39)	<0.0001‡†○	151 (28)	154 (26)	0.6392

n number of recommendations made by the pharmacist

‡ Statistically significant ($p < 0.05$)

† Statistically significant after Bonferroni correction; 8 tests ($p < 0.0063$)

○ Statistically significant after Bonferroni correction; 3 tests ($p < 0.0167$)

recommendations made in the practice pharmacist phase and a greater proportion of *Additional monitoring* recommendations in the external pharmacist phase. This result is not surprising given that *Additional therapy required* (relating to *Add drug*) and *Precaution* (relating to *Additional monitoring*) was found to be the top DRPs in the practice pharmacist phase and external pharmacist phase respectively.

Table 4 demonstrates that 53 % of the recommendations made by the pharmacist in the external pharmacist phase were implemented by the GPs. This figure closely aligns with implementation rates in other research from Australia on pharmacist conducted HMRs. [9, 10] The implementation rate of recommendations in the practice pharmacist phase was significantly higher with 71 % of recommendations coded as implemented. Although not measured during this study the greater uptake of recommendations may relate to an enhanced rapport between the pharmacist and the GP and also the pharmacist having access to the medical file made recommendations more targeted and less conjectural. Furthermore, being integrated into the medical centre provided greater opportunity for verbal communication to take place both formally and informally (such as passing in the hallway or in the lunch room). This may account for the significantly greater proportion of recommendations fully implemented by the GPs in the practice pharmacist phase (Table 4). The theory between closer rapport and increased uptake of recommendation has been reported elsewhere which found that GPs are more likely to respond positively to pharmacists who they know well [20].

Secondary analysis—home versus medical centre consultations

The home medicines review findings between consultations conducted in the patient's home compared to the medical centre in the practice pharmacist phase were very similar. Differences occurred in two DRP domains with a greater proportion of DRPs around *benefiting from medication aid/device* found in consultations conducted in the home. This

might suggest that conducting the review in the patient's home enables greater insight on how the patient is managing their medications. However, the result may have been potentially biased. The patient's, at the time of referral for a HMR, could select where they preferred the consultation to be conducted. Potentially the sicker, less mobile patients would prefer a home review and it would be expected this would be the group more likely to have difficulties managing their medications (potential for increased levels of confusion and changes to medication regimen).

The differences in the domains of pharmacist recommendations to the GPs were again similar between the two groups. Where difference occurred, they were related to the differences found in the DRP domains. There were no significant differences found in the uptake of recommendations made by the pharmacist to the GPs. This suggests that location of the HMR consultation has no impact on whether recommendations are implemented or not and may further support the increase rapport between pharmacist and GP outlined above.

Limitations

This study has several limitations. Firstly, the practice pharmacist phase involved one pharmacist practicing in one medical centre and as such the results obtained here may not be transferable to other medical centres. It is also not clear if the differences observed are mainly attributable to the integration of a pharmacist into the medical centre or due to the clinical and communicative skills of the individual pharmacist within the medical centre. Further to this, as there were several pharmacists conducting the HMRs in the external phase and that a sole pharmacist in the practice phase may account for differences found between the two phases.

The retrospective nature of the study also limited the amount patient data that was available for collection and potential confounders such as number of medications or medical conditions could not be accounted for. Although the study was conducted retrospectively, CF who conducted the HMRs and the analysis was not blinded to the study objectives. The coding system used to categorize and code DRPs has ambiguous elements. Identified DRPs could be coded under more than one category. To aid consistency in coding, only two people were tasked to code with discrepancies resolved by CF.

Another limitation is that information relating to DRPs and the recommendations made by the pharmacists relied solely on the HMR reports. Drug related problems which may have been identified and solved without being included in the report would have been missed in this analysis. This may include DRPs that the pharmacist had solved without input from the GP or DRPs which had been verbally discussed with the GP. However, given the similarity of the external pharmacist phase results to that of previous studies supports the findings of this study.

Conclusion

The results from this study show that a pharmacist integrated into a general practice medical centre to conduct HMRs had similar DRPs identified and made similar recommendations to that of an external pharmacist with some important differences. Furthermore, the integrated pharmacist identified a lower rate of DRPs as compared to externally operating pharmacists. The proposed cause of these differences was attributed to the practice pharmacist having access to the patient's medical file. Significantly higher rates of recommendations were implemented by the GPs when the pharmacist is integrated into the medical centre.

There were minimal differences in having the HMR consultation conducted in the patient's home compared to the medical centre with respect to type of DRP identified, recommendations made to the GP, or the implementation of the recommendations.

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Conflicts of interest The Authors declare that they have no conflicts of interest to disclose.

References

1. The Pharmacy Guild of Australia. Home Medicines Reviews. [Internet] Canberra: The Pharmacy Guild of Australia; 2011 [28 May 2011]; Available from: http://www.guild.org.au/The_Guild/tab-Pharmacy_Services_and_Programs/Medications_Management/Home_Medicines_Review/Home+Medicines+Reviews.page?.
2. Campbell Research and Consulting Pty Ltd. Home medicines review program qualitative research project final report. Canberra, Department of Health & Ageing; 2008.
3. Ackermann E, Williams I, Freeman C. Pharmacists in general practice–a proposed role in the multidisciplinary team. Aust Fam Physician. 2010;39(3):163–4.
4. Stafford L, Peterson GM, Bereznicki LR, Jackson SL, van Tienen EC, Angley MT, et al. Clinical outcomes of a collaborative, home-based post discharge warfarin management service. Ann Pharmacother. 2011;45(3):325–34.
5. Roughead EE, Barratt JD, Ramsay E, Pratt N, Ryan P, Peck R, et al. The effectiveness of collaborative medicine reviews in delaying time to next hospitalization for patients with heart failure in the practice setting: results of a cohort study. Circ Heart Fail. 2009;2(5):424–8.
6. Stafford A, Tenni P, Peterson G, Doran C, Kelly W. VALMER (the Economic Value of Home Medication Reviews). Canberra, The Pharmacy Guild of Australia;2010. Report No.: IIG-021.

7. Holland R, Desborough J, Goodyer L, Hall S, Wright D, Loke YK. Does pharmacist-led medication review help to reduce hospital admissions and deaths in older people? A systematic review and meta-analysis. Br J Clin Pharmacol. 2008;65(3):303–16.
8. Niquille A, Bugnon O. Relationship between drug-related problems and health outcomes: a cross-sectional study among cardiovascular patients. Pharm World Sci. 2010;32(4):512–9.
9. Castelino RL, Bajorek BV, Chen TF. Retrospective evaluation of home medicines review by pharmacists in older australian patients using the medication appropriateness index. Ann Pharmacother. 2010;44(12):1922–9.
10. Sorensen L, Stokes JA, Purdie DM, Woodward M, Elliott R, Roberts MS. Medication reviews in the community: results of a randomized, controlled effectiveness trial. Br J Clin Pharmacol. 2004;58(6):648–64.
11. Vinks TH, Egberts TC, de Lange TM, de Koning FH. Pharmacist-based medication review reduces potential drug-related problems in the elderly: the SMOG controlled trial. Drugs Aging. 2009;26(2):123–33.
12. Krska J, Cromarty JA, Arris F, Jamieson D, Hansford D, Duffus PR, et al. Pharmacist-led medication review in patients over 65: a randomized, controlled trial in primary care. Age Ageing. 2001; 30(3):205–11.
13. The Pharmacy Guild of Australia. Program specific guidelines: home medicines review. [Online] Canberra2011 [09/11/2011]; Available from: http://www.5cpa.com.au/iwov-resources/documents/5CPA/Initiatives/Medication_Management/Home_Medicines_Review/HMRProgramSpecificGuidelinesOct2011.pdf.
14. Freeman C, Cottrell WN, Kyle G, Williams I, Nissen L. does a primary care practice pharmacist improve the timeliness and completion of medication management reviews? International Journal of Pharmacy Practice. 2012;(in Press).
15. Mitchell G, Senior H, Foster M, Williams I, Chaffey J, Chambers R, et al. The role of allied health in the management of complex conditions in a comprehensive primary care setting. Canberra: Australian Primary Health Care Research Institute; 2012.
16. Bennett A, Smith C, Chen T, Johnson S, R H. A comparative study of two collaborative models for the provision of domiciliary medication review: St George Canterbury Medico/ Pharmacy Project - Executive Report. Sydney, Australia University of Sydney and St George Division of General Practice; 2000; Available from: http://beta.guild.org.au/uploadedfiles/Medication_Management_Reviews/Overview/St_George_Executive_summary_report_2000.doc.
17. Pharmaceutical Care Network Europe. The PCNE Classification V 6.2. [Online]: Pharmaceutical Care Network Europe Foundation; 2010 [07/11/2011]; Available from: http://www.pcne.org/sig/drp/documents/PCNE%20classification%20V6-2.pdf.
18. Stafford AC, Tenni PC, Peterson GM, Jackson SL, Hejlesen A, Villesen C, et al. Drug-related problems identified in medication reviews by Australian pharmacists. Pharm World Sci. 2009; 31(2):216–23.
19. Castelino RL, Bajorek BV, Chen TF. Are interventions recommended by pharmacists during Home Medicines Review evidence-based? J Eval Clin Pract. 2011;17(1):104–10.
20. Uribis Keys Young. Evaluation of the Home Medicines Review program (Pharmacy Component). [Online] Canberra: Pharmacy Guild of Australia; 2005 [15/11/2011]; Available from: http:// beta.guild.org.au/uploadedfiles/Medication_Management_Reviews/Overview/Urbis%20Keys%20Young%20evaluation.pdf .