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RESEARCH ARTICLE

Pharmacists in general practice: a focus on drug-related problems

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Abstract
Background Team based care has been used internationally to improve the delivery of best practice primary health care. The WentWest General Practice Pharmacist Project, involving the integration of pharmacists within general practice teams, was commissioned to improve medication management of general practice patients. A particular focus of the project was the performance of medication review to allow the detection and resolution of drug related problems (DRPs). *Objective* The objectives of this 6-month study (October 2016–March 2017) were to: (1) identify and classify the DRPs detected as a result of pharmacist activities within a general practice primary care setting. (2) compare the number of pharmacist recommendations and GP acceptance rates as a result of pharmacist patient consultations across multiple general practice sites. *Setting* 15 general practice primary care sites in Western Sydney NSW Australia. A multi-centre prospective observational study conducted over a 6-month period from October 2016 to March 2017. *Main outcome measure* Drug-related problems (DRPs). *Results* Six pharmacists recorded the results from 493 patient consultations. The pharmacists identified 1124 DRPs and made 984 recommendations, of which 685 (70%) were recorded as accepted by the GP. *Conclusion* Pharmacists have a valuable role to play in the detection and resolution of DRP as part of the general practice team.

Keywords Australia · Collaborative care · Drug-related problems · General practice pharmacist · Multidisciplinary care · Team based care

Impacts on practice

- One of the roles of general practice pharmacists should include identifying and resolving DRPs.
- General practice patients particularly those with multiple health conditions and/or medications are likely to benefit from a consultation with a pharmacist.

Introduction

Inter-professional collaborative care interventions are designed to improve patient care by combining the various competencies and skills of multiple healthcare professionals in an integrated cooperative way [1]. These interventions have been associated with an improvement in patient outcomes and offer an opportunity to utilise the skills of multiple healthcare professionals with team based collaboration [2].

One example of team-based primary care in Australia involves the integration of pharmacists in the general practice setting. Previous research has demonstrated that activities performed by integrated pharmacists are associated with significant improvements in patient health outcomes [3]. Despite this evidence, pharmacists are not currently routinely included as integrated general practice team members in Australia and there is no system level funding available to support this innovative practice.

Including pharmacists as part of the general practice team offers multiple advantages related to being located onsite in the general practice offices. These include improved access to comprehensive patient medical information and the ability for pharmacists to develop close collaborative relationships with prescribing General Practitioners (GPs) [4].

Pharmacists integrated in general practice teams can perform a variety of roles. These include direct patient care, population management activities and the provision

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of expert drug information and education for other primary care team members [5]. An example of one of the direct patient care roles that integrated pharmacists can undertake is in the detection and resolution of Drug-Related Problems (DRPs) [6, 7].

WentWest, the primary health network region for Western Sydney in New South Wales, Australia, as part of it's long term work in supporting general practice and primary care providers to implement team based care, commissioned the WentWest General Practice Pharmacist Project [8]. This project involved the integration of six non-dispensing pharmacists across 15 general practice sites in Western Sydney. The pilot phase commenced in March 2016 and the implementation phase of the project is currently ongoing.

Aim of the study

The aims of this observational study was to:

1. Identify and classify the DRPs detected as a result of pharmacist-patient consultations within a general practice setting as part of the WentWest General Practice Pharmacist Project.
2. Compare the number of pharmacist recommendations and GP acceptance rates as a result of pharmacist-patient consultations across multiple general practice sites.

Ethics approval

Prior to conducting the study, research ethics approval was granted by the Human Research Ethics Committee at the University of Technology Sydney (ETH16-0689).

Methods

WentWest general practice pharmacist project processes

Project recruitment

Six non-dispensing pharmacists were recruited for the project by WentWest project staff and associated general practice associations. Patients were selected and recruited either by the general practice staff, integrated pharmacists or general practitioners (GPs) with the assistance of a clinical audit tool [9]. In addition, some patients requested a pharmacist consultation in response to a sign advertising the pharmacist's availability posted in the general practice waiting room. The ten criteria for patient selection were defined by WentWest to capture the study target population of patients at risk of medication misadventure. These criteria were selected to target those with complex medication regimens and/or multiple co-morbidities and included: (1) polypharmacy, (2) diabetes, (3) adherence concerns, (4) asthma/COPD, (5) inadequate response to therapy, (6) suspected adverse reaction, (7) patient request, (8) pain management, (9) recent hospital discharge and (10) medication with a narrow therapeutic index.

Polypharmacy was defined by the project team as patients taking more than five medications. Adherence concerns were patients selected by GPs in response to suspected adherence issues.

Inadequate response to therapy were patients selected by the GP that were considered not to be responding as expected to seemingly appropriate therapy.

Project pharmacist training

Pharmacists participating in the project attended several meeting relating to data collection procedures and one full day training session that covered all aspects of the project intervention. (Pharmacist 5 and 6 joined the project later and only attended the full day training session.)

Project intervention: pharmacist consultation

The pharmacist intervention involved a consultation with the selected general practice patients, and may have included any of the following: (1) medication reconciliation and review; (2) adherence counselling; (3) patient education on medical conditions and medications; (4) review and ordering of laboratory tests; (5) healthy lifestyle advice including smoking cessation, diet and exercise; and (6) chronic disease management activities including advice on optimisation of therapy, disease state monitoring and the development of patient action plans where appropriate. Recommendations were then communicated to the patient's GP and focused on the detection and resolution of DRPs and requests for lab tests or monitoring where required. Where possible recommendations were communicated face to face with a consultation between the pharmacist, GP and the patient. When the GP was unavailable to discuss the pharmacist's recommendations face to face the pharmacist's recommendations were discussed with the patient, entered in the patient record and flagged for action by the GP.

Drug-related problem study methods

Study design

A multi-centre prospective observational study was conducted over a six-month period from October 2016 to March 2017. All 15 general practice sites from three different general

practice association districts (Blacktown, Mt Druitt and the Hills District) in Western Sydney NSW were included in the study.

DRP classification

A literature review conducted in 2014 concluded that there are several internationally recognised classification systems to analyse DRP. There is however, currently no established consensus on which classification system to use [10]. In response to this review, an aggregated system for classifying causes of DRPs was developed and this system was used for the purposes of this study [11]. This system classed the causes of DRPS into nine categories including (1) drug selection, (2) drug form, (3) dose selection, (4) treatment duration, (5) drug use process, (6) logistics, (7) monitoring, (8) unexpected or adverse drug reaction or no obvious cause of DRP and (9) other: where a cause was present that could not be classified into one of the other 8 categories. These categories were then further classified into 33 sub-categories that were used in this evaluation.

Data collection and analysis

As part of their usual practice the pharmacists participating in the project collected quantitative patient data using a data collection spreadsheet (in Microsoft Excel 2010©) that was developed to support the delivery of the intervention by the WentWest project team. This data collection spreadsheet was reviewed by the research team after the pilot phase of the project in July 2016 and refined to ensure accurate and relevant data was collected. This data was then entered into the Statistical Package for Social Sciences (SPSS) for Windows Version 24.0 (IBM, New York, USA) for analysis [12]. To ensure accuracy of the data, the classification of DRP causes was verified by two researchers. The data was then analysed using standard descriptive statistics. Means are presented ± standard deviation (sd). A one way analysis of variance (ANOVA) test with post hoc Tukey HSD (honestly significant difference) was conducted to compare means between individual pharmacists and individual practice sites and the number of recommendations made by pharmacists. Chi-squared tests were performed to examine the relationship between individual pharmacists and the proportion of recommendations accepted and between the practice site and proportion of recommendations accepted.

Results

Patient demographic data

Over the 6 month period, pharmacists collected data on 493 patient consultations. The average patient age was 67.7 years (± 13.6). Patients on average had 5.5 co-morbidities (± 2.7) and took 9.2 prescription and non-prescription medications (± 4.3). Although some patients met multiple selection criteria Fig. 1 describes the primary criteria patients were selected for consultation with a pharmacist.

The majority of the study patient population (81%) was selected for intervention due to polypharmacy, diabetes management, medication adherence concerns and asthma or COPD management.

DRPs identified

The majority of patients (94%) seen by the pharmacists presented with at least one DRP, with a mean number of 2.3 DRPs per patient (± 1.3).

The causes of the DRPs detected as a result of the pharmacist consultation related to five of the nine classification system categories namely drug selection, dose selection, drug use process, monitoring and unexpected or adverse drug reaction, and nine sub-categories as detailed in Fig. 2.

Pharmacists made a total of 984 recommendations in relation to the 1140 DRPs identified, of which 685 (70%) were recorded as actioned by the GP (Table 1).

The number of recommendations was lower than the number of DRPs detected as not all DRPs required action by the doctor. This was the case with patient education on inhaler technique or, where the pharmacist addressed adherence concerns. In addition, sometimes multiple DRPs were resolved with one recommendation, for example, ceasing a medication may have resolved both a 'dose too high' and a 'no indication for drug' problem.

Of the DRPs described in Fig. 2, 50% of the causes related to medication use without indication (340) and over dosage (220).

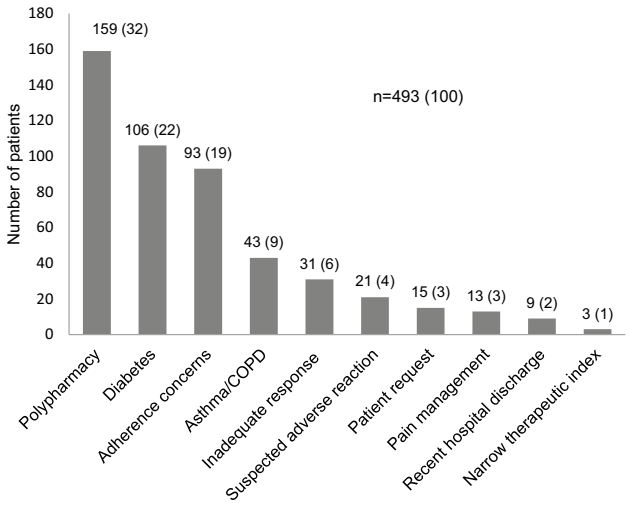

Fig. 1 Patient selection criteria n = number of patients (%)

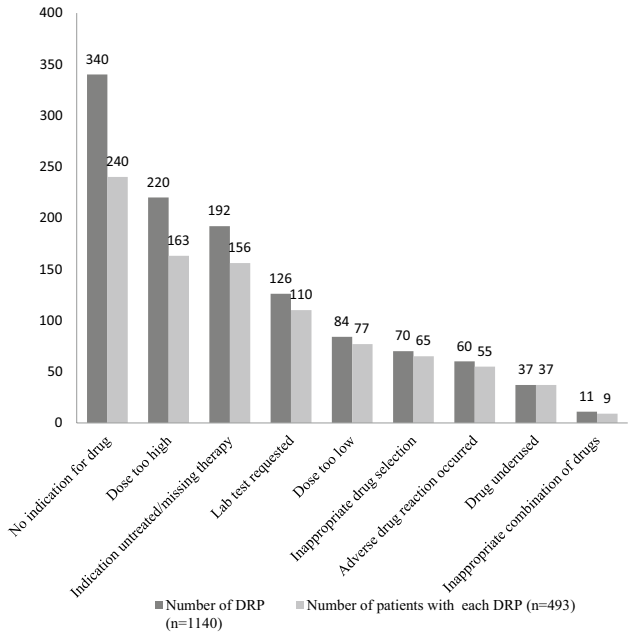

Fig. 2 Categorisation of causes of DRPs

Table 1 outlines the contributions of the individual pharmacists and demonstrates the variability between both individual pharmacist recommendations per consultation and the percentage of recommendations accepted by the GP.

The average consultation length (Table 1) for individual pharmacists varied from between 25 to 48 min. It is interesting to note that an increased length of consultation did not correlate with increased number of recommendations or an increase in the recommendation acceptance rate. In fact, Pharmacist 5 and 6 who had the longest average consult lengths at 44 and 48 min respectively, did not have the highest number of recommendations per consult.

One pharmacist was employed full time on the project and conducted 60% of the patient consultations (296 of 493). The remaining pharmacists worked a maximum of 1 day per week with most pharmacists doing a regular 4 h shift on a designated day at each practice, thus limiting their contribution to the data set. Several pharmacists had taken leave over January 2017 that also reduced their contribution to the data. Two pharmacists (Pharmacist 5 and 6) commenced patient consultations in January 2017, limiting both their training in project procedures and contribution to the dataset. One consequence of this, was that both Pharmacist 5 and 6 failed to record the number of their recommendations that were accepted by the GPs.

There was a statistically significant difference in the mean number of recommendations made by individual pharmacists ($F(15,436) = 2.6$, $p < 0.001$). Post hoc analysis (Tukey HSD) showed that Pharmacist 2 had a significantly greater mean number of recommendations per patient consultation than Pharmacist 1 ($p < 0.001$) however, there was no statistically significant difference in means between the remaining pharmacists. This difference could be due to a number of reasons. The fact that Pharmacist 1 number worked full time in the project and visited a large number of sites in comparison with Pharmacist 2 who worked 1 day per week in two practices may have contributed. A significant difference was found between four pharmacists and the proportion of recommendations accepted ($x^2 = 272.1$, $p < 0.001$), two pharmacists (Pharmacists 5 and 6) were excluded from the analysis as they did not record the number of their recommendations accepted.

Table 2 shows detail on the activities of the pharmacists at the 15 general practice sites. Of particular interest is the difference in the percentage of recommendations accepted for the same pharmacist across different sites, clearly illustrated by Pharmacist 1 who had differing rates of acceptance across eleven practice sites. In addition, the difference between pharmacists at the same practice site is illustrated with Practice 12 where Pharmacist 2 recorded 2.5 recommendations per consult and Pharmacist 4 recorded 2.3 recommendations per consult.

There was a statistically significant difference in the mean number of recommendations made per patient consultation by pharmacists at individual practice sites (F

Table 1 Pharmacist consultations and acceptance rates

Pharmacist	Number of patient consultations	Average consultation length (min ± SD)	Number of recommendations	Recommendations/consultation (mean)	Recommendations accepted by GP n (%)
Pharmacist 1	296	45 ± 7.0	501	1.7	256 (51%)
Pharmacist 2	159	23 ± 10.6	408	2.6	398 (98%)
Pharmacist 3	11	32 ± 7.1	20	1.8	20 (100%)
Pharmacist 4	6	25 ± 10.6	14	2.3	11 (79%)
Pharmacist 5	14	48 ± 12.4	26	1.9	Not recorded
Pharmacist 6	7	44 ± 3.8	14	2.0	Not recorded
Total	493	34 (± 12.7)	984	2.0	685 (70%)

Table 2 Pharmacist consultations, recommendations and GP acceptances by practice

Pharmacist ID	Practice ID	No. of patient consultations	No. of recommendations	Recommendations/consultation	Recommendations accepted by GP n (%)
1	Practice 1	17	29	1.7	17 (59%)
1	Practice 2	7	19	2.7	6 (32%)
1	Practice 3	20	44	2.2	28 (64%)
1	Practice 4	54	80	1.5	39 (49%)
1	Practice 5	41	65	1.6	29 (45%)
1	Practice 6	19	30	1.6	9 (30%)
1	Practice 7	24	34	1.4	16 (47%)
1	Practice 8	3	8	2.7	8 (100%)
1	Practice 9	90	158	1.8	77 (49%)
1	Practice 10	2	1	0.5	1 (100%)
1	Practice 11	19	34	1.8	26 (76%)
2	Practice 12	90	227	2.5	219 (96%)
2	Practice 13	84	214	2.5	208 (97%)
3	Practice 14	11	20	1.8	20 (100%)
4	Practice 12	6	14	2.3	11 (79%)
5	Practice 4	9	19	2.1	Not recorded
5	Practice 15	5	7	1.4	Not recorded
6	Practice 5	4	4	1.0	Not recorded
6	Practice 7	3	10	3.3	Not recorded
Totals		493	984	2.0	685 (70%)

(15,436) = 2.558, $p < 0.001$). This is consistent across all pharmacists who visited multiple sites. Post Hoc analysis (Tukey HSD) showed that Practice 2 had a statistically significant difference in the mean number of recommendations per patient consultation made in comparison with Practice 12 ($p < 0.027$) however, there was no statistically significant difference in means between the remaining practices. There was a significant difference between practice sites and the number of recommendations accepted ($x^2 = 231.6$ $p < 0.001$).

Discussion

Pharmacists integrated in general practice were effective in identifying the causes of patient DRPs and making recommendations for their resolution. GPs were willing to collaborate with pharmacists demonstrated by the high acceptance (70%) of pharmacist recommendations to resolve DRPs.

An advantage of this study included the implementation of the intervention across multiple sites in differing socioeconomic areas with multiple participating pharmacists. This multiple site, multiple practitioner design demonstrates that this type of intervention is potentially reproducible and feasible for more widespread implementation.

A similar study involving a pharmacist integrated in family practice by Vande Griend et al. [13] identified that in addition to patients with diabetes and COPD, patients with cardiovascular disease (especially those with heart failure and/or hypertension), depression and kidney impairment were most likely to benefit from medication review by an integrated pharmacist. Adjustment of patient selection and recruitment methods used by pharmacists and GPs to take into account these additional patient groups, may increase the potential impact of the intervention.

The fact that a majority (90%) of the patient population had at least one DRP, indicated that an appropriate target population had been selected for the intervention and is consistent with the results from previous studies [14, 15].

A large proportion (50%) of the causes of DRPs described in Fig. 2 related to medication use without indication (340) and over dosage (220).This highlights the potential opportunities for integrated pharmacists to recommend de-prescribing in appropriate cases. Reducing the number and dosage of medications a patient is taking is likely to reduce medication costs, reduce DRPs and increase the ability of patients to adhere to their medication due to reduction in medication regimen complexity [16].

In contrast to Pharmacist 1–4 who joined the project in the trial phase in March 2016 and who attended multiple meeting regarding data collection for the project, Pharmacists 5 and 6 joined the project in January 2017 and received only 1 day of training in project procedures. This may explain why both Pharmacist 5 and 6 failed to record the number of their recommendations accepted as they may have

been still adjusting to project procedures, including data collection. This theory is supported by a study by Jorgensen et al. [17], examining barriers and facilitators to integrating pharmacists in primary care teams, which found that when there was no pre-existing professional relationship between the pharmacist and other members of the team, there was a delay in the development of a collaborative role until these relationships were established and other teams members learned to trust and value the pharmacist.

The integrated pharmacists made recommendations for DRP resolution and these recommendations were accepted by GPs in 70% of cases. This acceptance rate supports the findings of previous research, which found that integrated pharmacists had a 71% acceptance of recommendations made to GPs [18].

We noted there was a statistically significant variability in the number of recommendations made, and the proportion of recommendations accepted by both individual pharmacists (51–100%). When we analysed the data by practice site, recommendation acceptance rates varied between 30 and 100%. As highlighted by Jorgensen et al. [17] this variability may have been due to a number of factors including the practice infrastructure, the pharmacist's professional relationship with the collaborating GPs and the willingness of the participating practitioners to collaborate.

These variabilities between pharmacists and practice sites have highlighted the potential benefit of conducting further research investigating how and why the differences between sites and pharmacists occurred. Qualitative data could be collected relating to barriers and facilitators for acceptance of pharmacist recommendations from participating pharmacists, GPs and patients to allow further insights to be gained.

Limitations of this study included that the data collected about recommendations made by pharmacists lacked specific detail on the agent associated with each recommendation. This limited the depth of analysis able to be performed and the ability of the research team to assess the potential clinical significance of the pharmacist recommendations.

In addition, the variability in pharmacist hours, length of time in the project and number of sites visited limited the ability of the research team to compare the results of individual pharmacists and may have reduced the significance of the statistical analysis. Additional research is required, and currently underway, to examine the impact of integrated pharmacists on long-term patient and health system outcomes.

Conclusion

This study supports the premise that pharmacists integrated in the general practice will be effective in identification of DRPs. GPs are willing to accept pharmacist recommendations and collaborate with pharmacists as part of the general practice team.

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Conflicts of interest All authors declare that they have no personal or financial conflicts to report.

References

1. Körner M, Bütof S, Müller C, Zimmermann L, Becker S, Bengel J. Interprofessional teamwork and team interventions in chronic care: a systematic review. J Interprof Care. 2016;30:15–28.
2. Reiss-Brennan B, Brunisholz KD, Dredge C, Briot P, Grazier K, Wilcox A, et al. Association of integrated team-based care with health care quality, utilization, and cost. JAMA. 2016;316:826–34.
3. Tan EC, Stewart K, Elliott RA, George J. Pharmacist services provided in general practice clinics: a systematic review and meta-analysis. Res Social Adm Pharm. 2014;10:608–22.
4. Freeman C, Cottrell WN, Kyle G, Williams I, Nissen L. Integrating a pharmacist into the general practice environment: opinions of pharmacist's, general practitioner's, health care consumer's, and practice manager's. BMC Health Serv Res. 2002;12:229.
5. Weber ZA, Skelley J, Sachdev G, Kliethermes A, Haydon-Greatting A, Patel A, et al. Integration of pharmacists into team-based ambulatory care practice models. Am J Health Syst Pharm. 2015;72:745–51.
6. Ellitt GR, Engblom E, Aslani P, Westerlund T, Chen TF. Drug related problems after discharge from an Australian teaching hospital. Pharm World Sci. 2010;32:622–30.
7. de Consenso Comite. Third consensus of Grenada on drug related problems (DRP) and negative outcomes associated with medicines. Ars Pharm. 2007;48:5–17.
8. Patient Centred Primary Care Collaborative Robert Graham Centre. The impact of primary care practice transformation on cost, quality, and utilization a systematic review of research published in 2016. https://www.pcpcc.org/sites/default/files/resources/pcmh_evidence_es_071417%20FINAL.pdf. Accessed 19 Oct 2017.
9. Pen CS PEN Clinical Audit Tool. http://www.pencs.com.au/. Accessed 19 Oct 2017.
10. Basger BJ, Moles RJ, Chen TF. Application of drug-related problem (DRP) classification systems: a review of the literature. Eur J Clin Pharm. 2014;70:799–815.
11. Basger BJ, Moles RJ, Chen TF. Development of an aggregated system for classifying causes of drug-related problems. Ann Pharmacother. 2015;49:405–18.
12. IBM Corporation SPSS Statistics for Windows, Version 24. Armonk, NY2016.
13. Vande Griend JP, Saseen JJ, Bislip D, Emsermann C, Conry C, Pace WD. Prioritization of patients for comprehensive medication review by a clinical pharmacist in family medicine. J Am Board Fam Med. 2015;28:418–24.
14. Tan EC, Stewart K, Elliott RA, George J. Pharmacist consultations in general practice clinics: the Pharmacists in Practice Study (PIPS). Res Social Adm Pharm. 2014;10:623–32.

15. Chan DC, Chen JH, Kuo HK, We C-J, Lu I-S, Chiu L-S, et al. Drug-related problems (DRPs) identified from geriatric medication safety review clinics. Arch Gerontol Geriatr. 2012;54:168–74.
16. Reeve E, Thompson W, Farrell B. Deprescribing: a narrative review of the evidence and practical recommendations for recognizing opportunities and taking action. Eur J Intern Med. 2017;38:3–11.
17. Jorgenson D, Laubscher T, Lyons B, Palmer R. Integrating pharmacists into primary care teams: barriers and facilitators. Int J Pharm Pract. 2014;22:292–9.
18. Freeman CR, Cottrell WN, Kyle G, Williams ID, Nissen L. An evaluation of medication review reports across different settings. Int J Clin Pharm. 2013;35:5–13.