

Effect of outpatient pharmacists' non-dispensing roles on patient outcomes and prescribing patterns

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Abstract

Background

The roles of pharmacists in patient care have expanded from the traditional tasks of dispensing medications and providing basic medication counseling to working with other health professionals and the public. Multiple reviews have evaluated the impact of pharmacist-provided patient care on health-related outcomes. Prior reviews have primarily focused on in-patient settings. This systematic review focuses on services provided by outpatient pharmacists in community or ambulatory care settings. This is an update of the Cochrane review published in 2000.

Objective

To examine the effect of outpatient pharmacists' non-dispensing roles on patient and health professional outcomes.

Criteria for considering studies for this review

This review has been split into two phases. For Phase I, we searched the Cochrane Effective Practice and Organisation of Care (EPOC) Group Specialised Register (January 1966 through March 2007). For Phase II, we searched MEDLINE/EMBASE (January 1966 through March 2008). The Phase I results are reported in this review; Phase II will be summarized in the next update.

Selection criteria

Randomized controlled trials comparing 1. Pharmacist services targeted at patients versus services delivered by other health professionals; 2. Pharmacist services targeted at patients versus the delivery of no comparable service; 3. Pharmacist services targeted at health professionals versus services delivered by other health professionals; 4. Pharmacist services targeted at health professionals versus the delivery of no comparable service.

Data collection and analysis

Two authors independently reviewed studies for inclusion, extracted data, and assessed risk of bias of included studies.

Main results

Forty-three studies were included; 36 studies were pharmacist interventions targeting patients and seven studies were pharmacist interventions targeting health professionals. For comparison 1, the only included study showed a significant improvement in systolic blood pressure for patients receiving medication management from a pharmacist compared to usual care from a physician. For comparison 2, in the five studies evaluating process of care outcomes, pharmacist services reduced the incidence of therapeutic duplication and decreased the total number of medications prescribed. Twenty-nine of 36 studies reported clinical and humanistic outcomes. Pharmacist interventions resulted in improvement in most clinical outcomes, although these improvements were not always statistically significant. Eight studies reported patient quality of life outcomes; three studies showed improvement in at least three subdomains. For comparison 3, no studies were identified meeting the inclusion criteria. For comparison 4, two of seven studies demonstrated a clear statistically significant improvement in prescribing patterns.

Authors' conclusions

Only one included study compared pharmacist services with other health professional services, hence we are unable to draw conclusions regarding comparisons 1 and 3. Most included studies supported the role of pharmacists in medication/therapeutic management, patient counseling, and providing health professional education with the goal of improving patient process of care and clinical outcomes, and of educational outreach visits on physician prescribing patterns. There was great heterogeneity in the types of outcomes measured across all studies. Therefore a standardized approach to measure and report clinical, humanistic, and process outcomes for future randomized controlled studies evaluating the impact of outpatient pharmacists is needed. Heterogeneity in study comparison groups, outcomes, and measures makes it challenging to make generalised statements regarding the impact of pharmacists in specific settings, disease states, and patient populations.

Plain language summary

The role of pharmacists in the community includes more than dispensing medications. It involves identifying, preventing, and resolving drug-related problems, as well as encouraging proper use of medications and general health promotion and education.

This review found forty-three studies which evaluated non-traditional roles of pharmacists. In general, the data included in this review supported the roles of pharmacists in patient counseling, therapeutic management, and providing health professional education with the goal of improving patient process of care and clinical outcomes. Non-traditional roles of outpatient pharmacists improves health care outcomes. The data show that educational outreach visits may impact physician prescribing patterns.

What's new

What's new

Last assessed as up-to-date: 17 January 2000.

Date	Event	Description
1 December 2010	Amended	Conflict of interest modified.

Background

In the past three decades, the roles of pharmacists in patient care have expanded from the traditional tasks of dispensing medications to working with other health professionals and the public. Multiple systematic reviews and meta-analyses have evaluated the impact of pharmacist-provided patient care on health-related outcomes ([Machado 2007a](#); [Machado 2007b](#)). It is important to conduct systematic reviews in this area because both the results and quality of the original studies vary. Thus, a rigorous review enables us to assess the best available evidence on the effects of pharmacist interventions.

The systematic reviews conducted thus far have focused on care rendered in specific practice settings (for example, ambulatory care, community pharmacy, acute care, long-term/intermediate care) ([Beney 2000](#); [Blenkinsopp 2003](#); [Christensen 2006](#); [Horn 2006](#); [Kaboli 2006](#); [Kane 2003](#); [Royal 2006](#); [Singhal 1999](#); [Tully 2000](#); [Van Wijk 2005](#); [Westerlund 2006](#)), to specific patient populations (for example, geriatric, pediatric) ([Hanlon 2004](#); [Holland 2008](#); [Rollason 2003](#); [Sanghera 2006](#); [van Eijken 2003](#)), and in specified therapeutic areas (for example, anticoagulation, antibiotic utilization, asthma, diabetes, depression, heart failure, hypertension, immunizations, mental health, Parkinson's disease, tobacco cessation) ([Dent 2007](#); [Donovan 2006](#); [Finley 2003](#); [Hogue 2006](#); [Holland 2005](#); [Jenkins 1996](#); [Lindenmeyer 2006](#); [Machado 2007a](#); [Machado 2007b](#); [Manley 2002](#); [McLean 2005](#); [Ponniah 2007](#); [Simonson 2007](#); [von Gunten 2007](#)). A few reviews have been conducted to evaluate the impact of pharmacist-provided care on specific health outcome criteria (for example, humanistic) ([Pickard 1999](#); [Pickard 2006](#); [Schumock 1996](#); [Schumock 2003](#)). Although there is some overlap in the focus of previous reviews, there are also gaps in the types of interventions assessed (for example, pharmacist-care provided to socio-

economically, ethnically, or linguistically diverse patient populations or patients with low health literacy). To our knowledge, there are no comprehensive systematic reviews thoroughly evaluating randomized controlled trials studying the impact of pharmacist-provided care in outpatient practice settings.

Because the impact of pharmacist-provided services in the hospital setting has been well-studied, this systematic review focused on services provided by outpatient pharmacists in community or ambulatory care settings. This review encompassed all outpatient pharmacist services targeted toward patients and health professionals, as well as all types of clinical disease states and health care process measures. This was an update to the previous Cochrane systematic review ([Beney 2000](#)) that incorporated the studies that have been published since 2000 as well as studies not included in the original review.

Objectives

The objective of this review was to examine the effect of outpatient pharmacists' roles on patient and health professional outcomes. Relevant health professional outcomes or healthcare practice measures included changes in prescribing patterns (for example, appropriateness of or prescribing, therapeutic duplication) and disease control (for example, disease-specific test ordering). Relevant patient outcomes included changes in clinical disease markers (for example, blood pressure) and humanistic quality of life outcomes.

We examined the following main hypotheses:

1. Does the delivery of patient-targeted services by pharmacists improve patient or health professional outcomes compared to the delivery of the same services by other health professionals?
2. Does the delivery of patient-targeted services by pharmacists improve patient or health professional outcomes compared to the delivery of no comparable services?
3. Does the delivery of health professional-targeted services by pharmacists improve patient or health professional outcomes compared to the delivery of the same services by other health professionals?
4. Does the delivery of health professional-targeted services by pharmacists improve patient or health professional outcomes compared to the delivery of no comparable services?

To test the above hypotheses, we examined the following comparisons.

1. Pharmacist services targeted at patients versus services delivered by other health professionals.
2. Pharmacist services targeted at patients versus the delivery of no comparable services.

3. Pharmacist services targeted at health professionals versus services delivered by other health professionals.

4. Pharmacist services targeted at health professionals versus the delivery of no comparable services.

Methods of the review

Criteria for considering studies for this review

Types of studies

Study designs that meet Effective Practice and Organization of Care Group (EPOC) inclusion criteria are randomized controlled trial (RCT), controlled clinical trial (CCT), controlled before and after study (CBA) and interrupted time series (ITS). In this area of research, it has historically been challenging to identify a substantial number of RCTs in the literature. In the original review and 2000 update, all study designs mentioned above were included. Due to the substantial increase in the number of published RCTs studying the effect of pharmacists' interventions on patient and health professional outcomes, we limited the current update to RCT study designs.

We included

RCTs randomizing:

patients;

pharmacists;

practices (pharmacies or medical clinics); or

geographical areas.

Types of participants

The participants for all comparative studies we included in this review were pharmacists (or pharmacies) who deliver services in outpatient settings other than, or in addition to, drug compounding and dispensing. We excluded studies involving services to patients in hospitals or skilled nursing facilities. We included studies of pharmacists delivering services to outpatients in a clinic attached to a hospital or a day hospital.

Types of intervention

The types of interventions we included were any services delivered by pharmacists other than drug compounding and dispensing. When available we collected additional data on the content of each intervention including recipients, format, source, timing, setting, and cost.

Types of outcome measures

We included studies only if 1) reported primary outcomes were objective with respect to measurement of health care process measures or patient outcomes and 2) relevant and interpretable data were presented. We therefore excluded subjective outcomes (for

example, self-reporting of symptoms, medication knowledge, satisfaction with pharmacist services) or outcomes for which reporting was incomplete (for example no numerical values reported, no baseline data provided). To minimize reporting bias, we excluded outcomes that were not primary. For studies that did not explicitly report which outcomes were primary, we included all objective and relevant outcomes.

We excluded adherence outcomes because there is another Cochrane review that assessed interventions to improve adherence ([Haynes 2008](#)). We also excluded resource-utilization and cost outcomes because these endpoints were recently assessed in another systematic review ([Perez 2009](#)).

Search methods for identification of studies

Search methods for identification of studies

When the original review was performed, there were few randomized controlled trials evaluating non-dispensing roles of outpatient pharmacists. Studies were identified by electronically searching the EPOC Specialised Register, MEDLINE, EMBASE, PHARMLINE and International Pharmaceutical Abstracts from January 1, 1966 through December, 1995. Professional librarians were consulted to advise on a broad search strategy for each database. In MEDLINE, broad searches using the MeSH headings 'pharmacy' and 'pharmacist' and each of the following publication types 'randomized controlled trial', 'controlled clinical trial', 'comparative study', 'follow up study', 'prospective study', and 'evaluation study' were performed.

The following journals were hand searched: American Journal of Hospital Pharmacy (1985 through 1995), International Journal of Pharmacy Practice Research (1987 through 1995), Journal of Social and Administrative Pharmacy (1987 through 1995), Scanner (a pharmacy abstract journal) (1987 through 1995), and The Pharmaceutical Journal (1960 through 1997). The Pharmacy Practice Research Literature Index (1984 through 1994) compiled by Peter Abel and published by the UK Pharmacy Practice Research Resource Centre, University of Manchester, England, was also searched.

The reference lists of trials identified for the review, as well as other review articles on the extended roles of pharmacists, were checked. Non-English language publications, if found, were to be included in the review.

An attempt was made to identify unpublished studies and works in progress by searching, for 1990 through 1995, the published abstracts of the annual meetings of the American Society of Hospital Pharmacists, Health Service and Pharmacy Practice Research Conference (UK), Pharmacy Practice Research Sessions of the Royal Pharmaceutical Society of Great Britain Annual Conference, and proceedings of the UK Clinical Research Association.

For the 2000 update, relevant studies were located by searching the EPOC Specialised Register, electronically searching MEDLINE, and ongoing handsearching of the International Journal of Pharmacy Practice Research and The Pharmaceutical Journal.

Given the significant increase in publications in this area over the past several years, we split the search for this update. We will complete this update in two phases. Phase I (the

current update) consists of studies identified in prior versions of this review and studies identified in the EPOC Specialised Register search (January 1966 through March 2007). Phase II (in progress) will include studies identified in prior versions of this review, the Phase I update, and studies identified through a MEDLINE and EMBASE (January 1966 through March 2008) search. Specific search criteria are included in [Appendices](#).

Data collection and analysis

Data collection and analysis

Selection of studies

Two review authors independently selected the trials to be included in the review. We resolved disagreements by discussion of the articles by at least two of the authors of the review.

Data extraction and management

We collected data using the EPOC Data Extraction Checklist. To streamline the data collection process, we built an online database on the Quesgen platform using the Data Extraction Checklist questionnaire. Two review authors independently extracted data for each study with a focus on outcomes and characteristics aimed at reducing bias. We discussed and reconciled differences in coding.

Assessment of risk of bias in included studies

Two review authors independently assessed the risk of bias of all studies eligible for the review using the EPOC Data Extraction Checklist. We adjudicated discrepancies by discussion of the studies. We assessed allocation concealment, blinding, follow-up of patients or health professionals (when applicable), baseline measurement, reliability of outcome measures, and protection against contamination. For included studies, the risk of bias characteristics are described in the [Characteristics of included studies](#) table. We identified studies with unit of analysis errors. No pooled data included unit of analysis errors.

Measures of treatment effect

We reported results for baseline (pre-intervention) and end-of-study (post-intervention) periods if available (see 'Outcomes Table' under [Data and analyses](#)). Where possible, we calculated pre-post intervention differences for each outcome for control and intervention groups, and the difference of pre-post intervention change between study groups (result interval). In all cases, we reported a more favorable outcome in the intervention group as a positive finding (that is where changes from baseline are in the intended direction) and vice versa as a negative finding. For quality of life outcomes, we did not report raw data for each quality of life domain; instead we listed each domain measured under the 'primary outcomes' column in the 'Outcomes Table' (under [Data and analyses](#)) and indicated in the 'significance' column which domains were significantly improved in intervention versus control groups during the course of the study. All outcomes included in this review are listed under the [Characteristics of included studies](#) and [Data and analyses](#) tables.

Assessment of heterogeneity

Among the included studies, there was great heterogeneity in comparison groups, intervention type, outcomes assessed, duration of intervention, length of follow-up, and measurement used for outcomes.

We attempted to perform a meta-analysis by subgrouping studies based on clinical disease state and outcome type. Unfortunately, there were insufficient data across the 43 included trials to perform subgroup analyses on all disease states.

There was a high degree of heterogeneity in the types of outcomes measured for each disease state. For example, in the four studies assessing disease control in patients with depression, one study used Brief Inventory of Depressive Symptoms (BIDS), Beck Depression Inventory (BDI), and Work and Social Disability Scale (WSDS) ([Finley 2003](#)), one study used BDI ([Rickles 2005](#)) and two studies used the self-rating Hopkins Symptom Checklist (SCL) ([Brook 2003b](#); [Capoccia 2004](#)). Due to the different outcome measures and measurement units, we were unable to pool these outcomes into one analysis. The same issue was present in studies targeting patients with asthma, chronic obstructive pulmonary disease (COPD), heart failure, hyperlipidemia and anticoagulation therapy. In these cases, we were unable to perform a meta-analysis due to the reasons described above, as well as the small number of studies performed with these disease states. We present data separately for each of these studies.

Subgroup analysis and investigation of heterogeneity

For studies measuring blood pressure and glycosylated hemoglobin (HbA1C), we collected enough data points to potentially perform a pooled analysis. Although these groups of studies were comparable in terms of disease state studied and outcomes assessed, there was variability in intervention type and length of follow-up. To minimize heterogeneity in these pooled analyses, we included in the meta-analysis only studies with similar disease state, intervention type, and length of study.

Performing a pooled analysis for continuous outcomes requires pre- and post- means and standard deviations for outcome measures for both control and intervention groups. Reporting of standard deviations was incomplete; only three of the seven studies measuring systolic and diastolic blood pressures and one of the five studies measuring HbA1C reported standard deviations.

We considered two methods to yield a standard deviation for data pooling purposes: 1) calculating a standard deviation from a P value and 2) imputation (using the standard deviation reported in other studies included in the analysis). Standard deviations derived from P values resulted in a high degree of study heterogeneity ($I^2 > 80\%$). Imputation had the least effect on study heterogeneity ($I^2 = 0$). Given these observations, we chose the imputation method.

Methodological quality

Results

Results

Description of studies

See: [Characteristics of included studies](#) ; [Characteristics of excluded studies](#) .

The prior update to this review ([Beney 2000](#)) identified 25 studies that met inclusion criteria. Six of the 25 included studies were pre-post designs, controlled by a separate site ([Cody 1998](#) ; [Lai 1998](#) ; [Peterson 1995](#) ; [Peterson 1997](#) ; [Schaffner 1983](#) ; [Tamai 1987](#)), two were quasi randomized controlled trials ([Erickson 1997](#) ; [McKenney 1973](#)), and the remainder were randomized controlled trials.

In Phase I of this update, we identified 107 publications that met our search criteria. Of these, 64 were excluded from the final analysis (see [Characteristics of excluded studies](#) and Excluded studies). All included studies were randomized controlled trials. One study was a before-and-after pragmatic randomized controlled trial ([Hall 2001](#)).

Characteristics of interventions

For study details see the [Characteristics of included studies](#) table.

Of the 43 included studies, seven studied pharmacist interventions targeted at health professionals ([Diwan 1995](#) ; [Freemantle 2002](#) ; [Hall 2001](#) ; [Ilett 2000](#) ; [Stergachis 1987](#) ; [Turner 2000](#) ; [Watson 2001](#)) and 36 reported on pharmacist interventions targeted at patients. In 11 of the 36 studies targeted at patients, the pharmacist intervention also targeted health professionals ([Borenstein 2003](#) ; [Choe 2005](#) ; [Gattis 1999](#) ; [Hanlon 1996](#) ; [Jackson 2004](#) ; [Mehos 2000](#) ; [Sadik 2005](#) ; [Schneider 1982](#) ; [Sookaneknun 2004](#) ; [Taylor 2003](#) ; [Tsuyuki 2002](#)). In most of these studies, pharmacists provided: a) oral or written recommendations to physicians regarding therapy modifications or resolution of medication-related problems and b) multiple follow-up visits with patients spanning several months (range: 1 month to 12 months). All but one of the included studies compared pharmacist services targeted at patients or health professionals versus provision of no comparable services (or usual care). One study ([Hawkins 1979](#)) compared pharmacist services with services provided by other health professionals. Eight of the 43 studies were randomized by clinical practice or region, with the remainder randomizing by individual patient or health professional.

In all seven studies targeted at health professionals, pharmacists conducted educational outreach visits at physician practices to promote guideline-based prescribing for certain medication classes including antibiotics ([Ilett 2000](#)) and nonsteroidal anti-inflammatory drugs (NSAIDs) ([Freemantle 2002](#) ; [Stergachis 1987](#) ; [Watson 2001](#)), and for certain disease states including *Helicobacter pylori* infection ([Hall 2001](#)), heart failure ([Freemantle 2002](#) ; [Turner 2000](#)), and cardiovascular disease ([Diwan 1995](#)). Overall, pharmacists conducted one or two visits lasting 10 to 15 minutes within a study period ranging from 3 months to 24 months. Educational outreach visits are the focus of a Cochrane review ([O'Brien 2007](#)). This review evaluated all but two ([Stergachis 1987](#) ; [Turner 2000](#)) of the seven studies identified above.

In 8 of 36 studies targeted at patients, the main focus of the pharmacist intervention was patient education ([Barbanel 2003](#) ; [Brook 2003a](#) ; [Gonzalez-Martin 2003](#) ; [Goodyer](#)

[1995](#) ; [Paulos 2005](#) ; [Rickles 2005](#) ; [Sarkadi 2004](#) ; [Van Veldhuizen 1995](#)). One study evaluated the effect of home blood pressure monitoring on blood pressure control with the pharmacist providing telephone follow-up to assess blood pressures and response to therapy ([Mehos 2000](#)). In the rest of the patient-targeted studies, pharmacist interventions were complex and commonly involved pharmaceutical therapy management consisting of pharmaceutical therapy optimization, monitoring of disease control and adverse drug reactions, identification of drug-drug interactions, compliance assessment, and patient education. Twenty-two studies took place in outpatient medical clinics, ten studies took place in community pharmacies ([Barbanel 2003](#) ; [Brook 2003a](#) ; [Cody 1998](#) ; [Park 1996](#) ; [Paulos 2005](#) ; [Rickles 2005](#) ; [Sarkadi 2004](#) ; [Sookaneknun 2004](#) ; [Tsuyuki 2002](#) ; [Weinberger 2002](#)), one study took place at a home care agency ([Meredith 2002](#)), and two studies involved hospital pharmacists following recently discharged patients at home ([Jackson 2004](#) ; [Peterson 2004](#)). The duration of the intervention ranged from 14 to 120 minutes with 1 to 22 intervention events conducted over the study period of 6 weeks to 23 months. Post-intervention follow-up was performed in two trials to assess duration of intervention effect after the studies were completed ([Odegard 2005](#) ; [Sarkadi 2004](#)).

In most patient-targeted studies, controls were 'usual care' groups in which patients continued to receive standard care from primary care health professionals; the usual care differed from the service provided by the pharmacist to the intervention group. In three of the seven studies targeting health professionals, control groups received no intervention ([Diwan 1995](#) ; [Ilett 2000](#) ; [Turner 2000](#)). In two of the other health professional-targeted studies, control groups received a non-pharmacist intervention. In one study, the control group received a non-targeted intervention ([Freemantle 2002](#)), and in the other study, the control group received mailed practice guidelines, but not the educational outreach visit by the pharmacist ([Hall 2001](#)). Two studies had more than one control group ([Watson 2001](#) ; [Weinberger 2002](#)). In the first study, which targeted health professionals to study the effect of an intervention composed of mailed practice guidelines and education outreach visits by the pharmacist, the first control group received no intervention while the second control group received mailed practice guidelines ([Watson 2001](#)). In the second trial, which targeted patients with asthma and COPD, the first control group received usual care while the second control group received home peak flow monitors but not follow-up by the pharmacist ([Weinberger 2002](#)).

Characteristics of health professionals delivering the intervention

In all studies, interventions were performed by either practicing pharmacists, pharmacy residents, or doctor of pharmacy students. In most studies, 1 to 4 pharmacists performed the intervention, but some studies involved more than 10 pharmacists across multiple practices ([Bond 2000](#) ; [Brook 2003b](#) ; [Diwan 1995](#) ; [Freemantle 2002](#) ; [Malone 2001](#) ; [Rickles 2005](#)).

Target population

In six of seven studies targeted at health professionals, participants were selected based on location. Two studies selected participants from general practices within one or more health authorities ([Freemantle 2002](#) ; [Hall 2001](#)) and four studies selected participants within a specific region ([Diwan 1995](#) ; [Ilett 2000](#) ; [Stergachis 1987](#) ; [Turner 2000](#)). In

one of seven studies, participating practices were selected based on their use of a specific computer system ([Watson 2001](#)).

Of the 36 studies targeting patients, 27 studies selected participants based on the clinical disease state; some studies included patients from more than one disease state. The following clinical disease states were represented across the included studies: asthma ([Barbanel 2003](#) ; [Gonzalez-Martin 2003](#) ; [Weinberger 2002](#)), COPD ([Solomon 1998](#) ; [Weinberger 2002](#)), depression ([Brook 2003a](#) ; [Capoccia 2004](#) ; [Finley 2003](#) , [Rickles 2005](#)), diabetes ([Choe 2005](#) ; [Clifford 2005](#) ; [Hawkins 1979](#) ; [Jaber 1996](#) ; [Odegard 2005](#) ; [Sarkadi 2004](#) ; [Van Veldhuizen 1995](#)), heart failure ([Gattis 1999](#) ; [Goodyer 1995](#)), hyperlipidemia ([Bogden 1997](#) ; [Paulos 2005](#) ; [Peterson 2004](#) ; [Tsuyuki 2002](#)) and hypertension ([Borenstein 2003](#) ; [Hawkins 1979](#) ; [Mehos 2000](#) ; [Okamoto 2001](#) ; [Park 1996](#) ; [Schneider 1982](#) ; [Solomon 1998](#) ; [Sookaneknun 2004](#)). Additionally, five studies selected participants based on characteristics other than the clinical disease state; these studies focused on patients with high risk of medication related problems ([Malone 2001](#) ; [Taylor 2003](#)), home care patients ([Meredith 2002](#)), patients with repeat prescriptions ([Bond 2000](#)), and patients on warfarin therapy ([Jackson 2004](#)).

The number of participants ranged from 21 to 6000 patients and 17 to 112 health professionals. Nine studies included fewer than 50 participants, 14 studies had between 50 and 100 participants, 12 studies had between 101 and 500 participants and eight studies had more than 500 participants. One study targeted pediatric patients ([Gonzalez-Martin 2003](#)) and the rest of the studies targeted adults, with nine studies focusing on elderly patients 65 years of age and older.

Risk of bias in included studies

Characteristics aimed at reducing bias are listed in the 'risk of bias' table under each study table in the [Characteristics of included studies](#) section. See and for graphic representations of the data presented below.

There were no major differences in the risk of bias of studies targeted at patients versus studies targeted at health professionals. Three of 43 studies had no risk of bias ([Malone 2001](#) ; [Meredith 2002](#) ; [Peterson 2004](#)). Only 15 of 43 studies adequately concealed allocation. Adequate follow-up of patients or health professionals (depending on target subject of study) was done in 27 of 43 studies. Baseline measures of primary outcomes were performed and were similar between intervention versus control groups in 27 of 43 studies, and protection against contamination was adequate in 12 of 43 studies. Because we only included objective primary outcomes in our review, most studies (41) were coded as having reliable outcomes and blinded assessment of outcomes.

Four studies had a unit of analysis mismatch. Of the four studies, three did not correct for clustering in the study analyses ([Freemantle 2002](#) ; [Turner 2000](#) ; [Weinberger 2002](#)). In two of these studies, the unit of allocation was practice while the unit of analysis was patient ([Turner 2000](#) ; [Weinberger 2002](#)) and in the third study, unit of allocation was health authority while unit of analysis was practice ([Freemantle 2002](#)). One study corrected for clustering in the analysis ([Bond 2000](#)).

Effects of interventions

All included outcomes are listed under the [Characteristics of included studies](#) and [Data and analyses](#) sections.

Comparison 1. Pharmacist services targeted at patients versus services delivered by other health professionals

For detailed descriptions of outcomes see [Analysis 1.1](#).

One study evaluating the effect of pharmacist directed medication management versus physician medication management showed a small, but statistically significant increase in systolic blood pressure in the intervention group (-2mmHg in intervention group versus 2mmHg in control group). No statistically significant difference was noted in diastolic blood pressure and blood glucose levels ([Hawkins 1979](#)).

Comparison 2. Pharmacist services targeted at patients versus the delivery of no comparable service

For detailed descriptions of outcomes see [Analysis 2.1](#), [Analysis 2.2](#), [Analysis 2.3](#), [Analysis 2.4](#).

Five of the 36 studies targeting patients reported process of care outcomes ([Bond 2000](#); [Jameson 1995](#); [Meredith 2002](#); [Taylor 2003](#); [Tsuyuki 2002](#)). These studies measured the effect of pharmacist interventions on prescribing, with one study showing improvement in eliminating therapeutic duplication ([Meredith 2002](#)), three studies showing a decrease in the total number of medications prescribed ([Bond 2000](#); [Jameson 1995](#); [Taylor 2003](#)), and one study showing an improvement in testing and statin prescribing for patients with hyperlipidemia ([Tsuyuki 2002](#)). Despite showing improvement in therapeutic duplication, Meredith et al were unable to demonstrate improvement for overall, cardiovascular, NSAID and psychotropic medication use.

Twenty-nine of the 36 studies targeting patients reported clinical and humanistic patient outcomes (including one study which reported process of care outcomes mentioned above ([Taylor 2003](#))). Pharmacist interventions resulted in improvement in most clinical outcomes, although these improvements were not always statistically significant. A meta-analysis was performed on studies with similar disease state, outcome, type of pharmacist intervention, duration of intervention, and length of follow-up. Hypertension and diabetes were the only disease states with a sufficient number of studies of comparable design; thus meta-analyses were performed only on studies evaluating these disease states.

Seven studies demonstrated improvement in systolic blood pressure ranging from 3.8 mmHg to 12.3 mmHg ([Borenstein 2003](#); [Mehos 2000](#); [Okamoto 2001](#); [Park 1996](#); [Schneider 1982](#); [Solomon 1998](#); [Sookaneknun 2004](#)), with two of these studies showing an increase in the proportion of patients controlled for blood pressure ([Borenstein 2003](#); [Sookaneknun 2004](#)). Four of the seven hypertension studies ([Mehos 2000](#); [Okamoto 2001](#); [Solomon 1998](#); [Sookaneknun 2004](#)) were included in a meta-analysis; these studies yielded an effect size of -6.32 mmHg (95% confidence interval (CI) -8.8 to -3.83) for systolic blood pressure and -3.12 (95% CI -4.57 to -1.67) for diastolic blood pressure ($P < 0.001$ for both measures).

Seven studies targeted diabetic patients ([Choe 2005](#) ; [Clifford 2005](#) ; [Hawkins 1979](#) ; [Jaber 1996](#) ; [Odegard 2005](#) ; [Sarkadi 2004](#) ; [Van Veldhuizen 1995](#)). Three of the five studies that assessed HbA1c demonstrated significant improvements in HbA1c between 0.5% and 2.1% ([Choe 2005](#) ; [Clifford 2005](#) ; [Jaber 1996](#)). Two of the three studies that assessed blood glucose levels demonstrated improvements in blood glucose between 7 mg/dL and 15 mg/dL compared to control ([Jaber 1996](#) ; [Van Veldhuizen 1995](#)). Two comparable studies were included in a meta-analysis ([Choe 2005](#) ; [Clifford 2005](#)); these studies yielded an effect size of -0.75% for HbA1c (P = 0.03; 95% CI -1.41 to -0.09) .

Three trials ([Bogden 1997](#) ; [Paulos 2005](#) ; [Peterson 2004](#)) targeting patients with hyperlipidemia demonstrated reductions in total cholesterol (-15.47 mg/dl to -37 mg/dl), triglyceride levels (-50.5 mg/dl), and the proportion of patients with decreased cholesterol and triglyceride levels. It was not clear, however, whether these findings were statistically significant in two of the three studies ([Paulos 2005](#) ; [Peterson 2004](#)). The improvement in total cholesterol was significant in women in one study ([Bogden 1997](#)). In three studies evaluating heart failure patients, pharmacist interventions were effective in decreasing all-cause mortality (odds ratio = 0.22, P < 0.05) ([Gattis 1999](#)), increasing mean distance walked in a two-minute test (16.1 meters in intervention group versus -3.6 meters in control group) ([Sadik 2005](#)), and increasing mean distance walked in 6 min/distance till breathless (21 meters in intervention group versus -22 meters in control group) ([Goodyer 1995](#)). In patients with asthma, pharmacist interventions significantly improved asthma symptom score on the North of England asthma scale (-6.0 in intervention group versus 0.3 in control group) ([Barbanel 2003](#)), but did not significantly improve forced expiratory volume in one second (FEV1) (0.07 in intervention group versus 0.17 in control group) and forced vital capacity (FVC) (0.07 in intervention group versus 0.19 in control group) spirometry testing ([Gonzalez-Martin 2003](#)). One study examined anticoagulation, diabetes, dyslipidemia, and hypertension control in patients with a high risk of medication related problems and found a significant increase in the proportion of patients at goal for these conditions as a result of the pharmacist intervention ([Taylor 2003](#)). In one study targeting patients on warfarin therapy, the pharmacist intervention resulted in a decreased incidence of total bleeding and improved anticoagulation control (67% of intervention group versus 41% of control group with a therapeutic international normalized ratio (INR)) although the median INR was not shown to be significantly different between the intervention and control groups ([Jackson 2004](#)). Pharmacist interventions did not result in significant improvements in clinical outcomes for patients with COPD ([Solomon 1998](#) ; [Weinberger 2002](#)) and depression ([Brook 2003a](#) ; [Capoccia 2004](#) ; [Finley 2003](#) ; [Rickles 2005](#)).

Eight of the 36 studies that reported patient outcomes collected data on quality of life outcomes using SF-36 and other questionnaires ([Cody 1998](#) ; [Gonzalez-Martin 2003](#) ; [Hanlon 1996](#) ; [Malone 2001](#) ; [Okamoto 2001](#) ; [Sadik 2005](#) ; [Solomon 1998](#) ; [Taylor 2003](#)). Three studies showed improvement in three or more quality of life subdomains in patients with asthma ([Gonzalez-Martin 2003](#)), heart failure ([Sadik 2005](#)) and high risk of medication related problems ([Malone 2001](#)).

Comparison 3: Pharmacist services targeted at health professionals versus services delivered by other health professionals

None included.

Comparison 4: Pharmacist services targeted at health professionals versus delivery of no comparable service

For detailed descriptions of outcomes see [Analysis 3.1](#).

In all seven studies targeting health professionals, the effect of the intervention was measured by changes in prescribing of specific medications for specific disease states. In one study, educational outreach visits by a pharmacist to promote guideline-based prescribing for two of four disease states (aspirin as antiplatelet therapy, angiotensin converting enzyme inhibitors (ACEIs) in heart failure, NSAIDs in osteoarthritis pain, antidepressants for depression) resulted in a statistically significant 5.2% increase in overall guideline adherence ([Freemantle 2002](#)). In one study, the number of total antibiotic prescriptions decreased as a result of the pharmacist intervention, although the significance for this outcome was not reported ([Ilett 2000](#)). Another study showed that pharmacist-provided academic detailing related to cholesterol treatment significantly increased the number of lipid-treatment prescriptions in females ([Diwan 1995](#)). In three studies evaluating prescribing of appropriate medications for *H. pylori* infection ([Hall 2001](#)), ACEIs for heart failure ([Turner 2000](#)), and NSAIDs ([Watson 2001](#)), educational outreach visits by pharmacists failed to produce statistically significant changes in prescribing. Only one of three measured outcomes showed a significant increase in an additional study evaluating the effect of educational outreach visits by pharmacists prescribing NSAIDs ([Stergachis 1987](#)).

Discussion

Discussion

Overall, pharmacist interventions are beneficial in improving patient and health professional outcomes. Study design and intervention heterogeneity make it challenging to summarize overall benefit. Heterogeneity was noted in the type of pharmacist interventions delivered in individual studies as well as outcome variables measured. Interventions differed by site of delivery (for example, primary care clinic, community pharmacy, specialized clinic setting), length of each intervention session (for example, one hour long session with pharmacist, 15 minute session with pharmacist), and frequency of intervention (for example, three sessions per year, monthly session). The most common interventions provided involved: a) oral or written recommendations to physicians regarding therapy modifications or resolution of medication-related problems and b) multiple follow-up visits with patients spanning several months; these interventions showed mostly positive outcomes.

An attempt was made to summarize data by therapeutic area, but variability in the type of intervention provided, length of intervention, frequency of intervention, type of outcome measures collected, and time of collection precluded our ability to pool data for each area. Meta-analyses were performed on hypertension and glycemic control studies with similar study characteristics. The meta-analyses performed for systolic blood pressure, diastolic blood pressure, and HbA1c showed a beneficial effect of -6.32

(95% CI -8.8 to -3.83), -3.12 (95% CI -4.57 to -1.67), and -0.75% (95% CI -1.41 to -0.09) for each outcome respectively.

Of the studies reviewed, pharmacist interventions showed the largest effect in blood pressure measures and the smallest effect in improving COPD and depression outcomes. Several reasons may explain the lack of effect of pharmacist interventions treating depression and COPD outcomes. It is possible that the studies did not have enough participants to detect the true impact of the intervention. All studies targeting depression recruited fewer than 150 patients. Two studies performed power calculations for medication adherence outcomes only, so it is possible that these studies were not adequately powered to detect differences in clinical outcomes ([Finley 2003](#); [Rickles 2005](#)). Two studies failed to recruit the number of patients needed to detect the specified effect size (13% to 28% difference in depression outcomes between intervention and control groups) at the 0.05 significance level ([Brook 2003a](#); [Capoccia 2004](#)). It is unlikely that the study period was too short to detect the clinical benefit of the pharmacist interventions as study duration ranged from 3 months to 12 months for all depression studies. Similarly, two of the COPD studies had fewer than 100 patients, which may not have yielded an adequate sample size to detect the effect of the pharmacist intervention. Although one COPD study recruited more than 200 patients, the intervention was performed in a community pharmacy setting and may not have been as rigorous as interventions performed in outpatient clinics and, as a result, failed to produce a significant improvement in COPD disease control ([Weinberger 2002](#)).

The impact of pharmacist interventions on healthcare practice measures is mixed. Few studies (12) in this review evaluated the effect of pharmacist interventions on healthcare practice measures, with prescribing practices being the most common primary outcome reported. The studies yielded conflicting results, with six studies showing a beneficial effect ([Diwan 1995](#); [Freemantle 2002](#); [Jameson 1995](#); [Meredith 2002](#); [Taylor 2003](#); [Tsuyuki 2002](#)), another study not reporting statistical significance ([Ilett 2000](#)), and the other four studies failing to show a statistically significant difference between study groups ([Hall 2001](#); [Stergachis 1987](#); [Turner 2000](#); [Watson 2001](#)).

Study quality could have impacted study results. Although most studies were blinded, many did not explicitly report methods to conceal allocation of subjects to intervention or control groups. Given the nature of practice-based interventions, it is not always possible to blind patients or conceal allocation to an intervention group. The impact of concealment of allocation on study results was likely minimal as outcome variables included in this review were objective (for example, validated clinical scales, labs). Patient or health professional follow-up was done in 27 of 43 studies; follow-up was inadequate in seven studies and unclear or not reported in nine studies. This could have impacted individual study outcomes. For example, poor patient follow-up could reflect patient satisfaction or dissatisfaction with the intervention. Follow-up rate may also reflect typical attrition shown in healthcare practice settings (for example, patient transfer to new health professionals). Only objective primary outcomes were included in this review and as such, most studies were coded as having reliable outcomes and blinded assessment of outcomes. Few studies (12 of 43) met protection against contamination criteria. This is challenging to accomplish in studies of this nature; most studies occur within one clinic setting or one healthcare practice group (with multiple health professionals). Bidirectional communication (for example, verbal, written, medical charts) between clinic staff (for example, health professionals, other staff),

changing practice environments, and staff/patient transfers make it possible for health professionals to improve upon the level of care provided or incorporate new knowledge acquired through informal consultation and educational sessions into practice. Given continuous improvement in the delivery of care, contamination would have likely reduced the difference in effect seen between interventions.

To simplify intervention delivery and minimize contamination between intervention groups, it is often easier for study investigators to randomize clinics/institutions based on location. This does, however, introduce the possibility of unit of analysis errors associated with cluster randomization. It is important to ensure that the appropriate unit of analysis is used in cluster randomization studies. There were few unit of analysis errors in this review. Of the four unit of analysis errors noted, two were in studies targeting health professionals. No studies with unit of analysis errors were included in meta-analyses.

A limitation of Phase I of this update is that it included only studies in the EPOC Specialised Register. The EPOC Specialised Register includes studies identified from MEDLINE back to 1966, HealthSTAR back to 1975, EMBASE back to 1980, and CINAHL back to 1982, for studies that meet the EPOC inclusion criteria. The CENTRAL database in The Cochrane Library is also searched on a regular basis. For more information see EPOC Specialised Register. Phase II will include both MEDLINE and EMBASE (January 1966 to March 2008).

Overall, this review indicates that pharmacist interventions can lead to improved patient outcomes for multiple disease states, although effect size may not always be substantial or statistically significant. Pooling data from multiple studies to perform a meta-analysis could help to better determine the true effect and magnitude of pharmacist interventions. However, the ability to perform meta-analyses is limited by heterogeneity in comparison groups, clinical conditions, outcomes variables, and type of pharmacist intervention studied. In addition, poor reporting of variance in outcome variables further complicates the ability to perform accurate meta-analyses. Practice-based interventions are challenging to evaluate and are often limited by available data in the practice setting or the ability to collect data without impeding care or both. Standardization of outcome variables assessed could facilitate comparisons of pharmacist interventions across multiple studies. Standardizing outcome variables for specific disease states and outcome data reporting in study manuscripts to include measures of variance (for example, standard deviation) would facilitate comparison of pharmacist interventions across multiple studies.

Authors' conclusions

Implications for practice

1. Does the delivery of patient-targeted services by pharmacists improve patient or health professional outcomes compared to the delivery of the same services by other health professionals?

There is not enough quality evidence available to make a conclusion in this area. The study included in this review that evaluated this comparison was of low quality ([Hawkins 1979](#)).

2. Does the delivery of patient-targeted services by pharmacists improve patient or health professional outcomes compared to the delivery of no comparable services?

The majority of included studies supported the roles of pharmacists in medication/therapeutic management and patient counseling.

3. Does the delivery of health professional-targeted services by pharmacists improve patient or health professional outcomes compared to the delivery of the same services by other health professionals?

There is not enough evidence available to make a conclusion in this area. None of the studies that met the review inclusion criteria evaluated this comparison.

4. Does the delivery of health professional-targeted services by pharmacists improve patient or health professional outcomes compared to the delivery of no comparable services?

Prescribing practice was the most common outcome reported in these studies. These studies showed mixed results, with three of the studies showing improvement and the other four showing no significant difference between groups. This is consistent with the results found in the Cochrane Review evaluating the effects of educational outreach visits ([O'Brien 2007](#)). The clinical relevance of these effects is unknown and should be further studied.

The evidence supports continued integration of pharmacists providing medication/therapeutic management of patients independent of or in collaboration with other health professionals and delivering patient counseling regarding drug therapy and other public health issues. There may be some benefit in providing educational outreach visits to health professionals as well.

Implications for research

Recommendations should be made on a standardized approach to measuring and reporting clinical, humanistic, and process outcomes for future randomized controlled trials evaluating the impact of outpatient pharmacists. Heterogeneity in study design, outcomes, and measures make it challenging to make generalized statements regarding the impact of pharmacists in specific settings, disease states, and patient populations. Future studies should continue to use a randomized controlled trial design with explicit reporting on factors that impact study quality (for example, concealment of allocation, blinding, follow-up) in the study manuscript. Steps should be taken to minimize risk of bias in studies; to accomplish this, investigators can measure objective outcome variables, collect baseline measurements, and minimize contamination. In study reports/manuscripts, authors should address both internal and external threats to study validity.

As expected in this type of research, the type of interventions will differ across studies. This is typically unavoidable as many of the interventions tested in this review are innovative practices or modifications of previously studied practices or both. Investigators should explicitly describe the type of intervention, format/content of intervention, individuals delivering/receiving the intervention, the length of

intervention, and the frequency of sessions/visits within the intervention in the study manuscript. Thorough reporting of details related to the study intervention allows other individuals or organizations to replicate beneficial models and make health care decisions based on comparing the best available evidence.

One of the challenges in summarizing the evidence in this area is the large degree of heterogeneity between studies. To facilitate the ability to make comparisons between studies, investigators should attempt to model the design of new studies after other well-designed studies (for example, selected outcome variables, time points to collect outcome variables). Studies should include clinically relevant outcome measures and strive, when possible, to measure clinical endpoints. This is often challenging in RCTs of shorter duration as it often takes years to see the effect of interventions on some outcomes (for example, stroke, myocardial infarction). Studies assessing the effect of educational outreach visits should include clinically relevant outcomes as opposed to surrogate markers such as physician prescribing habits. Few studies that assess the effects of pharmacists on patient outcomes include measures of the intervention's impact on preventing adverse drug events and medication errors. More studies should be performed in this area.

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Graphs

Graphs and Tables

To view a graph or table, click on the outcome title of the summary table below.

Pharmacist services targeted at patients versus services delivered by other health professionals

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
1 Outcomes Table: 2009 Review			Other data	No numeric data

Pharmacist services targeted at patients versus the delivery of no comparable service

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
1 Outcomes Table: 2009 Review			Other data	No numeric data
2 Systolic Blood Pressure (mmHg)	4	734	Mean Difference (IV, Random, 95% CI)	-6.32 [-8.80, -3.83]
3 Diastolic Blood Pressure (mmHg)	4	734	Mean Difference (IV, Random, 95% CI)	-3.12 [-4.57, -1.67]
4 Decrease in HbA1C (%)	2	260	Mean Difference (IV, Random, 95% CI)	-0.75 [-1.41, -0.09]

Pharmacist services targeted at health professionals versus the delivery of no comparable service

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
1 Outcomes Table: 2009 Review			Other data	No numeric data

Cover sheet

Effect of outpatient pharmacists' non-dispensing roles on patient outcomes and prescribing patterns

Reviewer(s) Nkansah Nancy, Mostovetsky Olga, Yu Christine, Chheng Tami, Beney Johnny, Bond Christine M, Bero Lisa

Contribution of Reviewer(s)

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Most recent changes	
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Date new studies found and included/excluded	Information not supplied by reviewer
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Comments and criticisms

Pharmacist interventions

Summary of comments and criticisms

Where and how pharmacist can intervene in e-prescribing to reduce or prevent doctor's errors?

I certify that I have no affiliations with or involvement in any organisation or entity with a direct financial interest in the subject matter of my criticisms.

Reviewer's reply

Contributors to comment

Lay Hook Kam, pharmacist

Keywords

Humans; *Ambulatory Care ; *Community Pharmacy Services ; *Delivery of Health Care ; *Outcome Assessment (Health Care) ; *Professional Role ; Hypertension [drug

therapy] ; Patient Education as Topic ; Pharmacists ; Physician's Practice Patterns ; Prescription Drugs [supply & distribution] [therapeutic use] ; Randomized Controlled Trials as Topic

History

History

Protocol first published: Issue 2, 1995

Review first published: Issue 4, 1997

Date	Event	Description
16 June 2010	New citation required but conclusions have not changed	New search, criteria for included studies changed to only include RCTs, new authors
16 June 2010	New search has been performed	Reconciled old and new studies
21 August 2008	Amended	Converted to new review format.
18 January 2000	New citation required and conclusions have changed	Substantive amendment

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