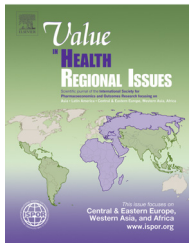
VALUE IN HEALTH REGIONAL ISSUES 7C (2015) 9–21

Available online at www.sciencedirect.com
ScienceDirect
journal homepage: www.elsevier.com/locate/vhri



A Systematic Review of Community Pharmacists' Interventions in Reducing Major Risk Factors for Cardiovascular Disease

Emmanuel Ifeanyi Chiazor, MPH[1,*], *Meirion Evans, PhD*[1], *Hugo van Woerden, PhD*[1], *Azuka C. Oparah, PhD*[2]

[1]*Department of Primary Care and Public Health, Cardiff University, Cardiff, UK;* [2]*Faculty of Pharmacy, Department of Clinical Pharmacy and Pharmacy Practice, University of Benin, Benin City, Edo, Nigeria*

ABSTRACT

Objectives: To conduct a systematic literature review and assess the effectiveness of community pharmacists' interventions in reducing major risk factors for cardiovascular diseases. **Methods:** A comprehensive literature search from 2000 onwards was performed using MEDLINE (1946 to June 4, 2013), EMBASE (1947 to present), CINAHL, and Cochrane Library. The gray literature was also searched. Studies were classified as diabetes, hypertension, dyslipidemia, and tobacco dependence. Data abstracted from the articles included study design/participants, study duration, key components of intervention, primary outcome, and key findings. Study quality was assessed using a checklist appropriate to the study design. **Results:** A total of 1020 citations were initially identified, with 27 meeting inclusion criteria. Eight studies were randomized controlled trials, five were cluster randomized trials, two were randomized before-after design studies, five were nonrandomized controlled before-after design studies, and seven were uncontrolled before-after design studies. Interventions focused on diabetes (n = 8), hypertension (n = 9), dyslipidemia (n = 7), and tobacco dependence (n = 3). Effect sizes ranged from 7.8 to 17.7 mm Hg and from 0.2% to 2.2% reductions in systolic blood pressure and hemoglobin A_{1c}, respectively, while reductions in total cholesterol ranged from 18.2 to 27.1 mg/dl. Study quality was generally poor. **Conclusions:** Available evidence suggests a potential for substantial benefit in diabetes and hypertension but clinical benefits in lipid management remain unclear. The true effect of interventions is uncertain due to poor study quality, inconsistent results, and potential for publication bias. Further well-designed studies are needed to determine the true impact of community pharmacists' interventions in reducing major risk factors for cardiovascular disease.

Keywords: Cardiovascular disease, diabetes, hypertension, community pharmacy, dislipidaemia, tobacco dependence.

Introduction

In the last decade, noncommunicable diseases have been reported as major contributors to total global mortality [1,2]. Of the estimated 57 million deaths reported worldwide in 2008, noncommunicable diseases (predominantly cardiovascular diseases [CVDs], diabetes, chronic lung diseases, and cancers) accounted for about 36 million deaths. Of these noncommunicable disease–related mortality estimates, 17.3 million deaths were related to CVD, with coronary heart disease (CHD) accounting for about 7.3 million deaths and stroke for 6.2 million deaths [3]. CVDs pose a huge public health challenge and have been recognized by the World Health Organization as the leading single contributor to global mortality, with low- and middle-income countries disproportionately affected [3].

Several risk factors have been reported to be associated with CVDs. Although some are simply nonmodifiable (e.g., age, sex, family history of CVD, genetic links, and ethnicity), others are modifiable. The risk of CVDs can be reduced by adopting a healthy lifestyle such as regular physical activity, consumption of fruits and vegetables, moderation of alcohol intake, dietary sodium reduction, avoiding tobacco use, avoiding foods rich in fat, and maintaining a healthy body weight [4–8]. About 80% of CHD and CVDs are linked to behavioral risk factors [2]. The effects of physical inactivity and unhealthy diet may present in an individual as overweight and obesity, high blood pressure, elevated blood glucose levels, and elevated blood lipid levels. These "secondary risk factors," which can be measured, indicate a higher risk of developing a stroke, cardiac arrest, heart failure, and other complications. The community pharmacy setting presents an opportunity for health improvement because it provides "high street" access to a trained health professional without appointment [9]. Community pharmacies are uniquely positioned in the heart of the community to access "hard-to-reach" groups and hence reduce health inequalities and be pivotal in public health improvement interventions.

Conflict of interest: The authors have indicated that they have no conflicts of interest with regard to the content of this article.

* *Address correspondence to:* Emmanuel Ifeanyi Chiazor, Department of Primary Care and Public Health, Cardiff University, Heath Park, Cardiff, UK.

E-mail: chiazorifeanyi@yahoo.com

2212-1099$36.00 – see front matter

http://dx.doi.org/10.1016/j.vhri.2015.03.002

Community pharmacies are often patients' first point of contact, and for some, their only contact with a health care professional [10]. The strategic locations of the pharmacies, extended opening hours, and ease of accessibility to the public without need for appointment make the community pharmacy setting uniquely suitable for implementing population-based chronic disease prevention interventions, especially in resource-poor settings with disproportionately high rates of CVD morbidity and mortality [11].

In countries in which health care costs are mostly covered by social insurance, the physicians are usually overburdened with high demand. Where health care costs are largely paid out of pocket at the point of service or by private insurance, a vast majority of the population is unable to access health care services. Therefore, the community pharmacy setting offers an avenue to consult with a well-trained health professional, thus either reducing the workload for primary care physicians or offering an alternative means of access to health promotion services for the less well-off in the society. Although the role of community pharmacists in health promotion has been acknowledged [12,13], not many studies have assessed the impact of interventions delivered by pharmacists within the community pharmacy setting. Although previous reviews have explored pharmacists' interventions to reduce risk factors for CVD, they focused on a single risk factor [14–17], were not limited to the community pharmacy setting [14,15,18,19], or are outdated [9]. Thus, the objectives of this study were to systematically review the literature and assess the effectiveness of interventions delivered within community pharmacy setting to reduce major risk factors for CVDs.

Methods

Search Strategy for the Identification of Literature

An initial MEDLINE search was conducted to find background literature on community pharmacists' activities in CVD risk reduction. Although the area of CVD has been well researched, the body of evidence in the field of community pharmacy practice is limited. This made it impractical to narrow the research to a particular context and evidence was sought from across the globe. The background search also aided in the identification of appropriate MeSH terms used in the formal search strategy, which was conducted between July 2013 and February 2014.

Literature Search Procedure and Databases Searched

Electronic databases searched included MEDLINE (1946 to June 4, 2013), EMBASE (1947 to present), CINAHL, and Cochrane Library. The gray literature was searched using the Cardiff University Index to Theses database and ProQuest Dissertations and Theses. Search terms included cardiovascular disease, coronary heart disease, ischemic heart disease, diabetes, hypertension, dyslipidemia, tobacco dependence, community pharmacist(s), and community pharmacy(ies).

Eligibility Criteria

Inclusion criteria were limited to studies carried out from January 2000 onwards: studies in which interventions were delivered by a pharmacist in a community pharmacy setting and interventions were intended to reduce the incidence or risk of CVD; studies that reported a clear outcome measure; articles in English language; and articles with full text and on human studies without regard to study design or location because generally not many published articles exist on community pharmacy practice research. Gray literature such as unpublished MPhil and PhD theses from 2000 onwards were also considered for inclusion.

The exclusion criteria were publications not related to community pharmacy–based interventions in preventing CVD incidence or its major risk factors; publications in foreign languages, due to the cost and time involved in translating materials; and articles published before 2000, because studies published before 2000 were considered obsolete, more so because previous authors highlighted that most community pharmacy practice research was undertaken in the last decade. Review articles and studies that focused only on economic outcomes without reporting clinical and/or humanistic outcomes were also excluded.

Data Collation and Analysis

Study selection process

All the articles retrieved were exported to Endnote Web Reference Management Software and duplicate records were removed. An initial screening of titles and abstracts was conducted and those that were not relevant to the research aim and objectives were excluded. A more detailed review of the remaining abstracts was undertaken to ascertain their eligibility. Full texts of potentially eligible studies were obtained and reviewed to determine whether they merited inclusion.

Abstraction of data

Identified articles were categorized according to the primary outcome of interest into diabetes, hypertension, dyslipidemia, and tobacco dependence. Data were abstracted from each study and entered into a matrix using the following framework: first author, year of publication, country, and evidence grade; study design and participants; study duration; key components of intervention; primary outcome, and key findings. If the primary outcome was not specified, the first outcome reported in the Results section was used, unless another outcome was specified in a power calculation. The matrix was used as the basis for a qualitative synthesis of findings and interpretation, taking into consideration the quality of evidence.

Assessing the methodological quality of included studies

Decision on methodological quality was based on what was reported because authors were not contacted. The quality assessment framework for research is generally based on hierarchy, with the randomized controlled trial (RCT) considered as the "criterion standard." The literature in the field of community pharmacy practice does not contain many RCTs but a substantial number of quasi-experimental and descriptive studies.

A deliberate attempt was made to avoid the use of scoring tools in study quality assessment for the following reasons: First, the lack of a reference standard for total quality score forces reviewers to make a judgment on what they consider to be an acceptable level of quality usually on the basis of reference used by previous authors. Second, scoring tools by implication assign equal weight to all domains irrespective of the degree to which the domain affects study validity. Furthermore, the question of how such scoring instruments have been validated was considered.

Two approaches were therefore used to assess the quality of evidence. First, studies were stratified into RCTs and non-RCTs. The Cochrane risk of bias tool [20] was used to assess the quality of each RCT on the following domains: adequacy of randomization, allocation concealment, blinding of participants, personnel and outcome assessors, completeness of data, selective outcome reporting, and "other bias."

Consort 2010 statement [21]: extension to cluster randomized trials (CRTs) was used to assess the quality of the included CRTs.

The Strengthening the Reporting of Observational studies in Epidemiology guideline [22] for reporting cohort studies was used to appraise the quality of included cohort studies. The Strengthening the Reporting of Observational studies in Epidemiology Statement is a checklist of 22 items that has been widely used to appraise the quality of observational studies. Thereafter, studies were assigned an evidence grade using the evidence categories used by the Department of Health in the National Service Frameworks [23] (Table 1). Because of the disparity in design, intervention, and outcomes that exist among studies on similar risk factors, a meta-analysis was not performed.

Results

Search Results

The search initially yielded 1020 citations; 27 met inclusion criteria. The flow diagram illustrating the sifting of literature for review is presented in Figure. 1.

Of the 27 articles included in the review, based on the primary end point reported, 8 studies (3 RCTs, 2 CRTs, 1 controlled and 2 uncontrolled before-after design studies) focused on diabetes [24–31]. Nine studies (one RCT, two CRTs, three controlled and three uncontrolled before-after design studies) focused on hypertension [32–40]. Seven studies (three RCTs, one CRT, two randomized and one uncontrolled before-after design studies) focused on dyslipidemia [41–47], whereas three studies (one RCT and one controlled and one uncontrolled before-after design study) focused on smoking cessation [48–50]. Study durations were variable and ranged from 3 to 24 months.

Effectiveness of Interventions

Of the eight studies that focused on diabetes, 75% reported favorable results (Table 2). Of the nine hypertension studies, six (67%) reported favorable results in terms of lowering systolic and diastolic blood pressure or the proportion of patients with controlled blood pressure at the end of the study (Table 3).

Table 1 – Evidence categories used by the Department of Health in the National Service Frameworks [23].

Evidence from research and other professional literature	
A1	Systematic reviews that include at least one randomized controlled trial (RCT), e.g., systematic reviews from Cochrane or National Health Service Centre for Reviews and Dissemination
A2	Other systematic and high-quality reviews that synthesize references
B1	Individual RCTs
B2	Individual nonrandomized experimental/intervention studies
B3	Individual well-designed nonexperimental studies, controlled statistically if appropriate. Includes studies using case-control, longitudinal, cohort, matched pairs, or cross-sectional random sample methodologies, and well-designed qualitative studies; well-designed analytical studies including secondary analysis
C1	Descriptive and other research or evaluation not in B (e.g., convenience samples)
C2	Case studies and examples of good practice
D	Summary review articles and discussions of relevant literature and conference proceedings not otherwise classified

Some 71% reported favorable results out of the seven studies that focused on lipids (Table 4), whereas all three studies on smoking cessation reported favorable results (Table 5). Overall, authors reported favorable results in 20 of the 27 (74%) studies, with more favorable results reported in studies without a control group, 86% (6 of 7), than in those with a control group, 70% (14 of 20).

Based on the primary end point reported in the studies reviewed, pharmacists' interventions (patient education, patient follow-up, identification of drug-related problems, and subsequent therapeutic recommendations to patient's physician) were considered to be effective in producing a "significant" difference in most of the studies; however, because of the multicomponent nature of the intervention, it was impossible to determine whether any intervention type was superior. Although these results are promising, the authors' favorable conclusions were not supported by findings reported in at least four of the reviewed studies [26,30,44,45].

In addition to the primary clinical outcomes, 13 studies reported the impact of interventions on at least one humanistic outcome (including patient knowledge, patient-reported health-related quality of life, and patient-reported lifestyle modifications). Of these 13 studies, 5 studies reported significant improvements in patient knowledge [24,27,29,37,45] and 4 studies reported significant improvements in patient-reported health-related quality of life [28,32,39,46]. These favorable results relating to patient-reported health-related quality of life were not supported by findings reported in two of the reviewed studies [24,47]. Four studies reported significant improvements in exercise in patients [29,34,43,46]; however, Doucette et al. [26] reported nonsignificant improvements in exercise, whereas two diabetes studies reported significant improvements in diet and foot care [26,29].

Methodological Quality of Included Studies

Studies were categorized on the basis of risk factors. Some studies had overlapping risk factors, and in such cases, classification was done on the basis of the first primary end point reported.

Most of the studies did acknowledge difficulties in recruiting participants. Strategies generally used in recruiting participants included identification of potential participants from pharmacy-held records, self-referral, or referral from physician; hence, it is conceivable that only highly motivated patients were approached to participate in the studies. This suggests a potential for selection bias that could overestimate the intervention effect.

Study quality varied widely with study design and the rigor with which the studies were conducted and reported. Randomized studies were rated to be of relatively higher quality than nonrandomized designs. Without exception, every study had potential for bias, which could potentially overestimate or underestimate the effectiveness of the pharmacists' interventions reported. Generally, study participants were not representative of the general population of patients with the risk factor under investigation, because in most cases, they participated voluntarily in the study. More so, most of the studies recruited regular pharmacy customers probably to ensure sufficient follow-up during the course of the study. This selected group of patients may reflect a stronger interest in self-management, hence possibly resulting in positive selection bias, which could overestimate effect size. It was not possible to blind participants in most of the studies; this could potentially introduce the "Hawthorne effect," thus underestimating the effect size [51]. In a controlled study, the effect size can be underestimated because the control group can improve its performance just by virtue of participating in a study. Most of the studies that used a randomized controlled

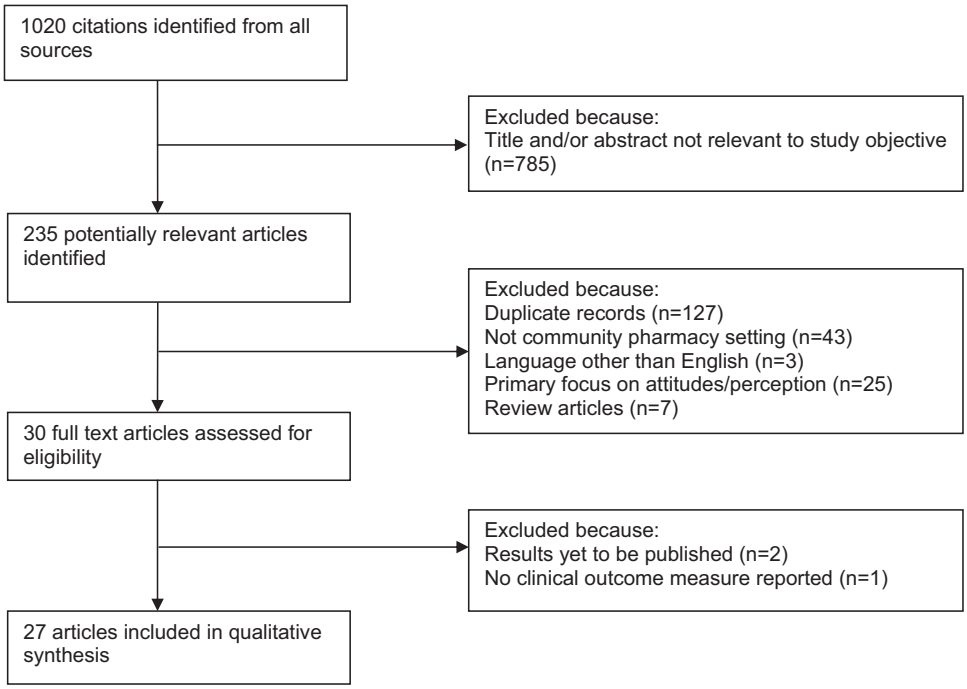


Fig. 1 – Flow chart illustrating sifting of literature for review.

design were flawed by small sample sizes and/or high attrition rates, which rendered most of them underpowered [24,26,27,38,41,42,46,48]; however, only study by Doucette et al. [26] was insufficiently powered to detect significant differences. In all, the randomized studies provide some evidence but were not sufficiently robust in terms of the number of participants recruited and how the participants were recruited; therefore, the findings should be interpreted with caution.

Based on primary outcomes, the effectiveness of pharmacists' interventions in diabetes was reported to be significant in two RCTs, two CRTs, one controlled before-after design study, and one uncontrolled before-after design study and nonsignificant in one RCT and one uncontrolled before-after design study. Although uncontrolled studies provide some level of evidence, it is difficult to judge whether observed benefits were truly as a result of the intervention. Other than the study by Doucette et al. [26], all other controlled studies revealed hemoglobin A_{1c} (Hb A_{1c}) reduction ranging from 0.5% to 2.2%.

The effectiveness of pharmacists' interventions in hypertension was reported to be significant in one RCT and three uncontrolled before-after design studies and unclear in two CRTs and three controlled before-after design studies. In the controlled studies, effect sizes on systolic blood pressure ranged from 7.8 to 17.3 mm Hg.

Similarly, the effectiveness of pharmacists' interventions in lipid management was reported to be significant in two RCTs, one CRT study, and one uncontrolled before-after design study and nonsignificant in one RCT, one randomized before-after design study, and one controlled before-after design study. With the exception of studies by Aslani et al. [42] and Paulós et al. [46], all other studies on lipid management did not report an outcome measure that would allow direct assessment of effect size. Aslani et al. [42] and Paulos et al. [46] reported a reduction of 18.2 and 27.1 mg/dl, respectively (1 mg/dl = 0.02586 mmol/dl), in total cholesterol. However, it may be misleading to assess CVD risk reduction on the basis of total cholesterol alone, making it difficult to judge the clinical benefit of these observed effect sizes. Two studies (one RCT and one controlled before-after design study) on smoking cessation reported the effectiveness of pharmacists' interventions to be significant. Overall, studies suggest that pharmacists' interventions in diabetes and hypertension resulted in clinically important reductions in Hb A_{1c} and systolic blood pressure.

Discussion

Effectiveness of Interventions

More than three-quarter of the studies that evaluated the impact of pharmacists' interventions on blood pressure reported statistically significant reductions in systolic blood pressure, whereas more than half of the studies reported statistically significant reductions in diastolic blood pressure. Most of the studies on diabetes management that assessed Hb A_{1c} as an indicator for glycemic control reported statistically significant reductions. The UK Prospective Diabetes Study showed that each 1% reduction in Hb A_{1c} over 10 years is associated with a risk reduction of 21% for any diabetes-related mortality, 14% for myocardial infarction, and 37% for microvascular complications [52].

A meta-analysis of 30 clinical trials concluded that a reduction of 5 mm Hg in systolic blood pressure lowered the risk of cardiovascular events and stroke by 25% and 30%, respectively [53]. Recommendations published by Izzo et al. [54] advocate that systolic blood pressure must be the major criterion for the management of hypertensive individuals, particularly middle-aged and older patients. This is further supported by the seventh report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure [55]. Reductions in blood pressure and Hb A_{1c} observed in the reviewed studies are clinically valuable, and a reduction of even 0.5% in Hb A_{1c} is clinically relevant.

In addition to clinical outcome measures, a number of studies reviewed that assessed knowledge or adherence reported significant improvements in knowledge and adherence to medication following pharmacists' interventions. Awareness-raising

Table 2 – Characteristics and key findings of included studies on diabetes (n = 8).

Reference	Study design; participants	Study duration	Key components of pharmacist interventions (sample size)	Description of control group (sample size)	Primary outcome measure	Key findings
Ali et al. [24], 2012	RCT; patients with type 2 diabetes	12 mo	Patient education regarding diabetes and lifestyle modifications; monitoring of blood glucose, BP, and BMI; medication adherence support; identification of DRPs; regular follow-up; and referral to patients' GP when appropriate (n = 25)	Usual care (n = 23)	Change in mean Hb A_{1c} (%) from baseline	Intervention: −1.6 (8.2 → 6.6)
B1						Control: −0.6 (8.1 → 7.5)
UK						(P = 0.001)
Correr et al. [25], 2011	Controlled before-after design study; patients with type 2 diabetes	12 mo	Patient education regarding diabetes and lifestyle modifications; adherence support; identification of DRPs; recommend therapy change to patients' GP; and regular follow-up (n = 4 pharmacies; 50 patients)	Usual care (n = 2 pharmacies; 46 patients)	Change in mean Hb A_{1c} (%) from baseline	Intervention: −2.2 (9.9 → 7.7)
B2						Control: −0.3 (8.6 → 8.3)
Brazil						(P = 0.001)
Doucette et al. [26], 2009	RCT; patients with type 2 diabetes	12 mo	Patient education regarding diabetes, medication adherence, and self-care behaviors; regular monitoring of Hb A_{1c}, LDL-C, and BP; identify DRPs and recommend therapy change to patients' GP; and regular patient follow-up and progress note sent to physician (n = 36)	Usual care (n = 42)	Change in mean Hb A_{1c} (%) from baseline	Intervention: −0.27 (7.99 → 7.72)
B1						Control: +0.12 (7.91 → 8.03)
USA						(P = 0.27)
Fornos et al. [27], 2006	RCT; patients with type 2 diabetes	13 mo	Lifestyle education; self- monitoring of blood glucose and BP; medication adherence support; detection of DRPs; and referral to patients' GP when appropriate (n = 56)	Usual care (n = 58)	Change in mean Hb A_{1c} (%) from baseline	Intervention: −0.5 (8.4 → 7.9)
B1						Control: +0.7 (7.8 → 8.5)
Spain						(P = 0.0001)
Krass et al. [28], 2007	CRT; patients with type 2 diabetes	6 mo	Patient education regarding diabetes and lifestyle modifications; medication adherence support; identification of DRPs; self-monitoring of blood glucose; regular	Usual care (n = 28 pharmacies; 159 patients)	Change in mean Hb A_{1c} (%) from baseline	Intervention: −1.0 (8.9 → 7.9)

continued on next page

Table 2 – *continued*

Reference	Study design; participants	Study duration	Key components of pharmacist interventions (sample size)	Description of control group (sample size)	Primary outcome measure	Key findings
			follow-up; and referral to patients' GP when appropriate (n = 28 pharmacies; 176 patients)			
B1 Australia						Control: −0.3 (8.3 → 8.0) (*P* = 0.01)
Mehuys et al. [29], 2011	CRT; patients with type 2 diabetes	6 mo	Patient education regarding disease and lifestyle modifications; medication adherence support; and identification of drug therapy problems (n = 35 pharmacies; 153 patients)	Usual care (n = 31 pharmacies; 135 patients)	Change in mean Hb A_{1c} (%) from baseline	Intervention: −0.6 (7.7 → 7.1)
B1 Belgium						Control: −0.1 (7.3 → 7.2) (*P* = 0.009)
Nau and Ponte [30], 2002	Uncontrolled before-after design study; patients with type 2 diabetes	6 mo	Patient education regarding diabetes and lifestyle changes; medication adherence support; blood glucose monitoring; identification of DRPs; and recommend therapy modifications to patients' GP when appropriate (n = 32)	Not applicable	Change in mean Hb A_{1c} (%) from baseline	−0.4 (7.8 → 7.4)
B3 USA						(*P* = NS)
Turnacilar et al. [31], 2009	Uncontrolled before-after design study; patients with type 2 diabetes	3 mo	Patient education regarding diabetes and lifestyle changes; medication adherence support; blood glucose monitoring; identification of DRPs; and referral to patients' GP when appropriate (n = 43)	Not applicable	Proportion of patients (%) from baseline attaining 80–120 mg/dl BG goal	39.5% of the patients attained the BG goal compared with 16.3% at baseline
B3 Turkey						(*P* = 0.01)

BG, blood glucose; BMI, body mass index; BP, blood pressure; CRT, cluster randomized trial; DRPs, drug-related problems; GP, general practitioner; Hb A_{1c}, hemoglobin A_{1c}; LDL-C, low-intensity lipoprotein cholesterol; NS, nonsignificant.
P value for between-group comparisons of change in mean Hb A_{1c} from baseline or within group for single-group studies.

Table 3 – Characteristics and key findings of included studies on hypertension (n = 9).

Reference	Study design; participants	Study duration	Key components of pharmacist interventions (sample size)	Description of control group (sample size)	Primary outcome measure	Key findings
Aguwa et al. [32], 2008 B3 Nigeria	Uncontrolled before-after design study; patients with hypertension	5 mo	Patient education regarding hypertension, lifestyle changes, medication adherence, and self BP monitoring; identification of DRPs; regular follow-up; and referral to patients' GP when appropriate (n = 24)	Not applicable	Change in mean BP from baseline	SBP (mm Hg): −14.3 (158.1 → 143.8) (P = 0.001) DBP (mm Hg): −10.8 (100.6 → 89.8) (P = 0.001)
Blenkinsopp et al. [33], 2000 B1 UK	CRT; patients with hypertension	6 mo	Patient education regarding hypertension and lifestyle changes; medication adherence support (n = 11)	Usual care (n = 9 pharmacies)	Proportion of patients with controlled BP at end of study	Intervention: 78.6% (22 of 28) Control: 45.7% (16 of 35) (P value not reported for comparison)
Chabot et al. [34], 2003 B2 Canada	Controlled before-after design study; patients with hypertension	9 mo	Using computerized decision-making aid tool to facilitate patient education on hypertension, lifestyle changes, adherence support, and recommend therapy adjustments to physician (n = 41 patients)	Usual care (n = 59 patients)	Change in mean BP from baseline	SBP (mm Hg): Intervention: −7.8 (141.0 → 133.2) Control: +0.5 (139.0 → 139.5) (P = 0.01) DBP (mm Hg): Intervention: −6.5 (78.0 → 71.5) Control: −4.0 (78.0 → 74.0) (P = 0.28)
Fikri-Benbrahim et al. [35], 2012 B2 Spain	Controlled before-after design study; patients with hypertension	5 mo	Education regarding hypertension, lifestyle changes, self-monitoring of BP, and medication adherence support; detection of DRPs; and referral to patients' GP when appropriate (n = 87)	Usual care (n = 89)	Proportion of patients with controlled BP at end of study	Intervention: 71.3% compared with 52.9% at baseline Control: 55.1% compared with 50.6% at baseline (P = 0.026)
McNamara et al. [36], 2012 B3	Uncontrolled before-after design study; high CVD risk score patients	6 mo	Education regarding lifestyle modifications; patient medication review; and recommend therapy to patients' physician when appropriate (n = 67)	Not applicable	Change in 5-y CVD risk score (%) from baseline	−1.7 (6.8 → 5.1)

continued on next page

Table 3 – *continued*

Reference	Study design; participants	Study duration	Key components of pharmacist interventions (sample size)	Description of control group (sample size)	Primary outcome measure	Key findings
Australia						($P < 0.001$)
Oparah et al. [37], 2006;	Uncontrolled before-after design study; patients with hypertension	6 mo	Education regarding hypertension, lifestyle changes, BP monitoring, and medication adherence support; detection of DRPs; and recommend therapy changes with patients' physician when appropriate (n = 36)	Not applicable	Change in mean BP from baseline	SBP (mm Hg): −50.5 (187.7 → 137.2)
B3						($P < 0.0001$)
Nigeria						DBP (mm Hg): − 28.6 (117.6 → 89.0)
						($P < 0.0001$)
Planas et al. [38], 2009;	RCT; patients with hypertension and diabetes	9 mo	Education on diet and lifestyle changes, medication review, adherence support, and identification of DRPs; recommend therapy changes to patients' GP when appropriate (n = 32)	Usual care (n = 20)	Change in mean SBP from baseline	Intervention: −17.32 (141.8 → 124.4)
B1						Control: +2.73 (145.4 → 148.1)
USA						($P = 0.003$)
Robinson et al. [39], 2010	Controlled before-after design study; patients with hypertension	12 mo	Education regarding lifestyle changes, monitoring patients' BP, medication adherence support, and identification of DRPs (n = 78)	Usual care (n = 62)	Change in mean BP from baseline	SBP (mm Hg): Intervention: −9.9 (151.5 → 141.6) Control: −2.8 (151.5 → 148.7) ($P < 0.05$) DBP (mm Hg): Intervention: −2.9 (82.4 → 79.5) Control: −1.0 (87.4 → 86.4) ($P = 0.16$)
B2						
USA						
Zillich et al. [40], 2005	CRT; patients with hypertension	3 mo	Education regarding hypertension and lifestyle modifications, adherence support, and self BP monitoring; recommend therapy changes to patients' physician (n = 6 pharmacies; 64 patients)	Usual care, BP monitoring, referred patients to GP (n = 6 pharmacies; 61 patients)	Change in mean BP from baseline	SBP (mm Hg): Intervention: −13.4 (151.5 → 138.1) Control: −9.0 (151.6 → 142.6) ($P = 0.12$) DBP (mm Hg): Intervention: −8.8 (85.3 → 76.5) Control: −5.6 (85.3 → 79.7) ($P = 0.03$)
B1						
USA						

BP, blood pressure; CRT, cluster randomized trial; CVD, cardiovascular disease; DBP, diastolic blood pressure; DRPs, drug-related problems; GP, general practitioner; RCT, randomized controlled trial; SBP, systolic blood pressure.

*P value for between-group comparisons of change in mean SBP and DBP from baseline or within group for single-group studies.

Table 4 – Characteristics and key findings of included studies on dyslipidemia (n = 7).

Reference	Study design; participants	Study duration	Key components of pharmacist interventions (sample size)	Description of control group (sample size)	Primary outcome measure	Key findings
Amariles et al. [41], 2012 B1 Spain	RCT; patients with CVD or CV risk factor	8 mo	Patient education regarding hypertension, lifestyle changes, medication adherence, and self BP monitoring; identification of DRPs; regular follow-up; and recommend therapy changes to patients' GP when appropriate (n = 356)	Usual care including counseling regarding CVD prevention (n = 358)	Proportion of patients achieving TC therapeutic goal of <200 mg/dL for patients without CVD or <175 mg/dL for patients with CVD	Intervention: +14.1% (42.4% → 56.5%) Control: +5.0% (39.1% → 44.1%) (OR 1.64; 95% CI 1.21–2.23)
Aslani et al. [42], 2010 B1 Australia	CRT; patients on lipid- lowering therapy	9 mo	Provided medicine use information, adherence support, and lifestyle modifications; monitored total blood cholesterol; and referred patients' to GP (n = 9 pharmacies; 49 patients)	Usual care (n = 8 pharmacies, 48 patients)	Change in mean TC (mmol/l) from baseline	Intervention: −0.47 (5.10 → 4.63) Control: −0.1 (4.81 → 4.80) ($P < 0.05$)
Blumi et al. [43], 2000 B3 USA	Uncontrolled before-after design study; patients with dyslipidemia	24 mo	Patient education regarding CHD risks, lifestyle modifications, medication use review, and adherence support; blood TC monitoring; and referral to patients' GP (n = 397)	Not applicable	Change in mean TC (mmol/l) from baseline	TC: −30.5 (238.0 → 207.5) ($P < 0.0001$)
Eussen et al. [44], 2010 B1 The Netherlands	RCT; new statin users	12 mo	Patient education on drug indication, effects, adverse effects, adherence support, and monitoring of lipid levels (n = 513)	Usual care (n = 503)	Discontinuation rates at 1 y	Intervention: 23% Control: 26% HR 0.84 (95% CI 0.65–1.10)
Nola et al. [45], 2000 B2 USA	Randomized before-after design study; patients with known CAD or lipid levels requiring therapy	6 mo	Lifestyle education; monitoring of drug therapy and cholesterol levels; adherence support; and referral to patients' physician when appropriate (n= 25)	Usual care (n = 26)	Change in mean risk factor prediction score from baseline	Intervention: −0.6 (17.0 → 16.4) Control: +0.6 (16.5 → 17.1) ($P = 0.05$)
Paulós et al. [46], 2005 B2 Chile	Randomized before-after design study; patients with dyslipidemia	4 mo	Patient education about CVDs, medication and lifestyle modifications, adherence support, and identification of DRPs; monitoring of cholesterol levels; and referral to patients' physician when appropriate (n = 23)	Usual care (n = 19)	Change in mean TC (mg/dl) from baseline	Intervention: −27.1 (205.1 → 178.1) ($P = 0.0266$) Control: −1.4 (203.2 → 199.1) ($P = 0.6624$)

continued on next page

Table 4 – *continued*

Reference	Study design; participants	Study duration	Key components of pharmacist interventions (sample size)	Description of control group (sample size)	Primary outcome measure	Key findings
Tsuyuki et al. [47], 2002 B1 Canada	RCT; patients with high risk of CV events	4 mo	Patient education about CV risk factors and lifestyle changes, medication review, and adherence support; monitoring of blood lipid levels; and referral to patients' physician when appropriate (n = 344)	Usual care including the provision of a booklet on risk factors and lifestyle changes (n = 331)	Composite: physician requests fasting lipid profile, prescribes new cholesterol-lowering drug or modified current drug therapy	Intervention: 57% (196 of 344) Control: 31% (102 of 331) OR 3.0; 95% CI 2.2–4.1 ($P < 0.001$)

BP, blood pressure; CAD, coronary artery disease; CHD, coronary heart disease; CRT, cluster randomized trial; CV, cardiovascular; CVD, cardiovascular disease; DRPs, drug-related problems; GP, general practitioner; HR, hazard ratio; OR, odds ratio; RCT, randomized controlled trial; TC, total cholesterol.

interventions focusing on benefits of therapy are critical to stimulate changes in behavior and improve adherence to medication. Whether improving knowledge translates to behavior change and better medication adherence, however, remains a subject for debate.

The findings from the study by Doucette et al. [26] are uncommon. Despite the improvements in healthy behaviors (diet and exercise) reported by the intervention group, statistically significant reductions in clinical markers for glycemic control were not achieved during the duration of the study. It is plausible that patients' diet and exercise habits improved gradually over the course of the study and there may have not been sufficient time for these behaviors to fully induce physiological changes that would be reflected in clinical markers. Furthermore, the impact of the changes may have been too small to precipitate an improvement in clinical markers given the small sample size of the study. Studies of lifestyle modifications have demonstrated that adopting healthy diet and exercise habits can improve clinical markers such as blood pressure, Hb A_{1c}, and low-density lipoprotein cholesterol [56–58].

Two considerably large RCTs (Tsuyuki et al. [47] and Eussen et al. [44]) that were rated above average in methodological quality were still limited in their generalizability. It would be expected that participants in an RCT should be drawn from a representative sampling frame; however, a number of factors present as challenge when designing and conducting an RCT in a community pharmacy setting. In most of the trials reviewed, only a few pharmacies gave consent to participate in the studies; hence, potentially eligible patients who do not refill their prescriptions in these few participating pharmacies were missed. This nonconsenting attitude could partly be explained be ethical consideration whereby no pharmacist is willing to deliver usual care to a patient who might benefit from an intervention. It may as well be that pharmacists are unwilling to consent for fear of losing patients' loyalty and patronage should they decline consent to participate in the study. More so, because patients refill their prescriptions at any convenient pharmacy outlet, it may be impractical to sample participants from a more representative study population such as a General Practice list. A careful evaluation of participants' consent rate in the trials reviewed showed that in most of the studies, a considerable proportion of eligible participants were nonconsenting. It is conceivable that patients are likely to decline consent if informed that they may be assigned to a control group, thereby denying them a potentially beneficial intervention; thus, the issue of generalizability of findings from trials conducted in a community pharmacy setting merits some consideration. This raises the question of how best to design a trial in a community pharmacy setting. Several options may be considered. To minimize the problem of contamination and patients' refusal, a CRT design (taking account of clustering effect) may be worthwhile. It may also be worthwhile to adopt a cross-over design in which case patients who originally started off by receiving usual care also receive the intervention much later into the study. Alternatively, the intervention may be provided to the control group at the end of the study. This delayed intervention design may however be limited if the study duration is intended to be long. These techniques could potentially minimize the ethical considerations that limit pharmacists' participation in intervention trials.

Another aspect that warrants careful consideration is the substantial incentives that were provided to pharmacists in the intervention group in most of the studies. It may be worth exploring to provide a similar incentive to pharmacists delivering usual care to assess whether these incentives may as well result in meaningful benefits in patients' clinical and/or humanistic outcomes.

Table 5 – Characteristics and key findings of included studies on tobacco dependence (n = 3).

Reference	Study design; participants	Study duration	Key components of pharmacist interventions (sample size)	Description of control group (sample size)	Primary outcome measure	Key findings
Bock et al. [48], 2010	Controlled before-after design study; current smokers	6 mo	EQ group: Computerized tool that aided assessment of smoking status, counseling on smoking-related diseases, smoking cessation strategies, regular follow-up (n = 100); EQ+ group: used computerized tool plus free nicotine patch (n = 100)	Observation (n = 100)	7-d point prevalence abstinence at 6 mo	EQ+: 28% (compared with control; OR 3.3; 95% CI 1.9–5.2)
B2						EQ: 15% (compared with control; OR 1.49; 95% CI 1.2–3.6)
USA						OBS only: 8%
						EQ+ vs. EQ (Ref) (OR 2.3; 95% CI 1.5–3.9)
Khan et al. [49], 2012	Uncontrolled before-after design study; current smokers	6 mo	Assessed patients' tobacco use pattern and readiness for change, counseling on smoking cessation aids, regular follow-up (n = 346)	Not applicable	Tobacco quit rate at 6 mo	25% quite rate was reported after 6 mo
B3						
Mexico						(P value not reported)
Maguire et al., 2000	RCT; current smokers	12 mo	Delivered PAS intervention, which involved structured counseling program on smoking cessation, distribution of information leaflet, and regular follow-up (n = 265)	Usual care (n = 219)	Self-reported smoking cessation at 12 mo with cotinine validation at the 12-mo follow- up	14.3% (38 of 265) of the intervention group was abstinent at 12-mo follow-up compared with 2.7% (6 of 219) of the control group ($P < 0.001$)
B1						
UK						

EQ, Expert Quit; OR, odds ratio; PAS, Pharmacists' Action on Smoking; RCT, randomized controlled trial.

Community Pharmacy Practice Implications

Community pharmacy practice setting presents an interesting opportunity for delivering interventions to reduce CVD risk factors, but a number of factors relating to the practicality of implementing these interventions in real-life practice merit consideration. Most of the studies reviewed reported carrying out some form of training and reimbursed pharmacists for delivering interventions. These potentially could have motivated them to faithfully deliver the interventions consistently. Studies have reported lack of time, specific training, and reimbursement as major barriers to the delivery of pharmaceutical care interventions in community pharmacy settings [59,60], which raises the question of to what extent are patients willing to pay for these services.

More so, most of the interventions required the pharmacist to regularly monitor patients' health status by way of blood pressure and/or blood glucose monitoring and in most cases researchers provided patients with blood pressure and/or blood glucose monitoring kits to encourage adherence to the research protocol. This also raises an important real-life question of patients' affordability of these kits, especially in resource-poor settings.

Strengths and Limitations

The strong points of this review include the systematic way in which evidence was sought, the evaluation of the impact of pharmacists' interventions on all major risk factors for CVD, and the inclusion of different types of pharmacists' interventions.

This study, however, should be considered in light of its limitations. First, only full-text articles published in English were included. There is a high chance that relevant articles were

missed because of these criteria. Although attempts were made to search the gray literature for unpublished studies, none was found. The authors are not confident that this study is free of publication bias because the potential exists.

Included studies were conducted in different countries and used different study designs. This calls for caution when interpreting the study findings because the issue of transferability of findings between countries and health care systems should be considered. Categorization of interventions and quality assessment was based on what was reported in the articles, and authors were not contacted for extra details even in cases of ambiguity. The authors are unaware of the cost-effectiveness of the interventions. The search term and study eligibility criteria limited identification of articles that focused on the cost-effectiveness of interventions.

Furthermore, this review was not able to estimate how much training a pharmacist needs to deliver the interventions, the frequency with which the pharmacist has to intervene, or whether there is an impact on CVD risk factors beyond the period of intervention. Also, this review was unable to determine which intervention component was more effective. This was because interventions were multicomponent and often delivered in combination. It is likely, however, that the combination of improved lifestyle behaviors, better medication adherence, and increased contact with pharmacists contributed to the observed improvements. Again, collaboration with physicians was another aspect of the intervention that may also have contributed to the observed improvements. These gaps present an opportunity for further research.

Conclusions

In all the studies reviewed, interventions were generally patient centered, physician centered, or both. Patient-centered intervention involved education regarding disease state, adherence support, and regular follow-up. Physician-centered intervention entails a collaborative working relationship with the physician to optimize patients' therapy.

Although study quality was generally poor, available evidence from the results of four controlled studies that focused on hypertension revealed a substantial reduction in systolic blood pressure. Similar findings were observed in studies that focused on diabetes where all but one of the controlled studies revealed substantial clinical benefits. Because all the results are in the same direction, it suggests that there might be potential for substantial clinical benefit in hypertension and diabetes. Most of the studies that focused on dyslipidemia did not report outcomes that would allow for direct estimate of the potential magnitude of impact of the intervention. The two studies that reported the impact of the intervention on total cholesterol showed substantial reductions. This suggests that there might be potential for substantial clinical benefit in total cholesterol, but total cholesterol alone may not be sufficient to determine the impact on CVD risk. Larger, longer, well-designed studies are needed to guide community pharmacists in this important area of practice.

REFERENCES

[1] Adeyi O, Smith O, Robles S. Public Policy and the Challenge of Chronic Noncommunicable Diseases. Washington, DC: The World Bank, 2007.

[2] World Health Organization. Global status report on noncommunicable diseases 2010. 2011. Available from: http://www.who.int/nmh/publications/ncd_report2010/en/. [Accessed August 15, 2013].

[3] World Health Organization. Global atlas on cardiovascular disease prevention and control. 2011. Available from: http://www.who.int/cardiovascular_diseases/publications/atlas_cvd/en/. [Accessed August 15, 2013].

[4] World Health Organization. Cardiovascular diseases key facts. Available from: http://www.who.int/mediacentre/factsheets/fs317/en/. [Accessed August 15, 2013].

[5] Capewell S, Beaglehole R, Seddon M, McMurray J. Explanation for the decline in coronary heart disease mortality rates in Auckland, New Zealand, between 1982 and 1993. Circulation 2000;102:1511–6.

[6] Ford ES, Ajani UA, Croft JB, et al. Explaining the decrease in U.S. deaths from coronary disease, 1980–2000. N Engl J Med 2007;356:2388–98.

[7] Laatikainen T, Critchley J, Vartiainen E, et al. Explaining the decline in coronary heart disease mortality in Finland between 1982 and 1997. Am J Epidemiol 2005;162:764–73.

[8] Unal B, Critchley JA, Capewell S. Explaining the decline in coronary heart disease mortality in England and Wales between 1981 and 2000. Circulation 2004;109:1101–7.

[9] Blenkinsopp A, Anderson C, Armstrong M. Systematic review of the effectiveness of community pharmacy-based interventions to reduce risk behaviours and risk factors for coronary heart disease. J Pub Health Med 2003;25:144–53.

[10] Pharmaceutical Services Negotiating Committee. Community pharmacy: at the heart of public health. Available from: www.psnc.org.uk/publications. [Accessed July 5, 2013].

[11] Beaglehole R, Bonita R. Global public health: a scorecard. Lancet 2008;372:1988–96.

[12] Agomo CO. The role of community pharmacists in public health: a scoping review of the literature. J Pharm Health Serv Res 2011;3:25–33.

[13] Björkman I, Viberg N, Rydberg L, Lundborg CS. Health promotion at Swedish pharmacies – views of the staff. Pharm Pract 2008;6:211–8.

[14] Machado M, Bajcar J, Guzzo GC, Einarson TR. Sensitivity of patient outcomes to pharmacist intervention, part II: systematic review and meta-analysis in hypertension management. Ann Pharmacother 2007;41:1770–81.

[15] Machado M, Bajcar J, Guzzo GC, Einarson TR. Sensitivity of patient outcomes to pharmacist interventions, part I: systematic review and meta-analysis in diabetes management. Ann Pharmacother 2007;41:1569–82.

[16] Wubben D, Vivian E. Effects of pharmacist outpatient interventions on adults with diabetes mellitus: a systematic review. Pharmacotherapy 2008;28:421–36.

[17] Blenkinsopp A, Hassey A. Effectiveness and acceptability of community pharmacy-based interventions in type 2 diabetes: a critical review of intervention design, pharmacist and patient perspectives. Int J Pharm Pract 2005;13:231–40.

[18] Cross LB, Franks AS. Clinical outcomes associated with pharmacist involvement in patients with dylipidemia. Dis Manag Health Outcomes 2005;13:31–42.

[19] Machado M, Nassor N, Bajcar JM, et al. Sensitivity of patient outcomes to pharmacist interventions, part III: systematic review and meta-analysis in hyperlipidemia management. Ann Pharmacother 2008;42:1195–207.

[20] Higgins JPT and Green S. (2011). Cochrane Handbook for Systematic Reviews of interventions. Version 5.1.0. The Cochrane Collaboration 2013. Available from: www.cochrane-handbook.org. [Accessed September 12, 2013].

[21] Campbell MK, Piaggio G, Elbourne DR, Altman DG. Consort 2010 statement: extension to cluster randomised trials. BMJ 2012;345:1–21.

[22] von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. PLoS Med 2007;4:e296.

[23] Anderson C, Blenkinsopp A, Armstrong M. Feedback from community pharmacy users on the contribution of community pharmacy to improving the public's health: a systematic review of the peer reviewed and non-peer reviewed literature 1990–2002. Health Expect 2004;7:191–202.

[24] Ali M. Schifano, Robinson P, et al. Impact of community pharmacy diabetes monitoring and education programme on diabetes management: a randomized controlled study. Diabetic Med 2012;29:326–33.

[25] Correr CJ, Melchiors AC, Fernandez-Llimos F, Pontarolo R. Effects of a pharmacotherapy follow-up in community pharmacies on type 2 diabetes patients in Brazil. Int J Clin Pharm 2011;33:273–80.

[26] Doucette WR, Witry MJ, Farris KB, McDonough RP. Community pharmacist–provided extended diabetes care. Ann Pharmacother 2009;43:882–9.

[27] Fornos JA, Andrés NF, Andrés JC, et al. A pharmacotherapy follow-up program in patients with type-2 diabetes in community pharmacies in Spain. Pharm World Sci 2006;28:65–72.

[28] Krass I, Armour CL, Mitchell B, et al. The Pharmacy Diabetes Care Program: assessment of a community pharmacy diabetes service model in Australia. Diabet Med 2007;24:677–83.

[29] Mehuys E, Van Bortel L, De Bolle L, et al. Effectiveness of a community pharmacist intervention in diabetes care: a randomized controlled trial. J Clin Pharm Therapeut 2011;36:602–13.

[30] Nau DP, Ponte CD. Effects of a community pharmacist-based diabetes patient-management program on intermediate clinical outcome measures. J Manag Care Pharm 2002;8:48–53.

[31] Turnacilar M, Sancar M, Apikoglu-Rabus S, et al. Improvement of diabetes indices of care by a short pharmaceutical care program. Pharm World Sci 2009;31:689–95.
[32] Aguwa CN, Ukwe CV, Ekwunife OI. Effect of pharmaceutical care programme on blood pressure and quality of life in a Nigerian pharmacy. Pharm World Sci 2008;30:107–10.
[33] Blenkinsopp A, Phelan M, Bourne J, Dakhil N. Extended adherence support by community pharmacists for patients with hypertension: a randomised controlled trial. Int J Pharm Pract 2000;8:165–75.
[34] Chabot I, Moisan J, Grégoire J, Milot A. Pharmacist intervention program for control of hypertension. Ann Pharmacother 2003;37:1186–93.
[35] Fikri-Benbrahim N, Faus MJ, Martínez-Martínez F, et al. Effect of a pharmacist intervention in Spanish community pharmacies on blood pressure control in hypertensive patients. Am J Health-Syst Pharm 2012;69:1311–8.
[36] McNamara KP, O'Reilly SL, Dunbar JA, et al. A pilot study evaluating multiple risk factor interventions by community pharmacists to prevent cardiovascular disease: the PAART CVD pilot project. Ann Pharmacother 2012;46:183–91.
[37] Oparah AC, Adje DU, EFO Enato. Outcomes of pharmaceutical care intervention to hypertensive patients in a Nigerian community pharmacy. Int J Pharm Pract 2006;14:115–22.
[38] Planas LG, Crosby KM, Mitchell KD, Farmer KC. Evaluation of a hypertension medication therapy management program in patients with diabetes. J Am Pharmacists Assoc 2009;49:164–70.
[39] Robinson JD, Segal R, Lopez LM, Doty RE. Impact of a pharmaceutical care intervention on blood pressure control in a chain pharmacy practice. Ann Pharmacother 2010;44:88–96.
[40] Zillich AJ, Sutherland JM, Kumbera PA, Carter BL. Hypertension outcomes through blood pressure monitoring and evaluation by pharmacists (HOME Study). J Gen Intern Med 2005;20:1091–6.
[41] Amariles P, Sabater-Hernández D, García-Jiménez E, et al. Effectiveness of Dader method for pharmaceutical care on control of blood pressure and total cholesterol in outpatients with cardiovascular disease or cardiovascular risk: EMDADER-CV randomized controlled trial. J Manag Care Pharm 2012;18:311–23.
[42] Aslani P, Rose G, Chen TF, et al. A community pharmacist delivered adherence support service for dyslipidaemia. Eur J Pub Health 2010;21:567–72.
[43] Blumi BM, McKenney JM, Cziraky MJ. Pharmaceutical care services and results in project ImPACT: hyperlipidemia. J Am Pharm Assoc 2000;40:157–65.
[44] Eussen SRBM, van der Elst ME, Klungel OH, et al. A pharmaceutical care program to improve adherence to statin therapy: a randomized controlled trial. Ann Pharmacother 2010;44:1905–13.
[45] Nola KM, Gourley DR, Portner TS, et al. Clinical and humanistic outcomes of a lipid management program in a community pharmacy setting. J Am Pharm Assoc 2000;40:166–73.
[46] Paulós CP, Nygren CEA, Celedón C, Cárcamo CA. Impact of a pharmaceutical care program in a community pharmacy on patients with dyslipidemia. Ann Pharmacother 2005;39:939–43.
[47] Tsuyuki RT, Johnson JA, Teo KK, et al. A randomized trial of the effect of community pharmacist intervention on cholesterol risk management. Arch Intern Med 2002;162:1149–55.
[48] Bock BC, Hudmon KS, Christian J, et al. A tailored intervention to support pharmacy-based counseling for smoking cessation. Nicotine Tob Res 2010;12:217–25.
[49] Khan N, Anderson JR, Du J, et al. Smoking cessation and its predictors: results from a community-based pharmacy tobacco cessation program in New Mexico. Ann Pharmacother 2012;46:1198–204.
[50] Maguire TA, McElnay JC, Drummond A. A randomized controlled trial of a smoking cessation intervention based in community pharmacies. Addiction 2001;96:325–31.
[51] McCarney R, Warner J, Iliffe S, et al. The Hawthorne effect: a randomised, controlled trial. BioMed Central Med Res Methodol 2007;7:1–8.
[52] Stratton IM, Adler AI, Neil HAW, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. BMJ 2000;321:405–12.
[53] Staessen JA, Wang J, Thijs LT. Cardiovascular prevention and blood pressure reduction: a quantitative overview updated until 1 March 2003. J Hypertens 2003;21:1055–76.
[54] Izzo JL, Levy D, Black HR. Importance of systolic blood pressure in older Americans. Hypertension 2000;35:1021–4.
[55] Chobanian AV, Bakris GL, Henry R, et al. Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program Coordinating Committee. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension 2003;42:1206–52.
[56] Boulé NG, Haddad E, Kenny GP, et al. Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: a meta-analysis of controlled clinical trials. J Am Med Assoc 2001;286:1218–27.
[57] Lindström J, Anne Louheranta A, Mannelin M, et al. The Finnish Diabetes Prevention Study (DPS): lifestyle intervention and 3-year results on diet and physical activity. Diabetes Care 2003;26:3230–6.
[58] Ratner R, Goldberg R, Haffner S, et al. Diabetes Prevention Program Research Group. Impact of intensive lifestyle and metformin therapy on cardiovascular disease risk factors in the diabetes prevention program. Diabetes Care 2005;28:888–94.
[59] Kotecki JE, Elanjian SI, Torabi MR. Health promotion beliefs and practices among pharmacists. J Am Pharm Assoc 2000;40:773–9.
[60] Uema SA, Vega EM, Armando PD, Fontana D. Barriers to pharmaceutical care in Argentina. Pharm World Sci 2008;30:211–5.