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THE PRESENT AND FUTURE

COUNCIL PERSPECTIVES

The Role of the Clinical Pharmacist in the Care of Patients With Cardiovascular Disease

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ABSTRACT

Team-based cardiovascular care, including the use of clinical pharmacists, can efficiently deliver high-quality care. This Joint Council Perspectives paper from the Cardiovascular Team and Prevention Councils of the American College of Cardiology provides background information on the clinical pharmacist's role, training, certification, and potential utilization in a variety of practice models. Selected systematic reviews and meta-analyses, highlighting the benefit of clinical pharmacy services, are summarized. Clinical pharmacists have a substantial effect in a wide variety of roles in inpatient and ambulatory settings, largely through optimization of drug use, avoidance of adverse drug events, and transitional care activities focusing on medication reconciliation and patient education. Expansion of clinical pharmacy services is often impeded by policy, legislation, and compensation barriers. Multidisciplinary organizations, including the American College of Cardiology, should support efforts to overcome these barriers, allowing pharmacists to deliver high-quality patient care to the full extent of their education and training. (J Am Coll Cardiol 2015;66:2129–39)

The American College of Cardiology (ACC) Board of Trustees and Strategic Plan endorse team-based care as a means to address the growing cardiovascular disease (CVD) epidemic (1,2). With a critical shortage of cardiologists, it is important that collaboration is developed with nonphysician providers, including clinical pharmacists, as an efficient and cost-effective means to improve patient outcomes. As with other qualified nonphysician practitioners, clinical pharmacists are underutilized; a 2009 ACC survey demonstrated that many cardiologists are unfamiliar with how best to apply a nonphysician team approach to patient care (3). Importantly, the major application of a clinical pharmacist to direct patient care is team-centric and not independent of physicians or other licensed providers.

Patients with CVD are at significant risk for adverse drug events and medication errors due to polypharmacy (4,5); they also have proportionally greater utilization of high-risk medications, such as anticoagulant agents. By focusing on preventing

The views expressed in this paper by the ACC's Cardiovascular Team and Prevention Councils do not necessarily reflect the views of the *JACC* or of the ACC.

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Listen to this manuscript's audio summary by *JACC* Editor-in-Chief Dr. Valentin Fuster.

ABBREVIATIONS AND ACRONYMS

ACC = American College of Cardiology

ACCP = American College of Clinical Pharmacy

ACPE = American College of Pharmaceutical Education

BPS = Board of Pharmacy Specialties

CPA = collaborative practice agreement

CPS = clinical pharmacy services

CVD = cardiovascular disease

medication-related adverse events and error, financial waste related to these events can be decreased and patient outcomes improved (6,7). In addition, patients with CVD are often underprescribed critical, evidence-based therapies for a variety of reasons (8,9). Clinical pharmacists are pharmacists who, through advanced training, experiences, and/or certification requirements for licensure as a general pharmacist, have the skills and knowledge to provide clinical pharmacy services (CPS) to the health care team and patients. CPS includes, but is not limited to, complex medication management, transitional care related to medications, and patient or clinician medication education (10). A summary of CPS is included in the **Central Illustration**, demonstrating that the clinical pharmacist may operate on a patient-specific, facility, or global level to achieve optimal medication outcomes. The American College of Clinical Pharmacy (ACCP) defines CPS as, "a health sciences discipline in which pharmacists provide patient care that optimizes medication therapy and promotes health, wellness, and disease prevention" (11). Clinical pharmacists also play a pivotal role in ensuring medication safety, either through specific medication interventions or in designing macroprocesses to reduce the medication-related risk of error. In the MEDAP (Medication Error Detection, Amelioration, and Prevention) study, an observational analysis of clinical pharmacists engaged in patient safety initiatives, cardiovascular drugs comprised the third most-commonly prescribed class of medications resulting in errors that required pharmacist intervention (12). Clinical pharmacists are uniquely positioned to address medication safety, due to their intimate understanding of the medication-use process and clinical pharmacology.

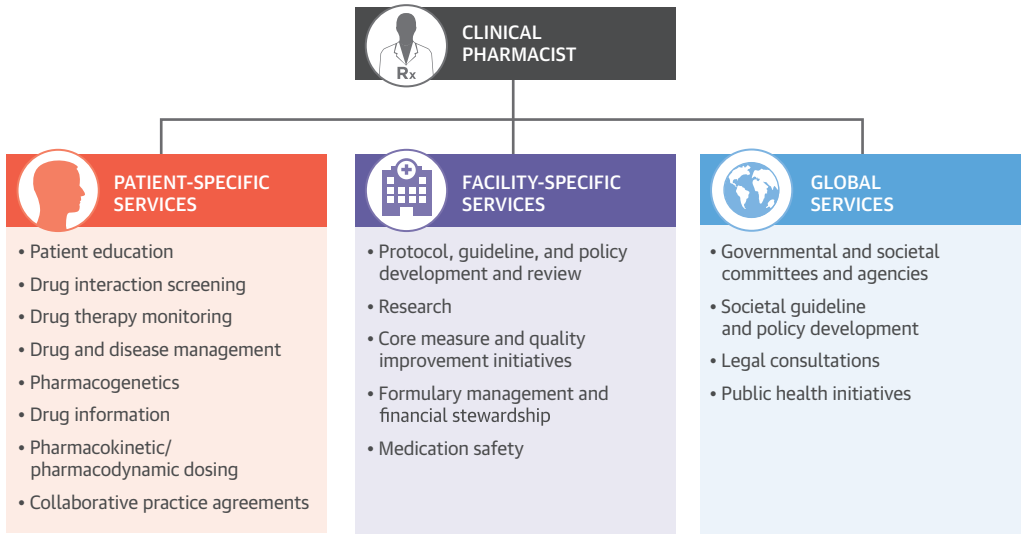
To maximize the role of the clinical pharmacist, the care team will benefit from understanding the training, development, utilization, and potential value of the clinical pharmacist in the cardiovascular care team. This paper will provide background information on clinical pharmacists' education, training, credentialing, and practice models in a variety of settings; it will also discuss collaborative practice opportunities for integrating clinical pharmacists into a team-based care model.

TRAINING AND CERTIFICATION

Figure 1 depicts the typical training pathway of a clinical pharmacist working in cardiovascular practice. There are currently 134 schools and colleges of pharmacy in the United States, a number that continues to grow (13). Pharmacy school training is preceded by a minimum of 2 years of undergraduate coursework, although many students have completed a bachelor's degree. Most pharmacy school curricula consist of 3 years of didactic coursework, followed by a fourth year of experiential education. The Doctor of Pharmacy (PharmD) degree is awarded upon graduation. Curricula must meet the core standards overseen by the American College of Pharmaceutical Education (ACPE), which have been recently updated (14). Integration of interprofessional education into curricula is recommended by the ACPE to better prepare students to provide patient-centered care. This involves pharmacy students interacting with medical, nursing, and other health professional students at various levels of training in coordinated educational or patient care activities (14). Introductory pharmacy practice experiences are completed in community pharmacy and hospital settings during the first 3 years, whereas advanced pharmacy practice experiences occur in the final year of school. The ACPE requires that these advanced experiences involve direct patient care, interactions with prescribers, and the provision of CPS alongside and supervised by clinical pharmacists (14,15).

Post-graduate education and training for a cardiovascular clinical pharmacist may differ from that of pharmacists working in other settings. Following graduation from an ACPE-accredited school of pharmacy, approximately 25% of pharmacists choose to continue their education in the form of either residency and/or fellowship training. These programs continue to grow in response to increased demand (16). A post-graduate year (PGY)-1 pharmacy residency program is intended to produce pharmacy practitioners competent in patient-centered care and pharmacy operational services that can be applied to any practice setting (17). Individuals desiring more specialized clinical training in a cardiovascular area can complete a PGY2 residency. The aim of a PGY2 pharmacy residency in cardiology is to train pharmacy practitioners in the care of patients with CVD, both from a prevention and treatment perspective (18). Cardiology pharmacy residency programs also train in the conduct of clinical research projects, the interpretation of cardiovascular biomedical published data, quality improvement initiatives, leadership and practice management, teaching and educational activities, and advocacy for CVD prevention. The American Society of Health-System Pharmacists currently lists 29 PGY2 training programs in cardiology pharmacy; these programs have collectively graduated at least 123 graduates since 2007 (19).

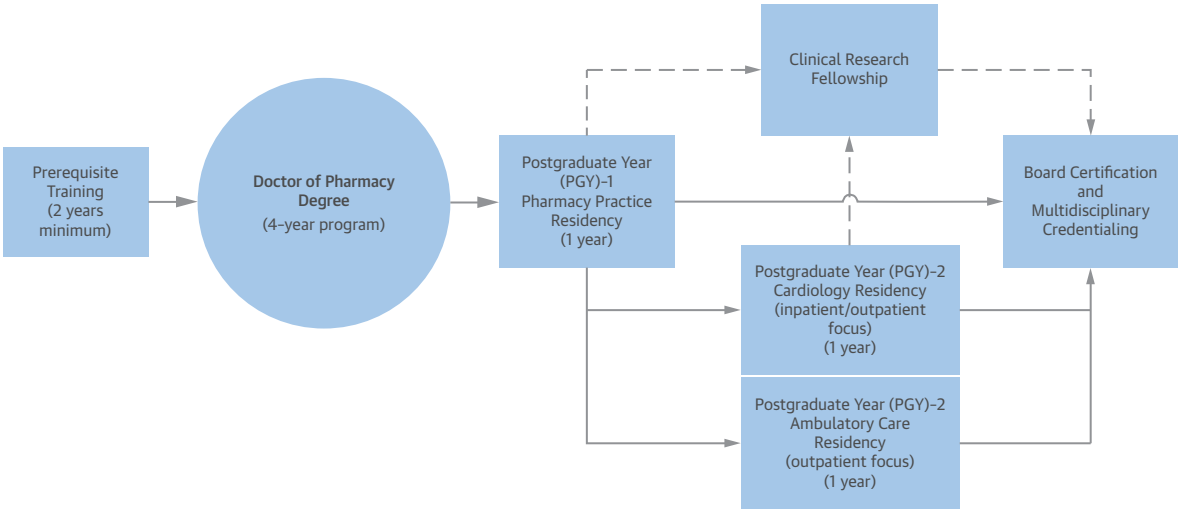
CENTRAL ILLUSTRATION **Clinical Pharmacists: Their Role in Cardiovascular Disease**



Dunn, S.P. et al. J Am Coll Cardiol. 2015; 66(19):2129–39.

The various roles clinical pharmacists perform in both inpatient and outpatient settings are depicted. A clinical pharmacist or team of clinical pharmacists may perform a variety of patient-specific functions related to medications. Clinical pharmacists often lead facility-level initiatives and even global initiatives toward improving and optimizing systems of medication use.

FIGURE 1 **Education and Training of a Clinical Pharmacist in a Cardiology Practice**



The most traditional routes to practice as a clinical pharmacist in cardiology are depicted. Participants complete a Doctor of Pharmacy program and then 1 or 2 years of post-graduate residency training (post-graduate year [PGY]-1 and -2). Ambulatory care–trained pharmacists are focused on outpatient care and would mostly focus on modifying chronic cardiovascular risk with pharmacotherapy with a broad understanding of pharmacotherapeutic management of chronic disease. Cardiology-trained clinical pharmacists are adaptable to a wide variety of cardiology practice settings, including inpatient and outpatient practices, which would provide a greater understanding of patient care in the cardiovascular continuum. Pharmacists may also complete a clinical research fellowship, designed to train the participant to be an independent research investigator.

A clinical research fellowship is a highly individualized post-graduate program designed to train pharmacists to become independent investigators (**Figure 1**). Its aim is for graduates to develop competency in all aspects of the scientific research process, from hypothesis generation to paper preparation and publication. Fellowships are offered through a variety of settings, including schools and colleges of pharmacy, the pharmaceutical industry, and academic health centers. Like PGY2 residency programs, fellowships are often focused on a specific area of pharmacy practice. The ACCP offers peer-review designation for qualified programs, and lists 6 fellowship programs with a primary or secondary specialty of cardiology.

Beyond formal didactic education and clinical training, pharmacy has mechanisms to ensure that entry-level practitioners have met the minimum qualifications through certification (20). For most health care professionals, this initial step in ensuring qualification to practice is through licensure. Beyond licensure, certification for the pharmacist is different from that of physicians and nonphysician practitioners. For pharmacists, certification is voluntary, consisting of pharmacist-only and multidisciplinary certifications (21). One of the major organizations with a long history of awarding specialty certification credentials to pharmacists is the Board of Pharmacy Specialties (BPS) (11). The mission of the BPS is to recognize pharmacy specialty practice and certify pharmacists' knowledge and skill to practice in the areas of nuclear, nutrition support, oncology, pharmacotherapy, ambulatory care, pediatrics, critical care, and psychiatric pharmacy; cardiology specialty certification is also being considered. Eligibility for certification through BPS requires pharmacy licensure, and documentation of 3 years of experience within a practice area or completion of a PGY1 and/or PGY2 residency, plus successful passing of a standardized, written examination. Through the BPS, pharmacists can also obtain certification in certain areas of subspecialization, including added qualifications in cardiology (22), which involves participation in specialty-related practice, teaching, research, and scholarship. As of 2013, more than 19,000 pharmacists have been credentialed by the BPS, with over 100 practitioners receiving added qualifications in cardiology (23).

Pharmacists may also obtain more broad-based, multidisciplinary certifications covering various areas of CVD. These types of certifications assess health care-related competency for an array of different professions (e.g., nurses, nurse practitioners, and physician assistants) (24). Eligibility requirements for each of these vary, but are typically dependent upon documentation of practice and completion of an examination. **Table 1** provides examples of multidisciplinary credentials for pharmacists in terms of the credentialing organization and intended scope of professional practice (24,25).

PHARMACIST PRACTICE MODELS AND CLINICAL ACTIVITIES

The benefits of CPS in federal, nonfederal, hospital, clinic, managed care, and other community settings have been extensively documented (26). However,

TABLE 1 Examples of Multidisciplinary Certifications for Pharmacists

Credentialing Organization	Credential	Intended Scope of the Credentialed Professional
National Certification Board for Anticoagulation Providers	Certified Anticoagulation Care Provider (CACP)	Provide care to patients receiving anticoagulation therapy. Clinical care includes systematic, organized, and ongoing patient education and therapeutic management in the inpatient and/or outpatient setting.
National Asthma Educator Certification Board	Certified Asthma Educator (AE-C)	Provide care and expertise in teaching, educating, and counseling individuals with asthma and their families in the knowledge and skills necessary to minimize the effect of asthma on their quality of life. A primary job responsibility is the provision of asthma coordination and counseling services.
National Certification Board for Diabetes Educators	Certified Diabetes Educator (CDE)	Defined roles as diabetes educators, not for those who may perform some diabetes-related functions as part of, or in the course of, other usual and customary duties.
Accreditation Council For Clinical Lipidology	Clinical Lipid Specialist (CLS)	Provide specialized care to patients with dyslipidemia and related cardiometabolic conditions.
American Board of Applied Toxicology	Diplomat of the American Board of Applied Toxicology (DABAT)	Participate in all aspects of toxicology, including the design and interpretation of safety studies for product development; review and interpretation of such studies for regulatory compliance; basic and applied research into toxic effects, mechanisms of toxic action, toxicokinetics, and toxicodynamics; and education of undergraduates, professional and graduate students, and the public in the science of toxicology through courses, legal cases, and media interactions.

Adapted with permission from Saseen et al. (24).

there is no unified national model of CPS; practices may vary across institutions. CPS have been associated with decreased costs of care, hospital mortality, drug costs, length of stay, and medication error rates (27–29). The Institute of Medicine recognizes that the pharmacist-physician-patient collaboration improves medication safety (30). Interacting with the health care team on inpatient rounds, interviewing patients and family, selecting and reconciling medications, performing dose titration, assisting with insurance coverage, and providing patient discharge counseling and follow-up are among the many efforts by clinical pharmacists that have resulted in improved outcomes in the inpatient setting (31–33). Interacting with a pharmacist in the inpatient setting has also helped improve post-discharge medication adherence (31,34), reduce adverse drug reactions and medication errors (31), and shorten hospital length of stay (31).

Several reviews and meta-analyses have demonstrated the effect of CPS in cardiovascular patients (**Table 2**). Clinical pharmacists have helped to improve CVD risk factor management (35–39). The results are consistent with other studies that showed improvements in CVD risk factor management by pharmacists in primary care offices (40,41), cardiology practices (42,43), a managed care organization (44), and a chain pharmacy setting (45). In general, the addition of inpatient and outpatient CPS resulted in improved care, with no evidence of harm.

Clinical pharmacists have shown a particular effect in patients with heart failure. For inpatient services, Gattis et al. (46), in a single-center, randomized clinical trial of 180 patients with heart failure, measured the effect of pharmacist participation in heart failure rounds. The composite of all-cause mortality and heart failure events was significantly lower after 6 months in the team with pharmacist participation (4 events vs. 16 events [all-cause mortality or heart failure]; $p = 0.005$). Pharmacists' care of inpatients and outpatients with heart failure has resulted in decreased hospitalizations (47,48) and readmissions (48). The Heart Failure Society of America recently coauthored a joint opinion paper with the ACCP Cardiology Practice and Research Network that outlined and supported roles for pharmacists in multidisciplinary heart failure teams (10).

Whereas many patient care services by clinical pharmacists can be performed concurrently with or complementary to physician practice (e.g., medication reviews, patient education and counseling, disease screening, referral, among others), clinical pharmacists may also perform independent direct medication management through a collaborative practice agreement (CPA) that expands the depth and breadth of services the pharmacist can provide. CPAs that include a pharmacist can help alleviate some of the demand for physician-provided care. CPAs create a formal relationship between physicians and pharmacists and define patient care functions (e.g., patient assessments, counseling, and referrals; ordering laboratory tests; administering drugs; and selecting, initiating, monitoring, continuing, and adjusting drug regimens) that a pharmacist can autonomously provide within the context of a protocol. CPAs are not new; federal pharmacists have collaboratively managed disease through medication use, cognitive services, and CPS for over 40 years (49). When a CPA is in place, a licensed health care professional makes a diagnosis and maintains ongoing supervision of patient care. Currently, 46 states and the District of Columbia allow for some form of CPAs. CPA provisions vary greatly from state to state with respect to the extent of the pharmacists' authorized services, limitations on practice sites and health conditions, authority to order laboratory tests, and requirements for pharmacist participation (e.g., certification, training, or enhanced licensure requirements or designations).

Kaiser Permanente of Colorado's collaborative practice model uses nurses and clinical pharmacists in direct patient care roles, guided by a physician. This model reduced all-cause mortality (adjusted hazard ratio: 0.24; 95% confidence interval: 0.20 to 0.29; $p < 0.001$) or coronary heart disease-related mortality (adjusted hazard ratio: 0.27; 95% confidence interval: 0.22 to 0.34; $p < 0.001$) in patients with coronary artery disease who were followed in the program for more than 3 years. Patients enrolled <90 days ("early exposure") after their coronary event had lower all-cause mortality over a 10-year follow-up period compared with other groups of patients not enrolled within 90 days post-event (4.7% early vs. 8.6% delayed, 16.4% intermittent, and 46.9% none; $p < 0.001$) (50). Patients usually enrolled in the nurse-managed cardiac rehabilitation program within 3 to 6 months after discharge for a coronary event, followed by enrollment in the pharmacist-managed program. The goals were to increase use of evidence-based therapies, help monitor and control diseases that increase CVD risk (e.g., hypertension, hyperlipidemia, diabetes, and abuse), and provide information to patients and other team members (51). Ripley et al. (52) describe in detail a similar practice model that uses cardiologist-clinical pharmacist collaboration in the long-term management of patients with CVD in both an academic faculty-based practice and a private sector specialty clinic. The practice model is structured around a

TABLE 2 Selected Systematic Reviews and Meta-Analyses of the Effect of Pharmacist Services on Cardiovascular Patient Care

Citation	Methods	Results	Authors' Conclusions
Carter et al. (35) *Purpose:* to determine the potency of interventions for BP involving nurses or pharmacists.	MEDLINE search (1970 to February 5, 2009) *Inclusion:* controlled clinical trials involving a nurse or pharmacist intervention. Determined mean reductions in SBP and DBP *37 studies*	*Improved BP (−8.75/−3.60 mm Hg):* education on BP medications. *Associated with significant SBP reductions:* pharmacist recommended medication to physician; counseling on lifestyle modification; pharmacist performed the intervention; use of a treatment algorithm; completion of a drug profile and/or medication history). *Associated with significant DBP reductions:* referral to a specialist; providing patient education about BP medications, completion of a drug profile and/or medication history; pharmacist performed the intervention. The nursing, pharmacist, and community pharmacist studies lowered BP; the amounts lowered were not statistically different.	Team-based care, including a pharmacist or nurse, was associated with improved BP control. *Limitations:* studies with short-term interventions and interventions performed outside of the clinic were less potent in efficacy.
Chisholm-Burns et al. (36) *Purpose:* to examine effects of pharmacist-provided direct patient care on therapeutic, safety, and humanistic outcomes.	NLM PubMed; Ovid/MEDLINE; ABI/INFORM; Health Business Fulltext Elite; Academic Search Complete; International Pharmaceutical Abstracts; PsycINFO; Cochrane Database of Systematic Reviews; National Guideline Clearinghouse; Database of Abstracts of Reviews of Effects; ClinicalTrials.gov; LexisNexis Academic Universe; and Google Scholar (start to January 2009) *Inclusion:* RCTs with pharmacist involvement in direct patient care and evaluated patient-related outcomes reported (therapeutic, safety, or humanistic) (start to November 2010) *298 studies*	*Mean difference between the pharmacist group and the comparison group:* • LDL-C: −6.3 mg/dl (95% CI: −6.5 to −6.0 mg/dl) • SBP: −7.8 mm Hg (95% CI: −9.7 to −5.8 mm Hg) • DBP: −2.9 mm Hg (95% CI: −3.8 to −2.0 mm Hg) • HbA_{1c}: −1.8% (SD = 0.5; 95% CI: −2.7 to minus;0.9). Medication adherence, patient knowledge, and quality of life general health meta-analyses were significant ($p < 0.05$)	Pharmacist services improved patient care, with no evidence of harm. *Limitations:* studies with short-term interventions were less likely to be successful. Not all studies were likely powered to detect significant differences. Implementation of interventions was not uniform and heterogeneous activities were applied.
Santschi et al (37) *Purpose:* to determine the effect of pharmacist care on the management of CVD risk factors among outpatients.	MEDLINE, EMBASE, CINAHL, Cochrane Central Register of Controlled Trials (start to November 2010) *Inclusion:* RCTs involving pharmacist care interventions among outpatients with CVD risk factors. Determined mean changes in BP, total cholesterol, LDL-C, and proportion of smokers using random effects models *30 studies (11,765 patients)*	*Compared with usual care, pharmacist care was associated with significant reductions in:* • SBP/DBP: 19 studies with 10,479 patients; −8.1 mm Hg (95% CI: −10.2 to −5.9 mm Hg)/ −3.8 mm Hg (95% CI: −5.3 to −2.3 mm Hg) • Total cholesterol: 9 studies with 1,121 patients; −17.4 mg/l (95% CI: −25.5 to −9.2 mg/l) • LDL-C: 7 studies with 924 patients; −13.4 mg/l (95% CI: −23.0 to −3.8 mg/l) • Risk of smoking: 2 studies with 196 patients; relative risk: 0.77 (95% CI: 0.67 to 0.89).	Pharmacists improved CVD risk factor management among outpatients. *Limitations:* types of interventions performed to affect BP, LDL-C, and so forth were not uniform.
Santschi et al. (38) *Purpose:* to assess the effect of pharmacist care on CVD risk factors in outpatients with diabetes.	MEDLINE, EMBASE, CINAHL, Cochrane Central Register of Controlled Trials (start to March 2012) *Inclusion:* RCTs involving pharmacist care interventions among outpatients with diabetes and CVD risk factors. Determined mean changes in BP, total cholesterol, LDL-C, and BMI using random effects models *15 RCTs (9,111 outpatients)*	*Compared with usual care, pharmacist care was associated with significant reductions in:* • SBP: 12 studies with 1,894 patients; 26.2 mm Hg (95% CI: 27.8 to 24.6 mm Hg) • DBP: 9 studies with 1,496 patients; 24.5 mm Hg (95% CI: 26.2 to 22.8 mm Hg) • Total cholesterol: 8 studies with 1,280 patients; 215.2 mg/dl (95% CI: 224.7 to 25.7 mg/dl) • LDL-C: 9 studies with 8,084 patients; 211.7 mg/dl (95% CI: 215.8 to 27.6 mg/dl) • BMI: 5 studies with 751 patients; 20.9 kg/m^2 (95% CI: 21.7 to 20.1 kg/m^2)	Pharmacists improved CVD risk factor management in outpatients with diabetes. *Limitations:* types of interventions performed to affect cardiovascular risk were not uniform.

Continued on the next page

defined scope-of-practice agreement between the cardiologists and pharmacists (52). Pharmacist involvement has also been demonstrated to improve medication adherence. A recent study by Ho et al. (53) evaluated a multifaceted intervention to improve medication adherence involving pharmacist-led medication reconciliation, education, and collaborative care between the pharmacists and physicians in the Veterans Affairs health system. Patients randomized to the intervention had greater adherence

TABLE 2 Continued

Citation	Methods	Results	Authors' Conclusions
Santschi et al. (39) *Purpose:* to assess the effect of pharmacist interventions on BP and identify potential determinants of heterogeneity.	MEDLINE, EMBASE, CINAHL, Cochrane Central Register of Controlled Trials (start to March 2012) *Inclusion:* RCTs involving pharmacist care interventions among outpatients with or without diabetes. Determined mean changes in BP using random effects models *39 RCTs (14,224 outpatients)*	*Compared with usual care, pharmacist care was associated with significant reductions in:* • SBP: −7.6 mm Hg (95% CI: −9.0 to −6.3 mm Hg; I2 = 67%) • DBP: −3.9 mm Hg (95% CI: −5.1 to −2.8; I2 = 83% mm Hg)	Pharmacists improved BP management in outpatients. *Limitations:* types of interventions performed to affect BP were not uniform.
Koshman et al. (47)	PubMed, MEDLINE, EMBASE, International Pharmaceutical Abstracts, Web of Science, Scopus, Dissertation Abstracts, CINAHL, Pascal, Cochrane Central Register of Controlled Trials (start to August 2007) *Inclusion:* RCTs evaluating the effect of pharmacist care activities on patients with HF in both inpatient and outpatient settings *12 RCTs (2,060 patients)*	*Pharmacist care reduced:* • All-cause hospitalizations: 11 studies with 2,026 patients (OR: 0.71; 95% CI: 0.54 to 0.94) • HF hospitalizations: 11 studies with 1,977 patients; (OR: 0.69; 95% CI: 0.51 to 0.94) Pharmacist collaborative care led to greater reductions in the rate of HF hospitalizations (OR: 0.42; 95% CI: 0.24 to 0.74) than pharmacist-directed care (OR: 0.89; 95% CI: 0.68 to 1.17).	Pharmacist care in the treatment of patients with HF greatly reduces the risk of all-cause and HF hospitalizations *Limitations:* mortality was not affected, likely due to the small sample size of many studies included. Follow-up was limited to ≤6 months. The interventions applied were not uniform.

BMI = body mass index; BP = blood pressure; CI = confidence interval; CVD = cardiovascular disease; DBP = diastolic blood pressure; HbA_{1c} = hemoglobin A1c; HF = heart failure; LDL-C = low-density lipoprotein cholesterol; OR = odds ratio; RCT = randomized controlled trial; SBP = systolic blood pressure.

to cardiovascular medications (clopidogrel, beta-blockers, statins, and angiotensin inhibitors) than the usual care group (89.3% vs. 73.9%; p = 0.003) (53).

SCOPE OF PRACTICE

In 2012, a consortium of stakeholders identified effective policies, practices, and barriers to expanding the role of pharmacists in delivering patient care services and entering into CPAs. The group acknowledged that broad access to patient care services delivered by pharmacists is limited by scope of practice acts, state boards of pharmacy, medicine regulations, and compensation barriers. Recognizing that physician-pharmacist CPAs may help alleviate some of the gaps in health care, the consortium proposed strategies for expanding pharmacists' patient care services through team-based care and CPAs (54,55). The Centers for Disease Control and Prevention and the American Pharmacists Association Foundation developed a toolkit for creating physician-pharmacist CPAs (56).

CPAs may also exist in hospitals. In 2012, The Centers for Medicare & Medicaid Services expanded the concept of medical staff to allow hospitals the flexibility to include pharmacists as eligible candidates with privileges to practice in the hospital in accordance with state law. The rule gives practitioners in states that allow pharmacists to enter into CPAs more involvement in patient care. As a result, pharmacists will undergo the credentialing or privileging process established by the workplace (57). These CPAs may exist to provide specific services in patients with CVD, such as anticoagulation adjustment and monitoring, insulin management, and smoking cessation, among other potential applications that may benefit a cardiology practice.

ADVOCACY AND PUBLIC HEALTH

The public health role of the clinical pharmacist has been evolving as clinical practice opportunities have expanded. Starting with the Department of Health and Human Services "Healthy People" initiatives, and continuing with the current "Million Hearts" Initiative to prevent 1 million heart attacks and strokes by 2017, pharmacists have been sought out for their potential contributions to these national campaigns. Pharmacists have a unique role in community-based public health initiatives due to the sheer number of neighborhood pharmacies, which provide easy access to care for patients. Although evidence-based drug therapies and government educational campaigns have been successful in reducing cardiovascular deaths in the past several decades, much work remains to be done. The Million Hearts campaign estimated that baseline aspirin use for high-risk patients is still only 47%, blood pressure is controlled in only 46%, cholesterol is only controlled in 33%, and smoking cessation is only 23% at baseline, all of which are far from their clinical targets of 70% (58). Pharmacist participation in the campaign through chain pharmacy corporations has largely targeted enhanced cardiovascular risk screening, as well as educational efforts (59). Although the specific effect

of pharmacists on the Million Hearts campaign is not known, the provision of CPS appears to be a commonality amongst several high-performing organizations contributing to the campaign (60). These roles may include direct patient management of blood pressure to treatment goal, monitoring and encouraging medication adherence, disease/medication education for patients, and support for physician staff. Pharmacists also participate significantly with registry or payor-directed efforts to systematically improve quality through improved medication use and optimization, such as the Joint Commission Core Measures. For example, hospitals employing clinical pharmacists credentialed in cardiology performed better in cardiovascular medication-related core measures (61).

Pharmacists, both clinical and general practitioners, play a valuable role in public disease prevention and health promotion through education, preventive health screenings, and quality assurance. Education of patients about cardiac risk factors, methods of risk factor modification, and diet and exercise contributes to reductions of cardiovascular events and promotes healthy lifestyles (62), including the promotion of medication adherence (63,64). Several demonstration projects and innovative practice settings with pharmacist involvement have yielded beneficial outcomes. The most notable of these was the Asheville Project, where pharmacist-provided education and monitoring positively affected long-term health outcomes, such as hemoglobin A_{1c} and serum lipid concentrations, while also reducing health care costs (65). Ramalho de Oliveira et al. (64) evaluated 10 years of pharmacy medication therapy management interventions in a large health system. Along with cost savings and improved patient outcomes, patient satisfaction scores were also high.

Targeting of higher cardiac-risk patients by pharmacists through implementation of quality assurance programs, disease-state management drug therapy protocols, and health outcomes research influences outcomes and decreases the likelihood of medication errors. Once a diagnosis is made, pharmacists can assist in chronic disease-state management, particularly with medication education and optimizing medication therapies for a given disease state.

IMPLICATIONS FOR MEDICAL PRACTICES

The potential for clinical pharmacy services in an ambulatory or hospital-based practice is vast, as optimization of medication use requires thorough evaluation of each aspect of the medication-use spectrum. At a minimum, having a clinical pharmacist available to a practice as a consultant to evaluate medication protocols and guidelines, offer suggestions for individual patient care through prospective or retrospective review on the basis of pharmacological principles, and provide medication education for patients and health care practitioners at all levels would provide significant benefit to a medical practice. Going further, as medication-related transitional care becomes a prominent goal of accountable care organizations and other health care quality organizations, clinical pharmacists could potentially have a larger role in ensuring that medication-related transitions are performed safely, either as direct participants or by directing or reviewing medication transitional care processes. In addition, much of complex medication management (e.g., pharmacological treatment of hypertension, diabetes, dyslipidemia, and anticoagulation, among others) could be directly delegated through the use of CPAs to a clinical pharmacist under the supervision of an individual practitioner or the medical practice, enabling greater efficiency for physicians and other providers in seeing patients. The information provided by Ripley et al. (52) and the ACCP is a valuable "how-to" for others wanting to implement CPAs in a physician office (52,66). Pharmacists can also play an important role in improving medication adherence in at-risk patients, either through direct consultation or other medication education-related activities.

Although the benefits of utilizing clinical pharmacists are bountiful, widespread adoption of this care model is impeded by the lack of a consistent direct reimbursement source for these activities. Pharmacists are not currently recognized as providers by the Social Security Act or Centers for Medicare & Medicaid Services and are, therefore, compensated at the lowest-level reimbursement code (i.e., level 1 or 99211) in most clinic settings or provided no compensation for activities. The Social Security Act is the reference point for current and emerging delivery systems and payment models, so it is important for pharmacists to be listed in the Social Security Act, along with other providers. Alternatively, pharmacists may utilize incident-to-billing for higher levels of reimbursement, provided that the medical practice has the infrastructure to support this model. However, the comprehensive scope and patient complexity requires that the pharmacists have adequate and variable time per visit, which precludes patient volume as a means to generating a sustainable income in the current reimbursement model.

To provide a sustainable platform for the incorporation of clinical pharmacists in a team-based care model, more support from the medical community and

changes in legislation are required. The 2011 U.S. Surgeon General Report: Improving Patient and Health System Outcomes through Advanced Pharmacy Practice publicly supported health care reform that includes pharmacists providing expanded patient care services (26). On the basis of the documented benefits of pharmacist-delivered care in many health care settings, the report recommends that health care leadership and policy makers optimize pharmacists' roles to deliver patient-centered care and disease prevention services in collaboration with physicians or as part of a health care team. The report further recognizes that the expansion of pharmacist services is often impeded due to policy, legislation, and compensation barriers; it recommends recognizing pharmacists as providers and allowing appropriate compensation for services provided.

Several legislative efforts have since been brought forth, including bills proposed within the last 2 Congresses that are designed to give Medicare beneficiaries in medically underserved communities access to pharmacist-provided ambulatory services under Medicare Part B (67). A proposed Medicare program to provide a separate payment for chronic care management, for which the physician may also bill for supervision of clinical staff, may be another pathway for the utilization of clinical pharmacists (68). Regardless, as "population health" reimbursement models with bundled payments and accountable care organizations become more prominent, direct fee-for-service reimbursement may be less important, as the financial incentives to provide optimal care, while also reducing preventable harm, are more closely aligned. Alignment on the basis of quality incentives can also be encouraged through multidisciplinary organizational involvement. Some examples of this are the ACC Surviving MI program (69), a key tenet of which is the involvement of pharmacists in care of patients with myocardial infarction, and in the Hospital to Home (H2H) Mind Your Meds program, which features accurate medication reconciliation as a key metric of success (70).

CONCLUSIONS

Clinical pharmacists, through their unique training and practice focused on medication use, are positioned to serve an important role for patients on the cardiovascular care team. Clinical pharmacists currently engaged with medical practices also make substantial contributions to practice through the optimization of drug use and avoidance of preventable adverse drug events. The ACC advocates team-based care, which includes clinical pharmacists, as a means to "transform care, improve heart health, and help meet the demands of the future." However, the use of pharmacists is limited in current care delivery models because pharmacists are not currently recognized as providers and are not eligible for payment under Medicare Part B. With more inclusive legislation, pharmacists could continue expansion of their roles to meet the demands, reduce medication-related costs, and improve quality of care for cardiac patients in an ever-changing health care system. Multidisciplinary organizations, including the ACC, should support efforts to overcome legislative and compensation barriers so that pharmacists may be included in health care delivery models that allow full use of their education and training to provide high-quality patient care.

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