

Outcomes of Patients Discharged From Pharmacy-Managed Cardiovascular Disease Management

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Treatment of elevated low-density lipoprotein cholesterol (LDL-C) is part of standard care for patients with coronary artery disease (CAD). National treatment guidelines recommend an LDL-C goal of <100 mg/dL for all patients with CAD and a goal of <70 mg/dL for those at particularly high risk.^{1,2} In addition, the National Committee for Quality Assurance Healthcare Effectiveness Data and Information Set (HEDIS), a tool used by the majority of health plans to measure performance on various dimensions of care and service, includes the proportion of patients with cardiovascular conditions who have LDL-C values of <100 mg/dL as part of the performance measures.³

Statins are the mainstay treatment option for lowering LDL-C and have been shown to improve clinical outcomes and survival among patients with CAD.⁴ As a result of this and other treatment strategies, there has been a decrease in both the numbers of deaths and the rate of death from CAD.⁵ However, real-world data consistently demonstrate that a significant portion of patients with CAD are not screened, initiated on lipid-lowering therapy, or treated to recommended LDL-C goals.⁶⁻⁸ Although the reasons for undertreatment have not been fully elucidated, healthcare provider, patient, and healthcare system factors likely all contribute.

In an effort to improve treatment patterns, multidisciplinary cardiac disease management programs have been established.⁹⁻¹² A meta-analysis of randomized controlled trials demonstrated that such programs improve processes of care, risk factor profiles including lipid and blood pressure levels, appropriate use of secondary prevention medications, and quality of life, and result in fewer hospitalizations for the patients enrolled.¹¹

The majority of studies evaluating these programs have focused their evaluations on a prespecified enrollment time in a program, but have not investigated the sustainability of a program's interventions over time once patients are discharged. Thus, few studies have explored the maintenance of treatment goals after discharge from such programs.¹²⁻¹⁴

Given limited resources within healthcare systems, care delivery must be focused and efficient in order to provide care to the greatest

number of high-risk patients and to be able to expand care to other patients who could derive benefit, such as those with diabetes, peripheral arterial disease, or cerebrovascular disease.

Objective: To evaluate whether patients with coronary artery disease (CAD) discharged from the Clinical Pharmacy Cardiac Risk Service (CPCRS) would maintain their lipid goals with use of an electronic laboratory reminder system.

Study Design: A 2-year, randomized study at Kaiser Permanente Colorado.

Methods: Patients with prior CAD (acute myocardial infarction, coronary artery bypass graft surgery, percutaneous coronary intervention) who had been enrolled in the CPCRS for at least 1 year and who had 2 consecutive low-density lipoprotein cholesterol (LDL-C), non-high-density lipoprotein cholesterol, and blood pressure readings at goal within 6 months before enrollment were randomized to remain in the CPCRS (CPCRS care) or to receive usual care from primary care physicians plus laboratory reminder letters (usual care). The primary outcome was maintenance of LDL-C goal at study end. The *t* test and χ^2 test of association were used to assess differences in mean and categorical values, respectively.

Results: A total of 421 patients (214 CPCRS care, 207 usual care) were randomized. Their mean age was 72 years; 74% were male. After 1.7 years of follow-up, the proportions of patients maintaining their LDL-C goal of <100 mg/dL were 91% and 93.1% in the CPCRS care and usual care groups, respectively (*P* = .46). The proportions maintaining their LDL-C goal of <70 mg/dL were 68.6% and 56.8% in the CPCRS care and usual care groups, respectively (*P* = .23).

Conclusion: This study demonstrated that LDL-C measures can remain controlled in most patients discharged from a cardiac disease management program.

(*Am J Manag Care.* 2009;15(8):497-503)

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Take-Away Points

Patients with coronary artery disease can maintain their lipid levels after discharge from a disease management program.

- Disease management programs for patients with heart disease improve processes of care and risk factor profiles for the patients enrolled; however, they are resource intensive.
- Patients can maintain lipid levels after discharge from such programs through the use of electronic laboratory reminder letters.
- Such a system of follow-up will allow disease management programs to provide care to other high-risk populations without the need for additional resources.

tions are initiated and titrated, as necessary. Patient care is delivered primarily over the telephone.

All interventions by the CPCRS are made using collaborative drug therapy management protocols for lipid, hypertension, and laboratory management. With regard to fasting lipid profiles (FLPs), the CPCRS reorders laboratory tests approximately 8 to 12 weeks after any changes to lipid-lowering medications or therapeutic lifestyle changes and does so until the patients have achieved their LDL-C goal. Once patients are at their goal, FLPs are ordered every 6 months until at least 2 consecutive LDL-C values are at goal, at which time patients are monitored yearly. With regard to blood pressure, the specialists review blood pressure at the time FLP results are available and adjust medications accordingly. The patient's primary care physician is notified of any medication changes via the electronic medical record.

However, methods to maintain the gains achieved within cardiac disease management programs need to be evaluated because such services are resource intensive. The purpose of this study was to evaluate whether patients with CAD who were at their LDL-C goal would maintain lipid control after discharge from a cardiac disease management program.

All patients are entered into a Web-based electronic database (HealthTrac), which is integrated with the KPCO's administrative, laboratory, pharmacy, diagnosis/procedure, vital sign, and demographic data. The HealthTrac database is used to identify patients due for laboratory tests in order to send reminder letters and minimize missed laboratory appointments. The CPCRS has achieved high participation rates (>90% of the entire CAD population at KPCO). The service also has achieved top-tier HEDIS scores, with 98% of the population screened and 82.8% with LDL-C of <100 mg/dL, and has demonstrated improvements in both surrogate and clinical outcomes of the patients enrolled.^{15,16} Prior to this investigation, patients were monitored by the CPCRS indefinitely or until they terminated their health plan membership with KPCO.

METHODS**Study Design**

This was a 2-year, randomized controlled study conducted at Kaiser Permanente Colorado (KPCO). Kaiser Permanente Colorado is a group-model, closed-panel, nonprofit health maintenance organization that provides integrated healthcare services to more than 480,000 members at 18 medical offices in the Denver-Boulder metropolitan area. Kaiser Permanente Colorado utilizes electronic medical records that contain all office visit, vital, laboratory, and pharmacy data. Approval to conduct the study with a waiver of informed consent was obtained from the KPCO Institutional Review Board.

Study Setting

In 1998, KPCO established the Clinical Pharmacy Cardiac Risk Service (CPCRS), a centralized, clinical pharmacy specialist-managed, physician-directed disease management program that utilizes a systems-based approach to focus on the long-term management of more than 12,000 patients with CAD.¹⁰ All KPCO patients with a history of acute myocardial infarction, percutaneous coronary interventions, or coronary artery bypass graft surgery are enrolled into the program through direct referral by primary care physicians, referral from a registered nurse-managed cardiac rehabilitation program, or administrative queries of *International Classification of Diseases, Ninth Revision* codes. The CPCRS staff work closely with primary care providers, cardiologists, and nurses to ensure that lipids are controlled, evidence-based secondary prevention treatment strategies are initiated and adhered to, and follow-up laboratory tests are completed. The CPCRS focuses on patient follow-up to ensure that appropriate lipid-lowering, antihypertensive, and smoking cessation medica-

tions are initiated and titrated, as necessary. Patient care is delivered primarily over the telephone.

Study Population

Patients identified for inclusion in the study were those who required only yearly follow-up per the CPCRS treatment protocol. Patients had to have at least 2 consecutive LDL-C and non-high-density lipoprotein cholesterol (non-HDL-C) values at goal; the most recent value had to have been recorded within 6 months prior to study enrollment. There was no prespecified required time frame between the 2 FLPs for eligibility. The LDL-C and non-HDL-C goals were defined as <100 mg/dL and <130 mg/dL, respectively, for all patients except those with diabetes, multivessel coronary disease, at least 1 recurrent coronary event, or current smokers. For these patients, the LDL-C and non-HDL-C goals were <70 mg/dL and <100 mg/dL, respectively.^{1,2,10}

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Patients also were required to have controlled blood pressure within 6 months prior to study enrollment. The blood pressure goal was defined as <140/90 mm Hg for all patients except for those patients with diabetes or chronic kidney disease, for which the goal was <130/80 mm Hg.¹⁷ Patients were excluded if they had a glycosylated hemoglobin measurement of $\geq 9\%$ within the previous 6 months, had dementia, died within 30 days of randomization, or had a life expectancy of less than 3 years.

Study Procedures

All patients eligible for study enrollment were identified administratively using the HealthTrac database and randomized on September 1, 2005. Eligible patients were randomly assigned in a 1:1 fashion using a computer-generated list of random numbers to either continue to receive CPCRS care or to be discharged from the CPCRS to receive usual care from the primary care team plus laboratory reminder letters (usual care).

Patients randomized to CPCRS care continued to receive the standard care delivered by the CPCRS for all CAD patients in the program. This care consisted of clinical pharmacy specialists telephoning patients to review the results of their annual FLP, blood pressure measurements, and medications and adherence; counseling on diet and exercise regimens; and making medication adjustments to maintain treatment goals. The specialists ordered follow-up laboratory tests through the electronic medical record. Additionally, all patients were mailed letters informing them of their results, were scheduled for a follow-up FLP, and received laboratory reminder letters. Each patient contact was documented in the electronic medical record for other healthcare providers to review and was estimated to take the clinical pharmacy specialist approximately 15 minutes.

Patients randomized to usual care were discharged from the CPCRS at the time of study enrollment (September 1, 2005), and an FLP was ordered for 1 year in the future with results to be returned electronically to each patient's primary care physician. It was the responsibility of the physician to address the results as they became available and order follow-up laboratory tests, as needed, during the study period. Patients in the usual care group received laboratory reminder letters that were generated electronically using the HealthTrac database. However, unlike the CPCRS care group, patients in the usual care group received no contact or counseling by the CPCRS specialists or letters informing them of their FLP or blood pressure results. Other than the aforementioned reminder letters, physicians received no additional clinical assistance from CPCRS specialists with respect to the usual care patients. In rare instances, physicians were able to contact the CPCRS

with specific questions regarding patients with significant medication side effects. Physicians did, however, have access to regional guidelines for the treatment of CAD risk factors.

Outcome Measures

Patients were followed for 2 years (until August 31, 2007) or until the date of termination of KPCO membership, a recurrent cardiovascular event, or death, whichever came first (study end). The primary outcome measure was the percentage of patients maintaining the LDL-C goal at study end. A number of secondary outcome measures were evaluated: the occurrence of fatal/nonfatal coronary events, all-cause mortality, and any-cause hospitalization over the 2-year study period between groups. Coronary events were defined as acute myocardial infarction, percutaneous coronary intervention, and/or coronary artery bypass graft. In addition, blood pressure control, maintenance of non-HDL-C goal, and persistence with lipid-lowering therapy were assessed at study end. The lipid and blood pressure values assessed for the outcomes were those reported most recently but no later than 1 year prior to the study end date. Persistence was confirmed if a patient had a day's supply of lipid-lowering therapy, based on the fill date and supply, which overlapped the study end date.

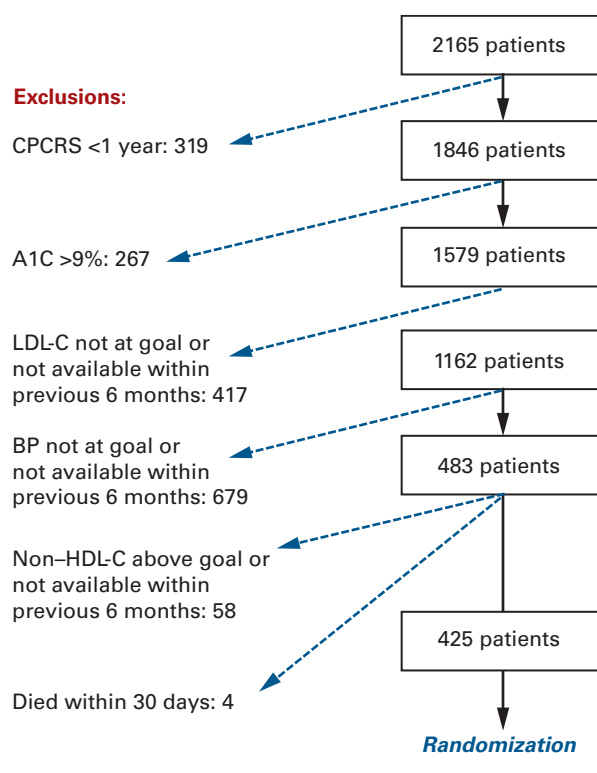
Sample Size

Based on dichotomizing the LDL-C goal and assuming that 99% of the CPCRS care group and 90% of the usual care group would remain at LDL-C goal at follow-up, a total of 150 study patients per group (300 study subjects) were required to provide a power of 80% and a 2-sided alpha of .05. To account for study subjects who terminated KPCO membership over the 2-year study period (estimated at approximately 20%), the sample size was increased to 400 patients.

Statistical Analysis

All statistical analyses were performed on an intention-to-treat basis utilizing SAS statistical software (SAS, Cary, NC). Baseline characteristics were reported as means, medians, and standard deviations for interval-level and ratio-level variables (eg, age, length of time between events, mean lipid levels) and proportions for nominal-level and ordinal-level data (eg, sex, cardiovascular event history). Interval-level outcome variables were assessed for normality of their distributions, and appropriate tests (eg, *t* test, rank-sum test) were used to assess differences in mean values between groups. To assess differences in proportions between groups on categorical variables, the Pearson χ^2 test of association was utilized. Patients were excluded from an analysis if they had missing data in the follow-up period. The alpha level for statistical significance was set at .05.

■ **Figure. Patient Disposition**



A1C indicates glycosylated hemoglobin; BP, blood pressure; CPCRS, Clinical Pharmacy Cardiac Risk Service; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol.

RESULTS

A total of 421 patients were randomized; 207 to usual care and 214 to CPCRS care. The reasons for study exclusion are detailed in the **Figure**. There were no differences between the groups at baseline (**Table 1**). The mean age of the population enrolled was 72 years and 74% were male. The majority of patients had a diagnosis of hypertension and a history of acute myocardial infarction. The majority of patients (76%) had an LDL-C goal of <100 mg/dL and 89% had a blood pressure goal of <140/90 mm Hg. The mean time of enrollment in the CPCRS prior to randomization was 4 years. The majority of patients (79%) were followed for the entire 2-year study duration; however, 8.4% terminated membership in KPCO (average of 9 months after randomization) and 12.6% died or had a recurrent cardiovascular event (average of 12 months after randomization) before the study end. The mean duration of follow-up was 1.8 years in the CPCRS care group and 1.6 years in the usual care group ($P = .02$).

The main study results are displayed in **Table 2**. The overall percentage of patients with at least 1 FLP performed during the study follow-up was 92.8% (94.3% CPCRS care vs 91.3%

in usual care; $P = .21$). The percentage of patients who maintained their LDL-C goal at study end was 85%. The percentages of patients who maintained their LDL-C goal of <100 mg/dL at study end were 91% and 93.1% in the CPCRS care and usual care groups, respectively ($P = .46$). The percentages of patients who maintained their LDL-C goal of <70 mg/dL at study end were 68.6% and 56.8% in the CPCRS care and usual care groups, respectively ($P = .23$). There were no differences between groups in maintenance of the non-HDL-C goal at study end (88.7% CPCRS care and 88.2% usual care; $P = .89$).

Overall, 75.7% of patients maintained their blood pressure goal by study end. A higher proportion of patients in the usual care group maintained a blood pressure goal of <140/90 mm Hg compared with those in the CPCRS care group (75% CPCRS care vs 84.2% usual care; $P = .03$). Among those with a blood pressure goal of <130/80 mm Hg, there were no differences between groups in the proportion that maintained their goal (60% CPCRS care vs 54.5% usual care; $P = .71$).

There were few coronary events during the study period. A total of 3.3% of patients in CPCRS care compared with 5.8% in usual care experienced a fatal/nonfatal coronary event during the study period ($P = .21$). Similarly, there were no differences in all-cause mortality (8.4% CPCRS care vs 7.7% usual care; $P = .80$) or any-cause hospitalization (33.6% CPCRS care vs 27.1% usual care; $P = .14$) between groups. There were no differences in persistence with lipid-lowering therapy between groups at the end of the study (86.5% CPCRS care vs 85.5% usual care; $P = .78$).

DISCUSSION

This 2-year, randomized study demonstrated that both LDL-C and blood pressure can remain controlled among patients with CAD discharged from our cardiac disease management program to usual care with laboratory reminder letters. We found that the majority of patients maintained their LDL-C and blood pressure goals at study end. In addition, there were no differences in the rates of recurrent coronary events and deaths at study end, although our study was not powered to evaluate these differences.

Few studies have evaluated the outcomes of patients discharged from cardiac risk reduction programs. One retrospective analysis of 68 patients (43.5% with prior CAD) evaluated follow-up and maintenance of lipid goals after being discharged back to usual care from a pharmacist-coordinated, multidisciplinary lipid clinic.¹³ All patients were advised to schedule an appointment with their physician within 6 months of discharge for review of their FLP, and a clinic discharge summary of these

recommendations was sent to each patient's physician. This study found that 53% and 43% of patients discharged for at least 6 months and 1 year, respectively, did not have a follow-up FLP completed; however, this study did not report the outcomes for the CAD patients specifically. Furthermore, LDL-C was maintained in only 61% of patients who had originally achieved their goal prior to clinic discharge.¹³ A nonrandomized study of 481 patients with CAD evaluated maintenance of LDL-C levels as a secondary outcome measure 18 months after discharge from a collaborative care intervention compared with usual care.¹² During the follow-up period after discharge, LDL-C levels were maintained in the intervention group and remained statistically lower than those in the usual care group. Finally, a study of 411 primary and secondary prevention patients who were followed for an average of more than 2 years after discharge from a cardiac risk reduction program with no systematic follow-up found no statistically significant changes in LDL-C levels over time.¹⁴

None of the aforementioned studies reported on the maintenance of blood pressure goals, and only one reported on the proportion maintaining their LDL-C goal after discharge. Our study provides further evidence from a prospective, randomized study that lipid levels and blood pressure can be maintained for at least 2 years.

In our study, rather than discharging patients from our CPCRS with no coordinated, systematic follow-up, we utilized an electronic laboratory reminder system for the usual care patients to ensure that, at a minimum, annual FLPs were obtained. Given the small proportion of patients with no FLPs over the 2-year study (7.2%), this system was effective. This study provides support for the position that most patients who achieve their LDL-C goal within a risk reduction program will likely maintain that goal once discharged. Although more than 90% of the patients in our study with an LDL-C goal of <100 mg/dL maintained that goal, the proportion who maintained their LDL-C goal of <70 mg/dL was much lower

Table 1. Baseline Demographics for the Study Population^a

Characteristic	Usual Care (n = 207)	CPCRS Care (n = 214)
Male	160 (77)	151 (71)
Age, mean (SD), y	71 (9)	72 (10)
Current smoker	6 (3)	9 (4)
Diabetes	18 (9)	24 (11)
Hypertension	133 (64)	147 (69)
Chronic kidney disease	4 (2)	1 (0.5)
Prior myocardial infarction	114 (55)	104 (49)
Percutaneous coronary intervention	105 (51)	99 (46)
Coronary artery bypass graft surgery	62 (30)	62 (29)
Systolic blood pressure, mean (SD), mm Hg	117 (12)	118 (11)
LDL-C, mean (SD), mg/dL	69 (16)	70 (15)
Non-HDL-C, mean (SD), mg/dL	93 (17)	94 (17)
Treatment goals		
LDL-C <100 mg/dL	160 (77)	162 (76)
LDL-C <70 mg/dL	47 (23)	52 (24)
Blood pressure <140/90 mm Hg	185 (89)	189 (88)
Blood pressure <130/80 mm Hg	22 (11)	25 (12)
Medication use		
Statin	186 (90)	194 (91)
Nonstatin	12 (6)	6 (3)
β-Blocker	139 (67)	129 (60)
ACE inhibitor/ARB	106 (51)	114 (53)
Time in service prior to enrollment, mean (SD), y	4 (2)	4 (1)

ACE indicates angiotensin-converting enzyme; ARB, angiotensin II receptor blocker; CPCRS, Clinical Pharmacy Cardiac Risk Service; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol.

^aValues are number (percentage) unless indicated otherwise.

in both groups, although not statistically different between groups. This result suggests that a 1-year follow-up interval may not be sufficient for those patients with more aggressive LDL-C goals; and shorter periods of follow-up may be warranted to maintain these goals. Future studies are needed to address this issue.

Our study is not without limitations. We did not evaluate the length of time it took to get to treatment goals within the CPCRS prior to study enrollment and whether this had an impact on the maintenance of LDL-C control. Thus, we cannot provide recommendations as to the length of time patients should remain within a risk reduction program before being discharged. The results of this study may not be generalizable to healthcare systems that do not have electronic medical records with laboratory ordering and patient tracking capabilities. This study relied heavily on the use of these electronic systems for patient tracking and follow-up. It is possible

■ **Table 2.** Study Results for Prespecified End Points

End Point	Percentage		P
	Usual Care (n = 207)	CPCRS Care (n = 214)	
Primary			
LDL-C goal			
<100 mg/dL	93.1	91.0	.46
<70 mg/dL	56.8	68.6	.23
Secondary			
Fatal and nonfatal coronary events			
	5.8	3.3	.21
All-cause mortality	7.7	8.4	.80
Any-cause hospitalization	27.1	33.6	.14
Non-HDL-C goal	88.2	88.7	.89
Lipid-lowering persistence	85.5	86.5	.78
Blood pressure goal			
<140/90 mm Hg	84.2	75.0	.03
<130/80 mm Hg	54.5	60.0	.71

CPCRS indicates Clinical Pharmacy Cardiac Risk Service; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol.

that patients may have maintained their goals with no systematic follow-up, as suggested by prior observational studies.¹²⁻¹⁴ Lastly, we did not compare the economic outcomes between groups. Additional resources (eg, more intense lipid management pharmacotherapy, more frequent clinic visits) may have been required to maintain the lipid control observed.

CONCLUSION

As evidence continues to emerge supporting the aggressive use of secondary prevention medications and control of risk factors for not only patients with CAD but also other high-risk patients, healthcare systems need to determine methods to deliver comprehensive and focused care to all patients that is sustainable over time. Cardiac disease management programs deliver comprehensive and focused care. Resources typically limit delivery of care to select patients at any given time. This study demonstrates that the majority of patients will maintain lipid and blood pressure goals after discharge from such programs with minimal, systematic follow-up. The ability to discharge well-controlled patients from a disease management program may permit expanding care to other high-risk patients without the need for additional resources.

Acknowledgment

The authors would like to thank the entire staff of Kaiser Permanente Colorado's Clinical Pharmacy Cardiac Risk Service.

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Funding Source: This study was funded by the American College of Clinical Pharmacy Research Institute's Frontiers Fund.

Author Disclosures: The authors (KLO, TD, JR, TLH, JAM) report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

A version of this article was presented at the American College of Clinical Pharmacy Annual Meeting; October 14-17, 2007; Denver, CO.

Authorship Information: Concept and design (KLO, TD, JR, TLH, JAM); acquisition of data (KLO, TD, JR); analysis and interpretation of data (KLO, TD, JAM); drafting of the manuscript (KLO, TD, JR, TLH, JAM); critical revision of the manuscript for important intellectual content (KLO, TD, JR, TLH, JAM); statistical analysis (KLO, TD); provision of study materials or patients (KLO); obtaining funding (KLO, TD); administrative, technical, or logistic support (KLO, TLH); and supervision (KLO).

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REFERENCES

1. Grundy SM, Cleeman JI, Merz CN, et al; National Heart, Lung, and Blood Institute; American College of Cardiology Foundation; American Heart Association. Implications of recent clinical trials for the National Cholesterol Education Program Adult Treatment Panel III guidelines [published correction appears in *Circulation*. 2004;110(6):763]. *Circulation*. 2004;110(2):227-239.
2. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA*. 2001;285(19):2486-2497.
3. National Committee for Quality Assurance. *Health Plan Employer Data and Information Set (HEDIS/NCQA) Quality Compass 2005*. Washington, DC: National Committee for Quality Assurance; 2005.
4. Baigent C, Keech A, Kearney PM, et al; Cholesterol Treatment Trialists' (CTT) Collaborators. Efficacy and safety of cholesterol-lowering treatment: prospective meta-analysis of data from 90,056 participants in 14 randomised trials of statins [published corrections appear in *Lancet*. 2005;366(9494):1358 and *Lancet*. 2008;371(9630):2084]. *Lancet*. 2005;366(9493):1267-1278.
5. Rosamond W, Flegal K, Furie K, et al; American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2008 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*. 2008;117(4):e25-146.
6. Sueta CA, Chowdhury M, Boccuzzi SJ, et al. Analysis of the degree of undertreatment of hyperlipidemia and congestive heart failure secondary to coronary artery disease [published correction appears in *Am J Cardiol*. 1999;84(9):1143]. *Am J Cardiol*. 1999;83(9):1303-1307.
7. Ghandehari H, Kamal-Bahl S, Wong ND. Prevalence and extent of dyslipidemia and recommended lipid levels in US adults with and without cardiovascular comorbidities: the National Health and Nutrition Examination Survey 2003-2004. *Am Heart J*. 2008;156(1):112-119.
8. Pearson TA, Laurora I, Chu H, Kafonek S. The Lipid Treatment Assessment Project (L-TAP): a multicenter survey to evaluate the percentages of dyslipidemic patients receiving lipid-lowering therapy and achieving low-density lipoprotein cholesterol goals. *Arch Intern Med*. 2000;160(4):459-467.
9. Murchie P, Campbell NC, Ritchie LD, Simpson JA, Thain J. Secondary prevention clinics for coronary heart disease: four year

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follow up of a randomised controlled trial in primary care. *BMJ*. 2003;326(7380):84.

10. Sandhoff BG, Nies LK, Olson KL, Nash JD, Rasmussen JR, Merenich JA. Clinical pharmacy cardiac risk service for managing patients with coronary artery disease in a health maintenance organization. *Am J Health Syst Pharm*. 2007;64(1):77-84.

11. Clark AM, Hartling L, Vandermeer B, McAlister FA. Meta-analysis: secondary prevention programs for patients with coronary artery disease. *Ann Intern Med*. 2005;143(9):659-672.

12. Straka RJ, Taheri R, Cooper SL, Smith JC. Achieving cholesterol target in a managed care organization (ACTION) trial. *Pharmacotherapy*. 2005;25(3):360-371.

13. O'Donnell DC, Chen NT, Piziak VK. Goal attainment and maintenance of serum cholesterol level in a pharmacist-coordinated lipid clinic. *Am J Health Syst Pharm*. 2001;58(4):325-330.

14. Pearson GJ, Olson KL, Panich NE, et al. Maintenance of improved lipid levels following attendance at a cardiovascular risk reduction clinic: a 10-year experience. *Vasc Health Risk Manag*. 2008;4(5):1127-1135.

15. Olson KL, Rasmussen J, Sandhoff BG, Merenich JA; Clinical Pharmacy Cardiac Risk Service Study Group. Lipid management in patients with coronary artery disease by a clinical pharmacy service in a group model health maintenance organization. *Arch Intern Med*. 2005;165(1):49-54.

16. Merenich JA, Olson KL, Delate T, Rasmussen J, Helling DK, Ward DG; Clinical Pharmacy Cardiac Risk Service Study Group. Mortality reduction benefits of a comprehensive cardiac care program for patients with occlusive coronary artery disease. *Pharmacotherapy*. 2007;27(10):1370-1378.

17. Chobanian AV, Bakris GL, Black HR, et al; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; 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: the JNC 7 report [published correction appears in *JAMA*. 2003;290(2):197]. *JAMA*. 2003;289(19):2560-2572. ■