

Low-density Lipoprotein Cholesterol Goal Attainment Among High-risk Patients: Does a Combined Intervention Targeting Patients and Providers Work?

Nelia M. Afonso, MD; George Nassif, MD; Anil N. F. Aranha, PhD; Bonnie DeLor, PharmD; and Lavoisier J. Cardozo, MD

Background: Physicians are aware of the National Cholesterol Education Program guidelines; however, most patients fail to attain cholesterol goals.

Objective: To determine whether a combined program of patient education and provider awareness could improve the National Cholesterol Education Program goal attainment among patients at high risk for cardiovascular events.

Methods: One hundred seven high-risk patients with cardiovascular disease were educated in a single 15-minute session regarding their cholesterol levels, risk factors, and medication adherence. Those with scores of 2 or lower on the Morisky questionnaire were classified as low-adherence patients, and those with scores of 3 or higher were classified as high-adherence patients. Seven physicians were provided this information and were requested to evaluate the dyslipidemia management of these patients. Lipid levels were re-evaluated 8 to 12 weeks after the intervention.

Results: At the start of the study, 38 (35.5%) of the 107 patients were at target low-density lipoprotein cholesterol (LDL-C) levels, and 64 of the 107 patients (59.8%) were at target levels after the intervention. High-adherence patients decreased their LDL-C levels from a mean of 118.6 mg/dL (3.07 mmol/L) to 98.6 mg/dL (2.55 mmol/L); low-adherence patients increased their LDL-C levels after the intervention from 134.5 mg/dL (3.48 mmol/L) to 142.1 mg/dL (3.68 mmol/L). A comparison between the LDL-C goal achievers vs nonachievers revealed a significant difference in adherence ($P = .001$). Among the goal achievers, significant decreases in preintervention vs postintervention total cholesterol levels ($P = .001$) and LDL-C levels ($P = .001$) were also noted.

Conclusion: This study demonstrates that an intervention simultaneously targeting patients and providers is successful in improving goal attainment among high-risk patients.

(*Am J Manag Care.* 2006;12:589-594)

Although physicians are aware of the National Cholesterol Education Program (NCEP) guidelines and attempt to achieve cholesterol goals with their dyslipidemic patients, most patients fail to attain cholesterol goals.^{1,2} The Lipid Treatment Assessment Project demonstrated that, at best, only 38% of patients achieved the NCEP Adult Treatment Panel II low-density lipoprotein cholesterol (LDL-C) goals; success rates were lowest among the patients who could benefit the most from therapy (18% of patients with coronary heart disease).³ Despite long-standing efficacy data for managing dyslipidemias, a significant gap remains between widely accepted evidence-based treatment

guidelines and routine clinical practice.³⁻⁸ The recent NCEP Adult Treatment Panel III guidelines call for more aggressive diagnosis and treatment of hyperlipidemia and have increased the number of persons considered to be at high risk for coronary artery disease (CAD).⁹ LDL-C plays a major role in initiating the development of atherosclerotic plaque. Therefore, the NCEP has established LDL-C as the primary target of therapeutic intervention. The LDL-C goal is the primary objective of therapy for all patients, except for those with triglyceride levels greater than 500 mg/dL (5.65 mmol/L). In these patients, targeting triglyceride levels becomes the primary goal.

As primary care physicians, our challenge is to identify high-risk patients and to be more aggressive in our efforts to achieve the Adult Treatment Panel III goals. This study was conducted to determine whether a combined program of patient education and provider awareness could improve the NCEP goal attainment among patients at high risk for cardiovascular events.

METHODS

Study Design

This was a prospective pre-post evaluation of a cohort of high-risk patients with cardiovascular disease. These included patients with CAD or a CAD-risk equivalent (ie, patients with diabetes mellitus, multiple risk factors that confer a 10-year risk for CAD >20%, or other clinical forms of atherosclerotic disease [peripheral arterial disease, abdominal aortic aneurysm, and symptomatic carotid artery disease] as defined by the NCEP

From the Department of Medicine, Wayne State University School of Medicine, Detroit, Mich. At the time of the study, Dr DeLor was a Clinical Education Consultant with Pfizer Inc.

This study was supported by a grant from the Blue Cross Blue Shield of Michigan Foundation. The funding organization had no role in the management, design, data collection, or analysis of the study or in the interpretation, preparation, review, or approval of the manuscript.

This study was presented at the 28th Annual Meeting of the Society of General Internal Medicine; May 13, 2005; New Orleans, La.

Address correspondence to: Nelia M. Afonso, MD, Department of Medicine, Wayne State University School of Medicine, 5C WSU Health Center, 4201 St Antoine Dr, Detroit, MI 48201-2153. E-mail: nafonso@med.wayne.edu.

Adult Treatment Panel III).⁹ Based on the NCEP guidelines, LDL-C improvement was the primary target of our intervention. This study was approved by the institutional review board. The medical records of all patients visiting an inner-city clinic associated with a major teaching hospital were reviewed during 6 months from November 2003 to May 2004. A priori, it was determined that a minimum of 78 high-risk patients were needed for the study to obtain a 90% confidence interval with a margin of error of $\pm 10\%$ to detect a 15% post-intervention increase in goal attainment. Consent was obtained from all patients who agreed to participate and who met study enrollment criteria. Patients younger than 18 years were excluded from the study.

Measures

Data collected during the initial visit comprised demographics, such as age, race/ethnicity, height, weight, and waist circumference, and cardiovascular risk factors, such as the presence of hypertension, diabetes mellitus, CAD, peripheral arterial disease, abdominal aortic aneurysm, symptomatic carotid artery disease, and smoking history. Baseline laboratory information recorded included lipid fractions and liver function test results in all patients, as well as glycosylated hemoglobin in patients with diabetes mellitus. Treatment details obtained included the total number of medications taken by the patient, as well as specifics about lipid-lowering agents. Lipid-level goals, as recommended by the NCEP Adult Treatment Panel III guidelines, were defined as follows: LDL-C goal of less than 100 mg/dL (< 2.59 mmol/L), triglycerides less than 150 mg/dL (< 1.70 mmol/L), non-high-density lipoprotein cholesterol (non-HDL-C) less than 130 mg/dL (< 3.37 mmol/L), and HDL-C of 40 mg/dL or higher (≥ 1.04 mmol/L).³ Follow-up lipid values were obtained 8 to 12 weeks after the initial intervention.

Morisky Adherence Scale

The patients completed a Morisky questionnaire to evaluate medication adherence.¹⁰ The Morisky score was calculated by tallying the number of "no" answers to the 4 Morisky survey questions of nonadherence. For the purpose of this study, those with scores of 2 or lower were classified as low-adherence patients, and those with scores of 3 or higher were classified as high-adherence patients.

Patient Intervention

One hundred forty-one high-risk patients were educated individually in a single 15-minute session by a trained research assistant who provided information to patients about cholesterol content of food, a low-cholesterol diet, the importance of medication adherence, and risks asso-

ciated with hyperlipidemia. Before their encounter with the physician, the patients were also given a printout with their current lipid fractions and their target lipid levels.

Physician Intervention

Information on the patient's current lipid profile and the percentage LDL-C reduction needed to achieve target levels were placed in the front of the patient's medical chart. Physicians were given information about the patient's level of adherence based on the Morisky survey. Statin dosing cards were also provided to the physicians to assist them with initiating and intensifying therapy according to the dose and the corresponding expected LDL-C reduction as listed in the product package inserts. Physicians were then asked to evaluate the dyslipidemia management during this visit among these patients and to fill out a form listing whether they had made any dietary recommendations or lipid medication changes for these patients. Follow-up lipid levels and liver function test results on these patients were obtained during their scheduled clinic visit 8 to 12 weeks after the intervention.

Statistical Analysis

The data obtained were coded, entered into a data file, and analyzed using SPSS for Windows version 7.0 (SPSS Inc, Chicago, Ill). For the purpose of analysis, the patients were grouped as LDL-C goal achievers (> 100 mg/dL [> 2.59 mmol/L] before and ≤ 100 mg/dL [≤ 2.59 mmol/L] after the intervention) or nonachievers (> 100 mg/dL [> 2.59 mmol/L] before and > 100 mg/dL [> 2.59 mmol/L] after the intervention). Continuous data (age, body mass index, blood pressure, number of medications, glycosylated hemoglobin, and lipid profile) of the 2 groups were compared using *t* test, and categorical data (sex, race/ethnicity, education, treatment, adherence, and concomitant diseases) were compared using χ^2 test. Baseline and end-of-study changes in the lipid profiles among LDL-C goal achievers and nonachievers were analyzed using paired *t* test. Results are presented as the mean \pm SD or as number (percentage). Statistical significance for all tests was established at a nominal $P < .05$.

RESULTS

One hundred sixty high-risk patients who were being treated by the 7 providers in the clinic were identified for the study. Of these, 141 were enrolled, and 19 patients declined to participate. Among the enrollees, 107 who had follow-up lipid test results after the intervention were considered in the final analysis.

Table 1 summarizes the patient demographics and the baseline laboratory data for the 141 enrolled patients. The

mean age was 59.6 years, 89.4% were African American, and 75.9% were female. One hundred thirteen patients (80.1%) were taking lipid-lowering medications at the start of the study. The group had a mean systolic blood pressure of 138.7 mm Hg, diastolic blood pressure of 79.1 mm Hg, and body mass index (calculated as weight in kilograms divided by height in meters squared) of 34.6; 117 (83.0%) were classified as high-adherence patients. The baseline lipid values of the cohort were as follows: total cholesterol, 196.2 mg/dL (5.08 mmol/L); LDL-C, 116.2 mg/dL (3.01 mmol/L); HDL-C, 51.4 mg/dL (1.33 mmol/L); and triglycerides, 143.8 mg/dL (1.62 mmol/L).

Achievement of Lipoprotein Targets

Preintervention and postintervention data were obtained in an intention-to-treat analysis of the 141 enrolled patients. The respective preintervention and postintervention levels were 202.1 ± 68.3 mg/dL (5.23 ± 1.77 mmol/L) and 183.3 ± 60.5 mg/dL (4.75 ± 1.57 mmol/L) for total cholesterol (*P* < .001), 196.2 ± 63.1 mg/dL (5.08 ± 1.63 mmol/L) and 181.7 ± 55.9 mg/dL (4.71 ± 1.45 mmol/L) for LDL-C (*P* < .001), 51.4 ± 14.8 mg/dL (1.33 ± 0.38 mmol/L) and 50.6 ± 14.6 mg/dL (1.31 ± 0.38 mmol/L) for HDL-C (*P* = .28), and 143.8 ± 111.6 mg/dL (1.62 ± 1.26 mmol/L) and

Table 1. Characteristics Among 141 Enrolled Patients*

Characteristic	Follow-up (n = 107)	No Follow-up (n = 34)	Entire Sample (N = 141)
Age, y	58.9 ± 14.1	61.9 ± 13.8	59.6 ± 14.0
Sex			
Female	83 (77.6)	24 (70.6)	107 (75.9)
Male	24 (22.4)	10 (29.4)	34 (24.1)
Race/ethnicity			
African American	92 (86.0)	34 (100.0)	126 (89.4)
White	12 (11.2)	0 (0.0)	12 (8.5)
Other	3 (2.8)	0 (0.0)	3 (2.1)
Education			
≤High school	64 (59.8)	23 (67.6)	87 (61.7)
≥College	43 (40.2)	11 (32.4)	54 (38.3)
Body mass index†	34.8 ± 9.7	33.6 ± 10.3	34.6 ± 9.8
Blood pressure, mm Hg			
Systolic	135.8 ± 16.9	148.2 ± 18.4	138.7 ± 18.0
Diastolic	77.8 ± 9.0	83.0 ± 9.9	79.1 ± 9.5
No. of medications	5.7 ± 2.8	6.1 ± 2.9	5.8 ± 2.9
Glycosylated hemoglobin, %	7.3 ± 1.8	8.1 ± 2.0	7.5 ± 1.9
Morisky adherence			
High	88 (82.2)	29 (85.3)	117 (83.0)
Low	19 (17.8)	5 (14.7)	24 (17.0)
Lipid profile, mg/dL			
Total cholesterol	202.1 ± 68.3	177.9 ± 38.8	196.2 ± 63.2
LDL-C	121.8 ± 53.8	101.7 ± 31.7	116.2 ± 49.9
HDL-C	57.8 ± 15.9	51.4 ± 14.8	51.4 ± 14.8
Triglycerides	147.9 ± 122.6	131.1 ± 65.7	143.8 ± 111.6
Smokers	14 (13.1)	4 (11.8)	18 (12.8)
Concomitant diseases			
Diabetes mellitus	74 (69.2)	23 (67.6)	97 (68.8)
Hypertension	91 (85.0)	32 (94.1)	123 (87.2)
Peripheral vascular disease	4 (3.7)	6 (17.6)	10 (7.1)
Coronary artery disease	19 (17.8)	6 (17.6)	25 (17.7)
Cerebrovascular disease	13 (12.1)	5 (14.7)	18 (12.8)
Abdominal aortic aneurysm	1 (0.9)	0 (0.0)	1 (0.7)

*Data are given as mean ± SD or as number (percentage). To convert cholesterol levels to millimoles per liter, multiply by 0.0209; to convert triglycerides, multiply by 0.0113.

†Calculated as weight in kilograms divided by height in meters squared.

LDL-C indicates low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol.

133.6 ± 70.6 mg/dL (1.51 ± 0.80 mmol/L) for triglycerides (*P* = .24).

Of 107 patients who returned for follow-up, 38 (35.5%) were at their LDL-C target at the start of the study and 64 (59.8%) were at their target at the end of the study, resulting in a 24.3% increase in the number of patients at target levels (*P* < .01). Among 107 patients (Figure), the respective preintervention and postintervention levels were 202.1 ± 68.3 mg/dL (5.23 ± 1.77 mmol/L) and 183.3 ± 60.5 mg/dL (4.75 ± 1.57 mmol/L) for total cholesterol (*P* < .001), 120.8 ± 53.8 mg/dL (3.13 ± 1.39 mmol/L) and 106.5 ± 50.0 mg/dL (2.76 ± 1.30 mmol/L) for LDL-C (*P* = .001), 51.8 ± 15.9 mg/dL (1.34 ± 0.41 mmol/L) and 50.9 ± 15.7 mg/dL (1.32 ± 0.41 mmol/L) for HDL-C (*P* = .29), and 147.9 ± 122.6 mg/dL (1.67 ± 13.9 mmol/L) and 134.7 ± 72.3 mg/dL (1.52 ± 0.83 mmol/L) for triglycerides (*P* = .25).

Based on the Morisky questionnaire, 82.2% of the cohort of 107 were classified as high-adherence patients and 17.8% as low-adherence patients. Among low-adherence patients, LDL-C levels increased after the intervention from 134.5 ± 88.32 mg/dL (3.48 ± 2.29 mmol/L) to 142.1 ± 87.1 mg/dL (3.68 ± 2.26 mmol/L) (*P* = .35); among high-adherence patients, LDL-C levels decreased after the intervention from 118.6 ± 44.4 mg/dL (3.07 ± 1.15 mmol/L) to 98.6 ± 35.2 mg/dL (2.55 ± 0.91 mmol/L) (*P* < .001).

Characteristics of LDL-C Goal Achievers and Nonachievers

The 69 patients who were not initially at their LDL-C goal were analyzed as a subgroup; the 37 patients who

achieved goal at the end of the study were compared with the 32 patients who did not achieve goal. There were no differences between the 2 groups in education, body mass index, diabetic control, or blood pressure control. The goal achievers were significantly older than the nonachievers (*P* = .02). At baseline, the goal achievers were taking a greater number of medications compared with the nonachievers (*P* = .08).

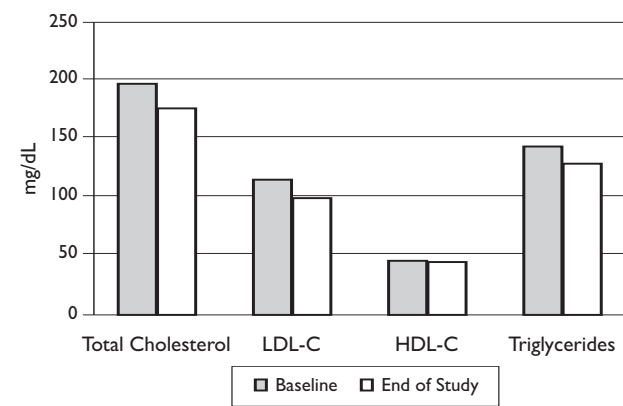
Ninety-seven percent of the LDL-C goal achievers were classified as high-adherence patients, compared with 62.5% of the nonachievers (*P* = .001). Physicians made increases in the dosage of existing lipid-lowering medications in 71.9% of goal nonachievers compared with 35.1% of goal achievers (*P* = .005). Initiation of a lipid-lowering medication was made in 27.0% of achievers compared with 9.4% of nonachievers (*P* = .12), and an additional lipid-lowering drug was added to the regimen in 13.5% of achievers compared with 3.1% of nonachievers (*P* = .27). Statistically significant differences were noted between baseline vs end-of-study total cholesterol levels (*P* = .001) and LDL-C levels (*P* = .001) among goal achievers but not among goal nonachievers (Table 2).

DISCUSSION

Numerous studies³⁻⁸ indicate that patients at high risk for CAD do not achieve their cholesterol targets, despite well-defined management goals. Strong evidence shows that adequate management of hyperlipidemia is effective in preventing and delaying cardiovascular complications.^{11,12} Our study demonstrates that an intervention targeting patients and their providers can be effective in helping high-risk patients achieve their lipid targets. In this group of patients who were primarily African American, we were able to increase the percentage of patients at total cholesterol and LDL-C goals from 35.5% before enrollment to 59.8% at the end of the study.

Although physicians are aware of the NCEP cholesterol guidelines and attempt to achieve these goals with their dyslipidemic patients, most patients fail to attain cholesterol goals, despite treatment with diet, exercise, or drugs.³⁻⁸ Phillips et al¹³ listed the following 3 primary reasons for clinical inertia: overestimation of care, use of “soft” reasons to avoid therapy intensification, and lack of provider education and practice organization focused on achieving therapeutic goals. Reminders, whether sophisticated computerized messages or simple flow sheets, are effective in reinforcing clinical practice and in prompting providers to take immediate action during the office visit.¹⁴⁻¹⁶ Eisenberg¹⁷ concluded that physician behavior could be altered by incorporat-

Figure. Baseline and End-of-Study Lipid Profiles Among 107 Patients With Follow-up Lipid Test Results After the Intervention



To convert cholesterol levels to millimoles per liter, multiply by 0.2059; to convert triglycerides, multiply by 0.0113. LDL-C indicates low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol.

ing educational information into timely feedback to clinicians. Davis and colleagues¹⁸ showed that reminders to providers were effective in 22 of 26 studies they reviewed. Our physician intervention served a dual purpose: it primarily provided information on adherence and on the current and target LDL-C levels, and it secondarily worked as a feedback and reminder to physicians to intensify treatment goals. This shows that a simple inexpensive approach is effective. There was a significant difference in the number of patients who had their lipid-lowering medication dosage increased among LDL-C goal achievers vs nonachievers. Physicians seemed to have tailored their medication changes according to the baseline cholesterol values.

Clinical inertia is a problem of healthcare providers that is separate from patient-related issues of adherence. Physicians often cite patient nonadherence as a barrier to better management.¹³ This did not seem to be a major issue in our patient population. Based on the Morisky questionnaire, 82.2% of our cohort were classified as high-adherence patients and 17.8% as low-adherence patients. The adherence level was much higher (97.3%) in the subgroup of LDL-C goal achievers. The fact that our intervention was successful in a highly adherent patient population indicates that the Morisky questionnaire may be a good predictor of success, especially when interventions are targeted toward a high-adherence group.

Nonadherence or low adherence to lipid-lowering therapy has been noted to negatively impact outcomes when compared to high adherence.¹⁹ Interventions aiming to improve outcomes should include consideration of patient factors such as medication adherence.²⁰ A meta-analysis²¹ of 28 studies revealed that the key adherence-enhancing interventions were providing reinforcement for patients' efforts to change, giving feedback on progress, and tailoring education to patient needs and circumstances. In patients with low adherence, other interventions that address health behavior change or motivational interviewing will likely lead to better outcomes.^{20,21}

There is a paucity of literature on lipid-lowering interventions that target patients and providers simultaneously. Our intervention can be classified as a complex or multicomponent intervention. It consisted of more than 1 discrete

component, comprising patient education regarding target cholesterol values, risks of hyperlipidemia, and dietary information. The physician intervention combined features of a feedback and reminder system. Each of these components may have had an independent effect on the results of the study, but it is impossible to determine which component resulted in improved lipid level goal attainment. Evidence suggests that complex interventions may have better results than single-strategy interventions.²²⁻²⁴

Although our uncontrolled study is not definitive, our data suggest that a multicomponent patient and provider intervention can improve the lipid level goal attainment in a high-risk predominantly African American population. In general, African Americans are underrepresented in lipid-lowering clinical end point trials and remain inadequately treated with lipid-lowering therapy in the clinical setting.^{25,26} This is of particular concern because the new NCEP guidelines indicate that more African Americans with hypercholesterolemia should be receiving intensive lipid-lowering treatment.²⁷

The study design has several limitations. This was a small study. Although we identified 160 patients, only 107 returned for follow-up. However, the magnitude of changes observed reflects the success of the intervention. Our intervention targeted patients, physicians, and the practice system; hence, it is impossible to quantify the effects of each intervention separately. The study looked at persistence and goal attainment during a short period. Sustained goal attainment with the intervention needs further study.

Our results are also limited by the lack of a comparison group, as the interventions were directed at the

Table 2. Baseline and End-of-Study Lipid Profiles Among 69 Low-Density Lipoprotein Cholesterol (LDL-C) Goal Achievers and Nonachievers*

Lipid	Baseline	End of Study	P
Goal achievers (n = 37)			
Total cholesterol	210.7 ± 42.9	161.3 ± 24.1	.001
LDL-C	131.2 ± 36.5	81.8 ± 13.6	.001
HDL-C	52.0 ± 12.6	52.3 ± 12.2	.82
Triglycerides	133.2 ± 67.0	137.4 ± 101.4	.80
Goal nonachievers (n = 32)			
Total cholesterol	241.6 ± 97.2	229.2 ± 87.1	.23
LDL-C	155.5 ± 69.7	153.9 ± 65.2	.78
HDL-C	53.5 ± 20.8	52.4 ± 22.1	.40
Triglycerides	168.3 ± 201.9	132.1 ± 54.8	.26

*Data are given as mean ± SD mg/dL unless otherwise indicated. To convert cholesterol levels to millimoles per liter, multiply by 0.2059; to convert triglycerides, multiply by 0.0113. HDL-C indicates high-density lipoprotein cholesterol.

entire practice. The patients served as their own controls. Secular trends and cointerventions, independent of our intervention, may have affected the results. These results may be inapplicable to other patient populations given the predominance of middle-aged African American women in our study. In addition, there is no gold standard for assessing patient adherence. Validation of any tool or technique in an attempt to select the optimal tool for a given setting or population has met with conflicting results.²⁸⁻³¹ We chose the Morisky questionnaire because it is undemanding and is easily incorporated into the office process of care. Concordance does not exist relative to the best tool to use in any specific practice setting. Finally, although providers were given dosing cards that would allow them to initiate or intensify therapy based on the dose-anticipated LDL-C reduction, we were unable to quantify the effect of this card in our success. Lack of dose intensification has been noted previously as an explanation for failing to achieve LDL-C goals.²⁷ Researchers using flex-dose initiation of therapy and dose intensification have demonstrated excellent results in facilitating intervention patients to reach their LDL-C goals.^{25,32,33}

CONCLUSIONS

Dyslipidemia in high-risk patients is a costly problem, and although guidelines for management are well established, many patients are not effectively treated. Our study demonstrates that a simultaneous intervention targeting patients and providers is successful in improving LDL-C goal attainment among a group of high-risk patients. In our predominantly African American population, we were able to achieve a substantial improvement in the number of patients at goal after our unique multicomponent intervention. The Morisky questionnaire is a robust and useful predictor of successful outcome of such an intervention. Evaluation of the effect of similar interventions targeting patients and providers to reduce clinical inertia, as well as improved patient education, should be carried out in other chronic disease processes such as diabetes mellitus and hypertension.

REFERENCES

1. Yarzebski J, Bujor CF, Goldberg RJ, Spencer FS, Lessard D, Gore JM. A community-wide survey of physician practices and attitudes toward cholesterol management in patients with recent acute myocardial infarction. *Arch Intern Med.* 2002;162:797-804.
2. McBride P, Schrott HG, Plane MB, Underbakke G, Brown RL. Primary care practice adherence to National Cholesterol Education Program guidelines for patients with coronary heart disease. *Arch Intern Med.* 1998;158:1238-1244.
3. 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;160:459-467.
4. Sueta CA, Chowdhury M, Bocuzzi SJ, et al. Analysis of the degree of under-treatment of hyperlipidemia and congestive heart failure secondary to coronary artery disease. *Am J Cardiol.* 1999;83:1303-1307.
5. Sloan KL, Sales AE, Willems JP, et al. Frequency of serum low-density lipoprotein cholesterol measurement and frequency of results ≤ 100 mg/dl among patients who had coronary events (Northwest VA Network Study). *Am J Cardiol.* 2001;88:1143-1146.
6. Ford ES, Mokdad AH, Giles WH, Mensah GA. Serum total cholesterol concentrations and awareness, treatment, and control of hypercholesterolemia among US adults: findings from the National Health and Nutrition Examination Survey, 1999-2000. *Circulation.* 2003;107:2185-2189.
7. Olson KL, Tsuyuki RT. Patients' achievement of cholesterol targets: a cross-sectional evaluation. *Am J Prev Med.* 2003;25:339-342.
8. Olson KL, Bungard TJ, Tsuyuki RT. Cholesterol risk management: a systematic examination of the gap from evidence to practice. *Pharmacotherapy.* 2001;21:807-817.
9. 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;285:2486-2497.
10. Morisky DE, Green LW, Levine DM. Concurrent and predictive validity of a self-reported measure of medication adherence. *Med Care.* 1986;24:67-74.
11. Scandinavian Simvastatin Survival Study Group. Randomized trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S). *Lancet.* 1994;344:1383-1389.
12. Long-term Intervention With Pravastatin in Ischemic Disease (LIPID) Study Group. Prevention of cardiovascular events and death with pravastatin in patients with coronary heart disease and a broad range of initial cholesterol levels. *N Engl J Med.* 1998;339:1349-1357.
13. Phillips LS, Branch WT, Cook CB, et al. Clinical inertia. *Ann Intern Med.* 2001;135:825-834.
14. Cohen DI, Littenberg B, Wetzel C, Neuhauser D. Improving physician compliance with preventive medicine guidelines. *Med Care.* 1982;20:1040-1045.
15. McDonald CJ, Hui SL, Smith DM, et al. Reminders to physicians from an introspective computer medical record: a two-year randomized trial. *Ann Intern Med.* 1984;100:130-138.
16. Litzelman DK, Dittus RS, Miller ME, Tierney WM. Requiring physicians to respond to computerized reminders improves their compliance with preventive care protocols. *J Gen Intern Med.* 1993;8:311-317.
17. Eisenberg JM. *Doctor's Decisions and the Cost of Medical Care: The Reasons for Doctor's Practice and Ways To Change Them.* Ann Arbor, Mich: Health Administration; 1986.
18. Davis RM, Wagner EH, Groves T. Managing chronic disease [editorial]. *BMJ.* 1999;318:1090-1091.
19. Wei L, Wang J, Thompson P. Adherence to statin treatment and readmission of patients after myocardial infarction: a six year follow-up study. *Heart.* 2002;88:229-233.
20. Newell SA, Bowman JA, Cockburn JD. A critical review of interventions to increase compliance with medication-taking, obtaining medication refills, and appointment-keeping in the treatment of cardiovascular disease. *Prev Med.* 1999;29(pt 1):535-548.
21. Mullen PD, Mains DA, Velez R. A meta-analysis of controlled trials of cardiac patient education. *Patient Educ Couns.* 1992;19:143-162.
22. McDonald HP, Garg AX, Haynes RB. Intervention to enhance patient adherence to medication prescriptions. *JAMA.* 2002;288:2868-2879.
23. Renders CM, Valk GD, Griffin S, Wagner EH, Eijk JT, Assendelft WJ. Interventions to improve the management of diabetes mellitus in primary care, outpatient and community settings. *Cochrane Database Syst Rev.* 2001;CD001481.
24. Berger BA, Staton AL, Felkey BG, et al. Effectiveness of an educational program to teach pharmacists to counsel hypertensive patients and influence treatment adherence. *J Pharm Mark Manage.* 1991;5:27-41.
25. Nyman MA, Murphy ME, Schryver PG, Naessens JM, Smith SA. Improving performance in diabetes care: a multicomponent intervention. *Eff Clin Pract.* 2000;3:205-212.
26. Ferdinand KC. Coronary heart disease and lipid-modifying treatment in African American patients. *Am Heart J.* 2004;147:774-782.
27. Marceline JJ, Feingold KR. Inadequate treatment with HMG-CoA reductase inhibitors by health care providers. *Am J Med.* 1996;100:605-610.
28. MacLaughlin EJ, Raehl CL, Treadway AK, Sterling TL, Zoller DP, Bond CA. Assessing medication adherence in the elderly: which tools to use in clinical practice? *Drugs Aging.* 2005;22:231-255.
29. Vik SA, Maxwell CJ, Hogan DB, Patten SB, Johnson JA, Romonko-Slack L. Assessing medication adherence among older persons in community settings. *Can J Clin Pharmacol.* 2005;12:e152-e164.
30. Grymonpre RE, Didur CD, Montgomery PR, Sitar DS. Pill count, self-report, and pharmacy claims data to measure medication adherence in the elderly. *Ann Pharmacother.* 1998;32:749-754.
31. Shalansky SJ, Levy AR, Ignaszewski AP. Self-reported Morisky score for identifying nonadherence with cardiovascular medications. *Ann Pharmacother.* 2004;38:1363-1368.
32. Jones PH, McKenney JM, Karalis DG, Downey J. Comparison of the efficacy and safety of atorvastatin initiated at different starting doses in patients with dyslipidemia. *Am Heart J.* 2005;149:e1.
33. Athyros VG, Mikhailidis DP, Papageorgiou AA, et al. Relationship between LDL-C and non-HDL-C levels and clinical outcome in the Greek Atorvastatin and Coronary Heart Disease Evaluation (GREACE) study. *Curr Med Res Opin.* 2004;20:1385-1392.