The Physician and Pharmacist Team

An Effective Approach to Cholesterol Reduction

Paul E. Bogden, MD, Leann M. Koontz, RPh, Pam Williamson, PharmD,
Robert D. Abbott, PhD

OBJECTIVE: To assess the effect of a program that encourages teamwork between physicians and pharmacists on attempts to lower total cholesterol levels and to meet recommended goals proposed by the National Cholesterol Education Program (NCEP).

DESIGN: A single-blind, randomized, controlled trial lasting 6 months.

SETTING: An ambulatory primary care center.

PATIENTS: A sample of 94 patients with total cholesterol levels of 240 mg/dL (6.2 mmol/L) or higher.

INTERVENTION: Equal numbers of patients were randomly assigned to a control arm in which standard medical care was received and an intervention arm which implemented close interaction between physicians and pharmacists.

MEASUREMENTS AND MAIN RESULTS: Absolute change in total cholesterol levels from baseline values and the percentage of patients who achieved an NCEP goal after 6 months of intervention were determined. The rate of success in achieving NCEP goals in the intervention arm was double the rate in the control arm (43% vs 21%, $p < .05$). Total cholesterol levels in the intervention arm declined 44 ± 47 mg/dL (1.1 ± 1.2 mmol/L) versus 13 ± 51 mg/dL (0.3 ± 1.3 mmol/L) in the control arm ($p < .01$). The effect of intervention on reducing total cholesterol levels was similar for men and women and did not appear to be altered by age. The effect of intervention was greatest in patients with coronary heart disease ($p < .01$) followed by those without disease but with two or more coronary heart disease risk factors ($p < .05$). An effect of intervention was absent in patients without coronary heart disease and with fewer than two risk factors.

CONCLUSIONS: Attempts to lower total cholesterol levels and achieve NCEP goals are likely to be more successful when combined with programs that include teamwork between physicians and pharmacists. Some programs, however, may be more successful for high-risk patients, for whom it is often easier to provide more aggressive therapies. Although altering adverse lipid profiles in lower-risk patients may be difficult, achieving optimal cholesterol levels could have an important impact on preventing movement to higher risk strata.

KEY WORDS: total cholesterol; low density lipoprotein cholesterol; hypercholesterolemia; National Cholesterol Education Program; coronary heart disease, risk factor.

J GEN INTERN MED 1997;12:158-164.

ing these guidelines, it is estimated that 52 million Americans would be candidates for dietary therapy and as many as 12.7 million would be candidates for cholesterol-lowering medication.² These numbers and the implications from the NCEP guidelines suggest that the success in achieving NCEP goals could have a major impact on reducing the risk of morbidity and mortality from coronary heart disease.^{3,4} As a result, identifying programs that increase the capacity for NCEP guidelines to be successful is important.

Unfortunately, experience has shown that publishing and distributing national guidelines has not sufficiently contributed to altering physician approaches to managing patients with elevated levels of total cholesterol.² Focused programs at the local level have called for modification in those practice patterns that are resistant to change.^{5,6} One type of proposed intervention has been to encourage physician consultation with a clinical pharmacist. Although such an approach has worked successfully for non-lipid-altering medications,⁷ a positive effect of a pharmacist interaction on broad-based approaches to lipid management involving medication, diet, and behavioral recommendations has not been demonstrated previously in a controlled clinical trial.

METHODS

Patient Enrollment

This controlled clinical trial was conducted at The Queen Emma Clinic, a teaching clinic located in The Queen's Medical Center and affiliated with the John A. Burns School of Medicine at the University of Hawaii. The clinic serves approximately 10,000 mostly indigent patients in downtown Honolulu. The practice of primary care medicine at the clinic is divided into two groups having physicians of equal experience. Each practice has five at-

Received from the Department of Medicine, John A. Burns School of Medicine, (PEB, RDA), and the School of Nursing, University of Hawaii, Honolulu (RDA); The Queen's Medical Center, Honolulu, HI (PEB, LMK, PW); Northern Virginia Kaiser Permanente, Springfield (PW); and the Division of Biostatistics, University of Virginia School of Medicine, Charlottesville (RDA).

Supported by a grant from The Queen's Medical Center, Honolulu, Hawaii.

Address correspondence and reprint requests to Dr. Bogden: University of Hawaii Integrated Medical Residency Program, 1356 Lusitana, 7th floor, Honolulu, HI 96813-2427.

The views expressed in this article are those of the authors and do not reflect the official policy or position of the Queen's Medical Center.

Current National Cholesterol Education Program (NCEP) guidelines use coronary heart disease and related risk factors to assist in providing recommendations for the treatment of hypercholesterolemia and to determine the goals that should be reached in order to minimize the risk of new or recurrent coronary episodes.¹ Us-

tending physicians under whose supervision there are five third-year medical residents, four second-year medical residents, and six medical interns.

Study enrollment occurred over a 1-year period beginning in October 1993, 4 months after publication of the "Summary of the second report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel II)."¹ Patients eligible for the study included individuals with total cholesterol concentrations of 240 mg/dL (6.2 mmol/L) or more within 6 months before randomization and study inception. Participants may or may not have been treated for hypercholesterolemia. Minors and patients unable to sign an informed consent form were not included among the study participants. The study was approved by The Queen's Medical Center Institutional Review Committee.

Before the inception of the study, patients were randomly allocated to one of the two group practices. One practice comprised the control arm of the study, and the other practice comprised the intervention arm. Patient recruitment for the study was stopped when 50 patients in each group were identified who met entry criteria. Patients were followed in each arm of the study for 6 months from the date of study entry. Although clinic visits were scheduled for the beginning and the end of the study, interim visits also occurred during follow-up.

During the course of the study, there was one death in the intervention group. The patient had moved to Micronesia, stopped taking prescribed medications, and died 4 months later from a myocardial infarction. Two patients in the intervention group and two patients in the control group were lost to follow-up. One patient in the control group died of meningitis. At the time the study was completed, there were 47 patients able to be evaluated in the intervention and control groups. Throughout the study, patients received medical attention exclusively by physicians from the group practice to which they were assigned.

Intervention and Control Groups

In the intervention arm, a pharmacist routinely advised and interacted with patients and physicians on the best course of pharmacologic therapy. This included recommendations on dosage, drug selection, and monitoring. In accordance with the NCEP guidelines, the pharmacist recommended the initiation of drug treatment only when low-density lipoprotein (LDL) levels were more than 30 mg/dL above the target level. In the event that the physician had already initiated pharmacologic treatment before entry of the patient into the study, the pharmacist made further recommendations based on the cost and effectiveness of the medication. Recommendations for cholesterol modification that adhered to NCEP guidelines were entered into outpatient charts. To ensure consistency in the application of the intervention over time, NCEP guidelines and the study objectives and instructions were reviewed

monthly by a pharmacist with residents and interns who may have rotated onto duty within the intervention group. At each clinic visit, intervention group patients met with the pharmacist for 30 minutes before seeing their physician. The pharmacist took a medication history, answered questions, and encouraged compliance. In addition, the pharmacist was responsible for keeping track of costs of drug regimens, determining the least costly regimen, and recommending that regimen to the physician. The pharmacist did not give dietary advice or make direct referrals to other health professionals.

During the patient visit, the pharmacist reviewed relevant laboratory data with the physician. The pharmacist also attached recommendations for the physician to the front of the patient's chart. Recommendations were reviewed with the resident or intern as well. The resident or intern then saw the patient and discussed management with a supervising attending physician. The resident and attending physician decided whether to accept or reject the pharmacist's recommendations.

In the treatment arm, the primary care physicians retained responsibilities to assess secondary causes of hyperlipidemia, monitor and treat other cardiovascular risk factors, review relevant laboratory data, assess individual patient preferences and unique circumstances in formulating an individual treatment plan, and manage comorbid conditions.

In the control group, patients received usual care by the resident physicians and interns under supervision of the control arm physicians. Interns, residents, group physicians, and patients did not cross over between the study and control groups. In the control arm, standard medical practice also included access to a pharmacy clerk for answers to patient questions and to clarification and processing of orders for medication. In contrast to the intervention group, access to the pharmacy clerk in the control arm was initiated by the patient. Participants were not told whether they would be in the intervention or control groups.

Lipid and Lipoprotein Determination

Baseline blood specimens were collected at study inception, and the final specimens were collected 6 months after the study began in the study and control groups. Lipid profile blood specimens were drawn and collected in SST vacutainer tubes. All sampling was done after an overnight fast of at least 12 hours. Serum was separated in a centrifuge within 1 hour after being drawn and transferred to aliquot tubes for determination of total and high-density lipoprotein (HDL) cholesterol. Levels of HDL cholesterol were measured in the supernatant fractions after precipitation of very-low-density lipoprotein and LDL cholesterol with phosphotungstic acid and magnesium ions. Levels of LDL cholesterol were calculated from the following formula^{1,8}: $\text{LDL cholesterol} = (\text{Total cholesterol} - \text{HDL cholesterol}) - (\text{Triglycerides}/5)$.

Outcome Measures

The primary outcome of the study to assess intervention performance was based on the absolute change in total cholesterol concentration from the baseline enrollment value. As NCEP guidelines are based on calculated LDL cholesterol,¹ intervention performance was also assessed by observing whether NCEP goals were achieved depending on the number of risk factors that characterized a patient at study entry and by the presence or absence of coronary heart disease. Absolute changes in LDL cholesterol were not evaluated in this report because calculated LDL cholesterol for individuals with triglycerides exceeding 400 mg/dL (4.5 mmol/L) or with chylomicronemia or other forms of hyperlipoproteinemia may differ considerably from true LDL cholesterol.^{8,9}

Risk factors identified by the NCEP guidelines include age (≥ 45 years for men, ≥ 55 years for women, or premature menopause without estrogen replacement therapy), family history of premature coronary heart disease, smoking, hypertension, HDL cholesterol below 35 mg/dL (0.9 mmol/L), and diabetes mellitus.¹ The definition of prevalent coronary heart disease and diabetes at study enrollment was based on medical records, a physician diagnosis, or a reported history by a patient. Coronary heart disease was often confirmed by records of a hospital admission and discharge for acute myocardial infarction or a reported medical history of angina pectoris or coronary insufficiency confirmed by patient records. A diagnosis of diabetes was based on a reported medical history that was confirmed by patient records or the use of insulin or oral hypoglycemic therapy. Hypertension was defined in the presence of a systolic blood pressure of 160 mm Hg or higher or a diastolic blood pressure of 95 mm Hg or higher based on consecutive readings by an attending nurse using a standard sphygmomanometer. Subjects receiving medications for the treatment of high blood pressure were also considered to be hypertensive.

For patients without coronary heart disease and fewer than two risk factors, the NCEP goal is to achieve an LDL cholesterol level less than 160 mg/dL (4.1 mmol/L). For patients without coronary heart disease and with two or more risk factors, the goal is to achieve an LDL cholesterol level less than 130 mg/dL (3.4 mmol/L). For patients with coronary heart disease, the goal is to achieve an LDL cholesterol level less than 100 mg/dL (2.6 mmol/L).

Statistical Methods

Comparisons between the control and the intervention groups were based on two-sample Student's *t* tests for total cholesterol and continuous baseline characteristics.¹⁰ Analysis of the data using nonparametric methods had little effect on the reported findings.¹⁰ For total cholesterol, a log transformation was used to improve statistical estimation and inference. For categorical data, Fisher's Exact Test was used to determine if a categorical

response was more frequent in the control group than the intervention group.¹⁰ Fisher's Exact Test was also used to determine whether the frequency that a patient met a study objective to lower LDL cholesterol was associated with the intervention. To determine if baseline levels of total cholesterol could account for any of the observed group differences in a response due to intervention, analysis of covariance models were used.¹¹ All hypothesis testing was conducted at a two-sided level of significance.

RESULTS

There were 69 women and 25 men who completed the study with an average age of 57 ± 12 years. The youngest woman was 29 years old and the youngest man was 33. The oldest woman and man were 85 and 77 years, respectively.

Table 1 describes the baseline patient characteristics. None of the differences in the distribution of patient characteristics was statistically significant.

Table 2 describes the baseline health status of the patients that might be related to the study outcomes for the control and intervention groups. None of the entry measures of health status differed significantly between the intervention and control groups.

The pharmacist made 186 recommendations over the 6-month study period. There were 17 recommendations

Table 1. Patient Characteristics Within Control and Intervention Groups*

Patient Characteristic	Control (n = 47)	Intervention (n = 47)
Age in years, mean (SD)	58 (13)	57 (11)
Gender, n (%)		
Female	38 (81)	31 (66)
Male	9 (19)	16 (34)
Income per year, n (%)		
<\$5,000	17 (36)	25 (53)
\$5,000–\$15,000	21 (45)	19 (40)
>\$15,000	9 (19)	3 (6)
Alcohol user, n (%)		
No	42 (89)	36 (77)
Yes	5 (11)	11 (23)
Cigarette smoker, n (%)		
No	37 (79)	37 (79)
Yes	10 (21)	10 (21)
Level of education, n (%)		
<12 years	24 (51)	20 (43)
12 years	10 (21)	17 (36)
>12 years	13 (28)	10 (21)
Medical insurance, n (%)		
Government	33 (70)	29 (62)
None	6 (13)	12 (25)
Private	8 (17)	6 (13)

*There were no statistically significant differences between the control and intervention groups for any of the patient characteristics.

Table 2. Patient Baseline Health Status Related to Treatment Goals Within Control and Intervention Groups*

Patient Health Status	Control (n = 47)	Intervention (n = 47)
Total cholesterol, mg/dL (SD)	266 (25)	282 (51)
Total cholesterol, mmol/L (SD)	6.9 (0.6)	7.3 (1.3)
Number of concurrent medical conditions (SD)	1.9 (1.0)	2.1 (1.2)
Number of medications (SD)	2.6 (1.6)	3.1 (2.0)
Medication for hypercholesterolemia, n (%)		
No	19 (40)	19 (40)
Yes	28 (60)	28 (60)
Patient perception of own health, n (%)		
Excellent or good	20 (43)	17 (36)
Fair	20 (43)	21 (45)
Poor or very poor	7 (14)	9 (19)
Risk factors, n (%)		
<2 [†]	11 (23)	13 (28)
≥2 [†]	29 (62)	29 (62)
Coronary heart disease	7 (15)	5 (10)

*There were no statistically significant differences between the control and intervention groups for any of the patient health status characteristics.

[†]Without coronary heart disease.

for a change in dose, 59 for a change in medication, 95 for monitoring, and 15 for patient education by personnel other than the pharmacist or physician (e.g., a dietitian). Overall, physicians accepted 90% (167/186) of the pharmacist's recommendations. All recommendations with regard to patient education, as well as 94% of recommendations to alter dosing and 93% of recommendations for patient monitoring were accepted by the intervention group physicians. As a result of the pharmacist recommendations, there were 27 medications started in the intervention group: 12 of pravastatin, 7 of nicotinic acid, 2 of premarin, 2 of cholestyramine, 3 of aspirin, and 1 of lovastatin. Twenty-one medications were discontinued at the pharmacist's recommendation: 6 of lovastatin, 4 of cholestyramine, 4 of pravastatin, 3 of niacin, 1 of aspirin, 1 of premarin, 1 of gemfibrozil, and 1 of dyazide. There were 16 accepted recommendations for increases in medication dosages: 11 of niacin, 4 of pravastatin, and 1 of cholestyramine.

Physicians declined to accept 19% (11/59) of the pharmacist recommendations for a drug selection. The 11 refusals to accept a drug selection were nearly evenly divided between 2 of the 20 physicians who participated in the study. Of the refused recommendations, there were 3 to start premarin, 2 to start pravastatin, 1 to start nicotinic acid, 1 to start "a lipid-lowering agent" not further specified, 1 to increase lovastatin, 1 to discontinue a β blocker

and start a calcium channel blocker instead, 1 to discontinue gemfibrozil, and 1 to discontinue lovastatin.

The percentage of patients who achieved the goal of lowering LDL cholesterol to levels described by NCEP guidelines is shown in Figure 1. The success rate in the intervention group was double the rate in the control group (43% vs 21%, $p < .05$). Within the intervention group, patients for whom the physician declined the pharmacist's recommendations fared worse than those for whom recommendations were accepted. Only 2 (17%) of 12 patients for whom recommendations were declined met their NCEP goals, compared with 18 (51%) of 35 patients for whom recommendations were accepted ($p = .047$).

The effect of the intervention in terms of meeting NCEP goals tended to be greater in women than in men. Women in the intervention group were more than twice as likely as women in the control group to meet NCEP goals (39% vs 16%). Although the number of men enrolled in the study was small, NCEP goals were achieved by half of the men in the intervention arm and by 44% in the control arm.

In contrast to meeting NCEP goals, the effect of the intervention on reducing total cholesterol concentrations from study entry to closure were similar in men and women (see Fig. 2). For the intervention group, total cholesterol levels in men declined 57 ± 50 mg/dL (1.5 ± 1.3 mmol/L). In the control group, average levels of total cholesterol declined by 26 ± 28 mg/dL (0.7 ± 0.7 mmol/L). For women, the average decline in total cholesterol levels was 37 ± 45 mg/dL (1.0 ± 1.2 mmol/L) in the intervention group as compared with 9 ± 55 mg/dL (0.2 ± 1.4 mmol/L) in the control group ($p < .05$). Although there

FIGURE 1. Percentage of men and women who achieved the NCEP goal of lowering LDL cholesterol within intervention and control groups. For patients without coronary heart disease, the goal was to lower LDL cholesterol to under 160 mg/dL (4.1 mmol/L) in patients with fewer than two baseline risk factors and to under 130 mg/dL (3.4 mmol/L) in patients with two or more baseline risk factors. For patients with coronary heart disease, the goal was to lower LDL cholesterol to under 100 mg/dL (2.6 mmol/L).

FIGURE 2. Average reduction in total cholesterol for men and women in the intervention and control groups.

appeared to be a tendency for men to have a greater reduction in total cholesterol than women, the difference was not statistically significant ($p = .18$), even after adjustment for baseline levels of total cholesterol.

The effect of the study intervention was most apparent in patients with the least favorable risk factor profiles. For patients with coronary heart disease or with two or more risk factors, 38% (13/34) of those in the intervention arm reached an NCEP goal as compared with 14% (5/36) in the control arm ($p < .05$). For patients without coronary heart disease and fewer than two risk factors, 54% (7/13) reached an NCEP goal in the intervention arm and 45% (5/11) in the control arm. The latter difference was not statistically significant.

In terms of absolute reductions in total cholesterol concentrations, Figure 3 confirms that the intervention had its greatest effect on patients with coronary heart disease ($p < .01$), followed by those without coronary heart disease but with two or more risk factors ($p < .05$). There was no significant effect on subjects without coronary heart disease and with fewer than two risk factors. Among patients in the intervention arm (see Fig. 3), the average reduction in total cholesterol concentrations increased significantly as risk profiles became more adverse ($p < .01$). For patients in the control arm, reductions in total cholesterol levels were similar across risk factor strata.

Age was not a factor in affecting the performance of the intervention. Although among patients aged 65 and older, significantly more of those in the intervention arm met their NCEP goal (7/12) as compared with those in the control arm (4/15, $p < .05$), similar benefits were observed in younger patients in the intervention arm (15/37) versus the control arm (7/32). Although the latter difference in the younger patients was not statistically significant, younger patients in the intervention group were able to lower their total cholesterol levels by significantly greater amounts (45 ± 47 mg/dL [1.2 ± 1.2 mmol/L]) than those in the control group (16 ± 58 mg/dL [0.4 ± 1.5 mmol/L], $p < .05$).

FIGURE 3. Average reduction in total cholesterol for patients with and without coronary heart disease (CHD). For patients without CHD, average reductions are also reported by the number of baseline risk factors.

The last month's mean medication charge dropped \$11.40 per patient from the first month's in the intervention group. There was a \$3.82 increase in the control group. The difference in the changes in medication charges between the groups was not statistically significant.

In contrast, during the 6-month study period, there were 108 lipid profiles and 35 hepatic function panels ordered for the intervention group as compared with 67 lipid profiles and 9 hepatic function panels for the control group. There were no significant differences in the number of urinalyses, serum chemistry panels, complete blood counts, or blood glucose determinations. Frequencies of visits to the emergency department and referrals to a dietitian also did not differ significantly. Clinic visits were significantly more common in the intervention group (12 on average) than in the control group (9 on average, $p < .05$).

DISCUSSION

The physician and pharmacist team achieved NCEP goals with a success rate double that of a control arm reflecting a traditional primary care internal medical practice (43% vs 21%, $p < .05$). Total cholesterol levels in the intervention arm declined 44 ± 47 mg/dL (1.1 ± 1.2 mmol/L) versus 13 ± 51 mg/dL (0.3 ± 1.3 mmol/L) in the control arm ($p < .01$). The effect of intervention was most evident in patients with coronary heart disease ($p < .01$) followed by those without disease but with two or more coronary heart disease risk factors ($p < .05$). An effect of intervention was not observed in patients without coronary heart disease and with fewer than two risk factors.

Although the results in this report are limited to a single institution, the effectiveness of a pharmacist consultation is consistent with previous investigations in which one-to-one educational outreach by a pharmacist in improving physician prescribing habits has been

shown to be effective.⁷ Others have also demonstrated the superiority of a pharmacist interaction over other modes of intervention including computer-generated feedback to physicians.¹² In an observational study, Shaffer and Wexler previously reported on the development of a referral lipid clinic team led by a clinical nurse, which included a clinical pharmacist, a nurse practitioner, dietitian, and clinical psychologist.¹³ A consulting cardiologist reviewed all laboratory tests and therapeutic decisions at a weekly preclinic meeting. Patients in this clinic were four times more likely to reach the NCEP I goal of a cholesterol level less than 130 mg/dL compared with an age-matched sample that was drawn from other clinics using physician-based care. In another observational study, Furmaga developed a hyperlipidemia clinic in which a pharmacist provided primary care, ordered laboratory and diagnostic tests, and selected and monitored the use of lipid-lowering drugs according to the pharmacist's clinical judgment, without a set protocol.¹⁴ The effectiveness of this clinic in reducing cholesterol was not reported.

In contrast to the Furmaga and Shaffer observational studies, this report describes a controlled clinical trial, which integrated a clinical pharmacist into a general medical practice. The pharmacist's role was defined by the more current and more complex Second Adult Treatment Panel NCEP protocol, as opposed to the first NCEP recommendations used in the Shaffer study. Specifically, our pharmacist's role was to recommend screening, advise on when to start diet therapy and when to start pharmacologic therapy, and recommend a laboratory monitoring schedule. In addition, the pharmacist was responsible for keeping track of costs of drug regimens and determining the least costly regimen, answering patient questions, obtaining a drug history, and encouraging patient compliance.

In this trial, both positive and negative factors may have contributed to the findings that might prevent our study results from being applicable to other institutions. Intervention programs are bound to differ according to how aggressively they are implemented. With considerable emphasis on levels of personal interaction in the intervention arm, sustained positive rapport among physician, pharmacist, and patient is likely to be an important factor in achieving success in similar intervention strategies. Because the physician and pharmacist were aware of their roles in the current study, it is possible that they were more eager to cooperate and respect opposing opinions more often than would be the case in a general day-to-day setting. Continued medical training of the physician and pharmacist on the most current approaches to management of hypercholesterolemia is also important.

Another potential limitation of this study is that LDL cholesterol levels were calculated rather than measured for all patients, including those few with elevated triglycerides (> 400 mg/dL). Calculating LDL cholesterol levels for individuals with elevated triglycerides (> 400 mg/dL [4.5 mmol/L]) may have limited the capacity to evaluate the success of reaching NCEP goals.^{8,9} The influence of regression to the

mean may also be a factor,¹⁵ but presumably, its contribution was evenly distributed between the control and intervention arms through the randomization process.

Nevertheless, we conclude that attempts to lower total cholesterol levels and achieve NCEP goals appear more likely to be successful when combined with a program which incorporates teamwork between physicians and pharmacists. In this study, the physician and pharmacist team was able to lower total serum cholesterol concentrations among study participants by an average amount that was more than three times greater than the average amount that occurred with standard medical care (44 vs 13 mg/dL). Using estimates from the Lipid Research Clinics Coronary Primary Prevention Trial for individuals with serum cholesterol levels above 265 mg/dL, this reduction in total cholesterol levels would correspond to a greater than 24% relative risk reduction in definite coronary heart disease deaths and a 19% relative risk reduction in nonfatal myocardial infarction annually.¹⁶

This study has also shown that efforts to achieve the NCEP goals of reaching optimal LDL cholesterol levels in the presence of hypercholesterolemia were accomplished more successfully by introducing a team approach of physicians and pharmacists in an ambulatory primary care setting. The findings suggest, however, that such interventions might be more successful in high-risk groups in whom the consequence of an adverse risk profile is easier to recognize. Heightened awareness and an urgent need to act in the high-risk patient may have an important impact on the success of an intervention. This is in spite of the fact that the NCEP goals are harder to achieve for individuals at the highest risk of a new or recurrent coronary event.¹

It is uncertain whether the patient who falls in the lower risk strata, the physician, or the pharmacist views the need for vigorous management of elevated cholesterol as less important than for higher-risk patients. Although higher-risk patients are more likely to develop new or recurrent events, the NCEP guidelines take this into account by establishing different goals according to risk factor status. The goals are designed to be easier to achieve for low-risk patients. Once a goal has been identified, however, the NCEP guidelines do not imply that it should be pursued less vigorously for one risk stratum versus another. It seems important that the development of programs to improve lipid profiles for low-risk patients with elevated total cholesterol levels should not be neglected. Attention to low-risk patients can have an important impact on health care resources as the number of patients in the low-risk strata is sizable.

Finally, although the benefits of increased teamwork between physicians and pharmacists seem promising in improving patient management of hypercholesterolemia, implementation of such intervention programs in a general clinic setting is not without cost. The cost of directing physician and pharmacist time away from other activities to more concerted efforts of interaction must be balanced

with the utilization of medication, laboratory, emergency department, and hospital services. Overall, it is difficult to quantify the cost of new programs that formally structure pharmacist consultation in the management of patients with hypercholesterolemia. Each institution needs to consider the cost of implementing such programs, as well as the degree of aggressiveness with which they are applied.

REFERENCES

1. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Summary of the Second Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel II). *JAMA*. 1993;269:3015-23.
2. Sempas CT, Cleeman JI, Carroll MD. Prevalence of high blood cholesterol among U.S. adults. *JAMA*. 1993;269:3009-14.
3. LaRosa JC, Hunningshake D, Bush D, et al. The cholesterol facts: a summary of the evidence relating dietary fats, serum cholesterol, and coronary heart disease: a joint statement by the American Heart Association and the National Heart, Lung, and Blood Institute. *Circulation*. 1990;81:1721-33.
4. Levine GN, Keaney JF Jr, Vita JA. Cholesterol reduction in cardiovascular disease. *N Engl J Med*. 1995;332:512-21.
5. Koseoff J, Kanouse DE, Rogers WH, et al. Effects of the NIH Consensus Development Program on physician practice. *JAMA*. 1987;258:2708-13.
6. Lomas J, Anderson GM, Domnick-Pierre K, et al. Do practice guidelines guide practice? The effect of a consensus statement on the practice of physicians. *N Engl J Med*. 1989;321:1306-11.
7. Avorn J, Soumerai SB. Improving drug therapy decisions through educational outreach: a randomized controlled trial of academically based "detailing." *N Engl J Med*. 1983;308:1457-63.
8. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma without use of the preparative ultracentrifuge. *Clin Chem*. 1972;18:499-502.
9. Wilson PW, Abbott RD, Garrison RJ, Castelli WP. Estimation of very-low-density lipoprotein cholesterol from data on triglyceride concentration in plasma. *Clin Chem*. 1981;27:2008-10.
10. Rosner B. *Fundamentals of Biostatistics*. Boston, Mass: PWS Kent Publishing Co; 1993.
11. Netter J, Wasserman W. *Applied Linear Statistical Models*. Homewood, Ill: Richard D. Irwin, Inc; 1974.
12. Steele MA, Bess DT, Franse VA, et al. Cost effectiveness of two interventions for reducing outpatient prescribing costs: DICP. *Ann Pharmacother*. 1989;23:497-500.
13. Shaffer J, Wexler LF. Reducing low-density lipoprotein cholesterol levels in an ambulatory care system. *Arch Intern Med*. 1995;155:2330-5.
14. Furmaga EM. Pharmacist management of a hyperlipidemia clinic. *Am J Hosp Pharm*. 1993;50:91-5.
15. Forrow L, Calkins DR, Allshouse K, Horowitz G, Delbanco TL. Evaluating cholesterol screening: the importance of controlling for regression to the mean. *Arch Intern Med*. 1995;155:2177-84.
16. Lipid Research Clinics Program. The Lipid Research Clinics Coronary Primary Prevention Trial Results. *JAMA*. 1984;251:365-74.

JOURNAL OF GENERAL INTERNAL MEDICINE SUBSCRIBERS

Do we have your new address?

Send us your new address three months before it becomes effective, so we will have time to get it into our computer system and ensure that your copies of JGIM continue to arrive uninterrupted. Send your old mailing label, your new address with zip code, the effective date of your new address, and your current telephone number.

Nonmember subscribers notify:

Tina Lynch
Blackwell Science, Inc.
Commerce Place, 350 Main St.
Malden, MA 02148

SGIM members notify:

Elnora Rhodes
Society of General Internal Medicine
700 13th Street, NW, Suite 250
Washington, DC 20005