CASE REPORT

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The Impact of Automatic Prescriptions on Reducing Low-Density Lipoprotein Cholesterol Levels

CONTEXT. Compliance with the National Cholesterol Education Program (NCEP) guidelines for secondary prevention of atherosclerotic disease has been poor.

OBJECTIVE. To determine whether an automatic prescription would improve compliance with NCEP guidelines on low-density lipoprotein (LDL) cholesterol for secondary prevention of atherosclerotic disease.

DESIGN. Observational study in which physicians chose whether to use an automatic prescription system.

PATIENTS. 126 patients with established coronary or cerebrovascular disease whose LDL cholesterol level was greater than 100 mg/dL.

INTERVENTION. By signing the automatic prescription, physicians allowed the study team (medical director and pharmacist) to change lipid-lowering medications. One member of the team then contacted the patient, advising him or her of any changes to medications and treatment. The patient was told that his or her doctor was recommending this change on the basis of recent laboratory tests.

OUTCOME MEASURES. The proportion of patients reaching the LDL cholesterol goal of 100 mg/dL or less.

RESULTS. Physicians used the automatic prescription for 25 patients. Eighteen of the 25 patients in the intervention group (72.0%) achieved the LDL cholesterol goal compared with only 43 of the 101 controls (42.6%) ($P = 0.004$). After adjustment for differences in age, sex, triglyceride levels, total cholesterol levels, high-density lipoprotein cholesterol levels, and preintervention LDL cholesterol levels, the likelihood of achieving the LDL cholesterol goal was 1.74 times higher in the automatic prescription group than in the control group ($P = 0.025$).

CONCLUSION. An automatic prescription can help physicians comply with the NCEP guidelines.

Recent studies suggest that for most patients with atherosclerotic disease, physician management of cholesterol levels is suboptimal.[1] The National Cholesterol Education Program (NCEP) low-density lipoprotein (LDL) cholesterol goal of 100 mg/dL or less represents a more aggressive approach to prevention than has been recommended in previous guidelines. Most patients require a combination of lifestyle changes and medication to reach this goal.[2] However, evidence suggests that fewer than 20% to 30% of patients with atherosclerotic disease are receiving cholesterol-lowering therapy and that only 14% of patients have achieved the recommended goal.[3]

The issue of suboptimal management of cholesterol levels in patients with atherosclerotic disease is significant, considering that clinical trials have demonstrated

See related editorial on pages 247–249.

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that appropriate management can decrease morbidity and mortality rates by 30% to 50%.[4,5] With this in mind, we set out to improve compliance with the recommended cholesterol benchmarks for secondary prevention and to improve appropriate drug use for cholesterol reduction therapy in patients in a large medical group.

The central innovation was an automatic prescription in which the physician could adhere to the recommendations suggested for the prescription simply by signing his or her name or could refuse the recommendation. We hoped that even physicians who refused the recommendation would be reminded of their patient's suboptimal LDL cholesterol level and would be encouraged to take appropriate action.

Methods

Setting

Bristol Park Medical Group consists of 101 primary care physicians and 14 physician assistants in Orange County, California. The group uses five hospitals in the Orange County area and serves approximately 180,000 patients (approximately 146,000 of whom are in managed care). Ninety percent of the group's revenue is derived from managed care, and approximately 70% of this is full-risk capitation.

Bristol Park has had an active disease management department for more than 5 years. In addition to physicians and physician assistants, the group also employs a full-time pharmacist, seven full-time educators, a nurse practitioner dedicated to disease management, and a registered nurse whose title is director of disease management.

Patient Selection

Patients for this study were identified by searching our billing system for International Classification of Diseases, Ninth Revision, codes 410–414 and 428–440. These are the diagnoses associated with a primary diagnosis of some type of atherosclerotic vascular disease. A chart audit was performed for all patients with these codes. **Figure 1** depicts our study design.

At initial assessment, the total number of patients with known atherosclerotic vascular disease was 447. Of these patients, only 300 were available throughout the study period. The other 147 patients did not complete the study because they died, relocated out of the area, or left our medical group. Of the 300 patients available, 135 were missing data on either the preintervention or postintervention LDL cholesterol levels. For the remaining 165 patients, LDL cholesterol was tested during both defined study periods (the preintervention period was September to December 1998, and the postintervention period was June to September 1999); 39 of these patients were already at the LDL cholesterol goal of 100 mg/dL or less. Therefore, 126 patients were not initially at the NCEP target and served as the study sample.

Disease Management Strategies

Decision Aids

We developed a cholesterol management algorithm and educational materials for both providers and patients. Among the tools created for this project was a two-sided cholesterol pocket slide-ruler based on NCEP guidelines. To facilitate physician work rather than make it more cumbersome, the tool was created with direct input from practicing physicians. This pocket slide-ruler gives providers instant access to risk factors, drug initiation levels, different goal levels, and percentage of LDL cholesterol reduction needed to reach the goal and to determine appropriate medication and dosing.

The Automatic Prescription

Figure 2 depicts our core strategy—the automatic prescription. Our group pharmacist developed this tool to inform the provider of a patient's need for more aggressive therapy and to facilitate medication changes.

The prescription tool is divided into two sections by a perforated line. The upper segment is simply a standard prescription blank. The lower part includes patient-specific information, drug and dosage recommendations, and project rationale and goals. It contains Health Plan Employer Data and Information Set and NCEP goals, the project's rationale, current cholesterol medication, risk factors, amount of LDL cholesterol reduction required to reach the goal of 100 mg/dL or less, the oldest and latest lipid panels, and a new drug or dose recommendation. Dosing recommendations were based on the patient's most current lipid panel. If a current lipid panel was not available, a recommendation would be made to obtain a lipid panel to determine whether the patient was at the LDL cholesterol goal. Medication status was assessed to ensure that patients were not prescribed a medication that they had taken previously. A physician-option section allowed physicians to choose how they wished to proceed.

The study team completed the automatic prescription tool for all 126 patients and sent them to the patient's primary care provider. The providers could take various actions on the basis of the tool. First, they could ignore it. Second, they could use the information and change the medication themselves. Third, they could sign the prescription section of the tool, activating the automatic prescription and allowing the study team to make the recommended changes.

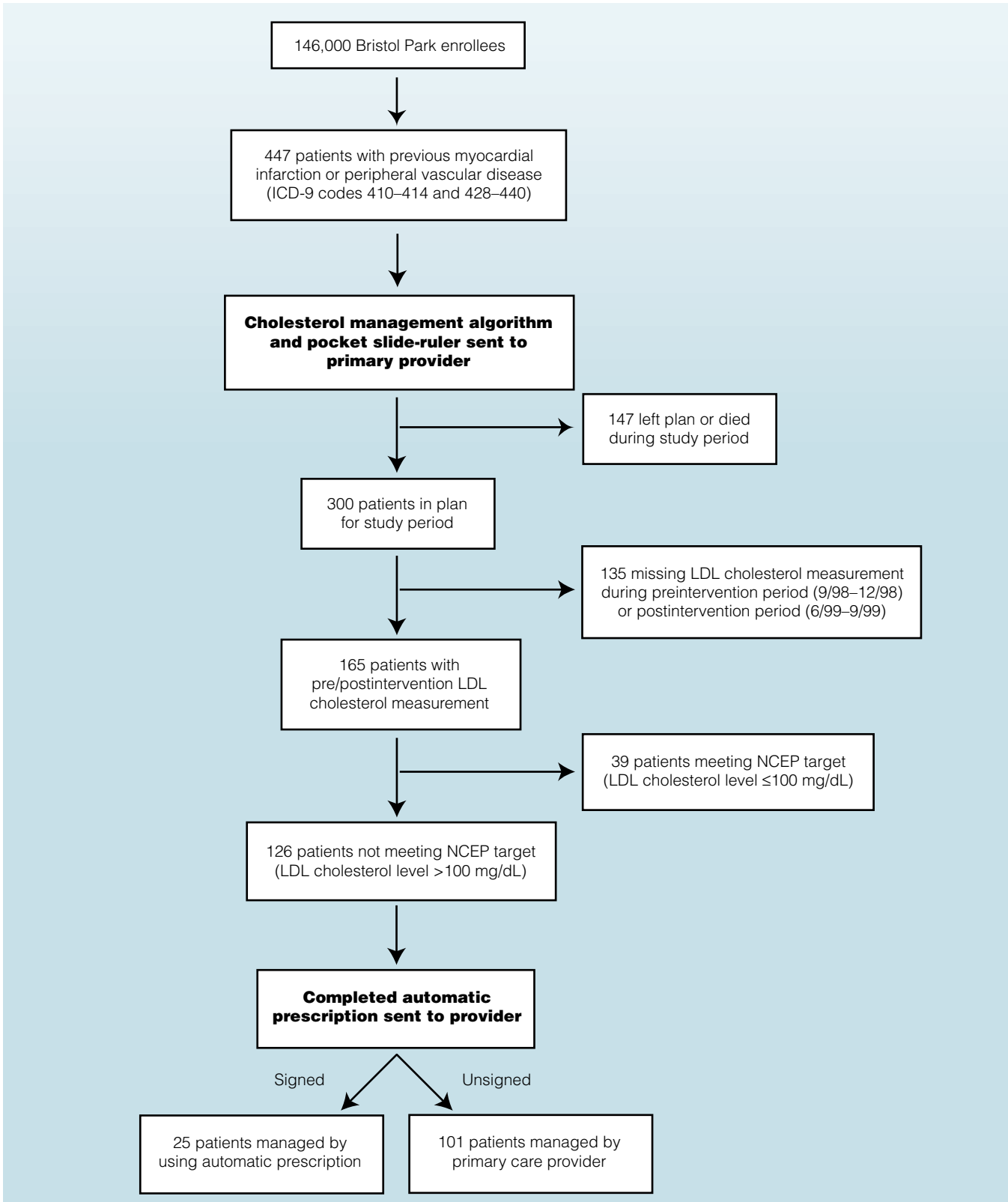

FIGURE 1. Study design. ICD-9 = International Classification of Diseases, Ninth Revision; LDL = low-density lipoprotein; NCEP = National Cholesterol Education Program.

Physicians permitted use of the automatic prescription for 25 patients. One member of the study team then contacted each patient, advising him or her of any changes to medications and treatment. The patients were told that their doctor was recommending this change on the basis of their recent laboratory tests. New

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Rx Pt. Name _____ Date _____ Name/Number _____

Address _____ Phone# _____

M.D. Signature _____ **Refill** _____

DEA# _____

Dear Dr. _____

The 1999 HEDIS measures regarding cholesterol management after acute cardiovascular event have been established. Bristol Park's goal is to follow HEDIS and NCEP guidelines, which are as follows:

Goal: To assess two components of cholesterol management after an acute cardiovascular event.
1) The percentage of members who have low-density lipoprotein (LDL) screening; and
2) The percentage of members who have a documented LDL level <100 mg/dl.

Rationale: In August, we conducted chart reviews with secondary prevention patient. We found a significant gap with these patients in meeting the above two components.

After a DUR of _____ **MR#** _____ **Insurance** _____
who is currently on _____ **since** _____
This patient has risk factors of _____
& needs a reduction of ____% to reach the threshold of an LDL less than 100 mg/dl to reach NCEP guidelines.

We are requesting your approval to switch patient's current med so the patient can reach NCEP goal as well as to help control cost.

SUGGEST

Based on patient's baseline Trig of _____ Tchol of _____ HDL of _____ LDL of _____ on _____
Based on patient's latest Trig of _____ Tchol of _____ HDL of _____ LDL of _____ on _____
Lescol _____ for a total reduction of _____ %
Lipitor _____ for a total reduction of _____ %
_____ for a total reduction of _____ %

Please mark the appropriate box:

❒ Okay for pharmacy department to make switch.
❒ I prefer to make the switch myself.
❒ Patient is deceased.
❒ This is not my patient.

Signature _____ Date _____

We will consider no response as a consent to change.

FIGURE 2. The automatic prescription tool. DUR = drug use review; HDL = high-density lipoprotein; HEDIS = Health Plan Employer Data and Information Set; LDL = low-density lipoprotein; MR = medical record; NCEP = National Cholesterol Education Program; Tchol = total cholesterol; trig = triglyceride.

prescriptions were called in to the patient's pharmacy. If a study member contacted the patient, the patient's primary care provider received a report detailing the patient's status and guidelines for appropriate follow-up with the patient. If needed, the clinical pharmacist would also call the health plan for prior authorization to facilitate the approval of a nonformulary medication.

The remaining 101 patients were managed by the primary care provider and served as the control group for this study. Although the automatic prescription was not activated, physicians may still have used the information contained in the automatic prescription tool.

Statistical Analysis

We used the exact binomial test[6] to compare the proportion of patients in the two groups who achieved their NCEP goal value for LDL cholesterol after the intervention. To adjust for the potential impact of demographic and biological variables on goal achievement, we used a logistic regression model[7] to compute the adjusted odds of goal achievement for the study group compared with the control group. We converted the odds ratio obtained from the logistic regression model to the more intuitive "success ratio" using the formula provided by Zhang and Yu.[8] The success ratio is defined as the proportion of study group patients achieving the NCEP goal divided by the proportion of control group patients achieving this goal. We also used the Student paired *t*-test for comparing preintervention and postintervention LDL cholesterol values for both study groups, and we used the two-sample independent *t*-test for comparing the percentage change in LDL cholesterol values between the study group and the control group after intervention.

Results

Table 1 shows the characteristics of the two study groups and of the patients excluded from the study. Not surprisingly, patients who left the plan or died during the study period tended to be older. The two study groups were similar in age, while patients in the automatic perscription were more likely to be male. Although the mean total cholesterol was higher for automatic perscription patients, mean preintervention LDL cholesterol levels did not significantly differ between groups.

Table 2 shows our primary outcomes. After the intervention, 72% (n = 18) of patients in the automatic prescription group achieved the NCEP goal, whereas only 42.6% (n = 43) of patients in the control group did ($P < 0.01$). Adjustment for differences in age, sex, triglyceride levels, total cholesterol levels, high-density lipoprotein (HDL) cholesterol levels, and preintervention LDL cholesterol levels by using logistic regression demonstrated that patients in the automatic prescription group were 1.74 times more likely to achieve the NCEP goal than patients in the control group (95% CI, 1.10 to 2.12). **Table 2** also shows that the mean LDL

TABLE 1
Characteristics of the Study Groups and Patients Excluded from the Study*

CHARACTERISTIC	PRIMARY COMPARISON		*P* VALUE†	EXCLUDED PATIENTS	
	AUTOMATIC PRESCRIPTION GROUP (n = 25)	CONTROL GROUP (n = 101)		LEFT PLAN OR DIED (n = 147)	MISSING PRE- AND POSTINTERVENTION LDL (n = 135)
Mean age, *yr*	61.4	63.7	> 0.2	69.7	65.9
Men	96%	79%	0.05	66%	60%
Mean total cholesterol level, *mg/dL*	193	206	0.01	208	201
Mean preintervention LDL cholesterol level, *mg/dL*	129	132	> 0.2	125‡	116§

*LDL = low-density lipoprotein.
†For differences between the two primary comparison groups.
‡Available for 87 patients.
§Available for 70 patients.

TABLE 2
Primary Outcomes*

OUTCOMES	AUTOMATIC PRESCRIPTION GROUP (*n* = 25)	CONTROL GROUP (*n* = 101)
Achieving NCEP goal		
Proportion of patients with LDL cholesterol level ≤100 mg/dL	72%	42.6%
Between-group difference	Absolute increase in patients treated with automatic prescription, 29.4 percentage points (95% CI, 7.5–51 percentage points)	
Change in LDL cholesterol level		
Mean preintervention LDL cholesterol level, *mg/dL*	129	132
Mean postintervention LDL cholesterol level, *mg/dL*	95	111
Mean decline within group	34 (CI, 25–42)	21 (CI, 15–26)
Between-group difference	13 mg/dL greater decline in patients treated with automatic prescription (CI, 1–25 mg/dL)	

**LDL = low-density lipoprotein; NCEP = National Cholesterol Education Program.*

cholesterol level decreased significantly in both the automatic prescription and the control groups, perhaps reflecting the educational value of the completed but not activated automatic prescription. On average, however, the additional reduction in LDL cholesterol level among patients in the automatic prescription group was 13 mg/dL.

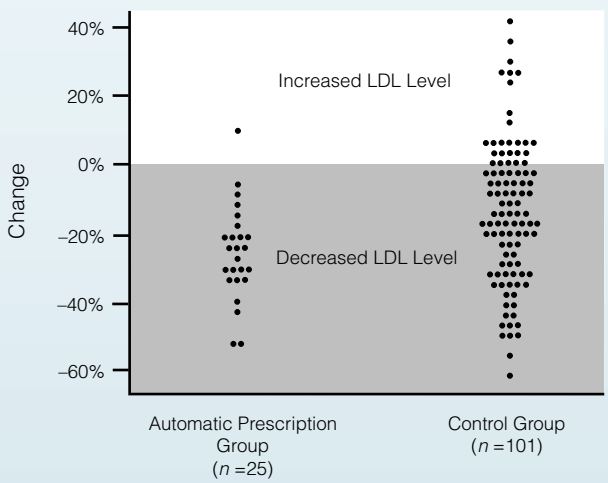

FIGURE 3. Percentage change in low-density lipoprotein (*LDL*) cholesterol level.

Figure 3 shows the distribution of percentage change in LDL cholesterol values in the two groups. The level of LDL cholesterol increased in only one patient in the automatic prescription group. In contrast, 21 patients in the control group had increased LDL cholesterol values after the intervention.

Discussion

Hyperlipidemia is the major modifiable risk factor for chronic heart disease in all age groups. Unfortunately, studies reveal that only about 30% of patients with established coronary heart disease and hypercholesterolemia received preventive therapy, and half of those discontinued treatment within 6 months. Another national study found only 14% adherence in patients reaching the NCEP goal for secondary prevention. Providers' hesitancy to use lipid-lowering medications, despite their well-known efficacy, is still a major barrier.

We provide some evidence that an automatic prescription can be used successfully to improve secondary prevention of atherosclerotic cardiovascular disease. However, the conclusion stated previously assumes that the patients who received this intervention are a random sample of the underlying population of patients with atherosclerotic cardiovascular disease: that is, that no selection bias exists. This study did not randomly assign patients to receive the intervention; thus, the results may be biased because of unknown differences

between patients who received the intervention and those who did not. Analysis shows that age, triglyceride levels, HDL cholesterol levels, and preintervention LDL cholesterol levels did not significantly differ between groups (the groups did differ from each other with respect to the number of men and women and total cholesterol values). Furthermore, because the adjusted success ratio of 1.74 is close to its unadjusted value of 1.69, no statistical evidence indicates that these variables are confounding the association between the study outcome and the study intervention. However, these patient groups may differ from each other with respect to unknown biological factors that affected postintervention LDL cholesterol values. In addition, many patients dropped out of the study, and for others no data on outcome measures were available; thus, the possibility that selection bias affected the study's results is increased.

Other limitations inherent to this design include the possibility of bias due to maturation (temporal trend) and statistical regression (regression to the mean). Statistical regression would be implausible if the pretest–posttest correlations on the outcome measure were close to 1.0: The magnitude of statistical regression depends on the reliability of the measures, and unreliable measures have lower pretest–posttest correlations.[9] We cannot rule out *differential* statistical regression as a contributing cause in this study because the Pearson correlation coefficient between the pretest–posttest LDL cholesterol values at 6 months was 0.478 ($P < 0.005$) in the control group and 0.078 ($P > 0.2$) in the automatic prescription group. As for maturation, a long series of pretest observations would obviously permit testing the threat sensitively, but by virtue of the study design such a strategy is not available.

Even with these caveats in mind, we believe that this study highlights an important and novel intervention to improve physician practice and patient care. Although we were permitted to activate the automatic prescription in only 25 patients, the results in this group were dramatic. We hope that with the success of the program and familiarity, it will become more widely used. Results from this study should be treated as preliminary and provide the stimulus for replication by a larger quasi-experimental study or a randomized, controlled study.

Take-Home Points

- **Adherence to the NCEP guidelines for LDL cholesterol in secondary prevention of atherosclerotic disease is needed.**
- **An automatic prescription was developed to inform a physician of a patient's need for more aggressive therapy. By signing the automatic prescription, the physician authorized the study team to make medication changes.**
- **72% of patients managed by automatic prescription met the NCEP goal of LDL cholesterol level of 100 mg/dL or less, compared with 42.6% of controls.**
- **Because the decision to use the automatic prescription was left to the physician, the differences observed may reflect differences in practice styles among physicians. A randomized trial is needed to ensure the validity of the results.**

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