Impact of a Multifaceted Intervention on Cholesterol Management in Primary Care Practices

Guideline Adherence for Heart Health Randomized Trial

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Background: Physician adherence to National Cholesterol Education Program clinical practice guidelines has been poor.

Methods: We recruited 68 primary care family and internal medicine practices; 66 were randomly allocated to a study arm; 5 practices withdrew, resulting in 29 receiving the Third Adult Treatment Panel (ATP III) intervention and 32 receiving an alternative intervention focused on the Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7). The ATP III providers received a personal digital assistant providing the Framingham risk scores and ATP III–recommended treatment. All practices received copies of each clinical practice guideline, an introductory lecture, 1 performance feedback report, and 4 visits for intervention-specific academic detailing. Data were abstracted at 61 practices from random samples of medical records of patients treated from June 1, 2001, through May 31, 2003 (baseline), and from May 1, 2004, through April 30, 2006 (follow-up). The proportion screened with subsequent management (primary outcome) was calculated. Generalized estimating equations were used to compare results by arm, accounting for clustering of patients within practices.

Results: We examined 5057 baseline and 3821 follow-up medical records. The screening rate for lipid level management decreased significantly (41.9% to 29.7%) in intervention practices and more markedly (79.7% to 68.9%) in control practices. The net change in appropriate management favored the intervention (+9.7%; 95% confidence interval [CI], 2.8%-16.6% [P < .01]). Appropriate management of lipid levels decreased slightly (73.4% to 72.3%) in ATP III practices and more markedly (79.7% to 68.9%) in control practices. The net change in appropriate management favored the intervention (+9.7%; 95% confidence interval [CI], 2.8%-16.6% [P < .01]). Appropriate drug prescription within 4 months decreased in both arms (38.8% to 24.8% in ATP III practices and 45.3% to 24.1% in control practices; net change, +7.2% [P = .37]). Overtreatment declined from 6.6% to 3.9% in ATP III and rose from 4.2% to 6.4% in control practices (net change, −4.9% [P = .01]).

Conclusions: A multifactor intervention including personal digital assistant–based decision support may improve primary care physician adherence to the ATP III guidelines.

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Lowering high blood cholesterol levels is effective in reducing the risk of cardiovascular disease (CVD), leading cause of death in the United States.1,2 The National Cholesterol Education Program Adult Treatment Panel (ATP) guidelines have been disseminated to promote the appropriate management of dyslipidemia; the ATP III guidelines were released in 2001.3 Use of the previous ATP guidelines was suboptimal because many eligible patients were not prescribed therapy to lower lipid levels (LLT).4,7 There is ample evidence that physician adherence to many clinical practice guidelines (CPGs) has been poor.8 Simple CPG dissemination alone is typically ineffective in changing medical practice; rather, multifaceted interventions targeting different barriers to change are likely to be necessary.9 One strategy to bolster CPG adherence is academic detailing (AD), in which experts and/or opinion leaders visit clinicians to discuss medical topics; AD studies have documented improvements in care.10-12 We considered the ATP III recommendation that the 10-year risk of coronary heart disease (CHD) be estimated via the Framingham risk score (FRS) and used to determine optimal cholesterol level management to be a potentially important barrier to physician adherence. A computerized decision support system (CDSS) that calculates the FRS and delivers recommendations was deve-
Figure 1. Computerized decision support tool screen views from the Guideline Adherence for Heart Health Trial. ATP III indicates Third Adult Treatment Panel; CHD, coronary heart disease; dz, disease; Rx, prescription; TC, total cholesterol level; and TG, triglyceride level.

Statistical analysis of CDSS usage was performed using the chi-square test for comparing the number of times the CDSS program was used, and this information was collected using an adaptor. A tracking program on each device recorded the number of times the CDSS program was used; this information was collected at AD visits to practices every 6 months. The 4 AD sessions were open to the providers and the clinic staff and were designed to reinforce ATP III or JNC-7 content (depending on the provider's practice's intervention assignment). Each visit was conducted by a GLAD HEART physician-investigator and a study staff member. The second AD visit provided practice-specific feedback regarding their screening rate for lipid levels and appropriate management of lipid level test results.

The intervention was not blinded; practices received an intervention focused on the ATP III guidelines or an alternative intervention focused on the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7). Randomization was stratified by practice type and size and blocked (block size 8). Providers in both arms participated in CPG dissemination activities, which included distribution of paper copies of the ATP III and JNC-7 guidelines, an initial didactic session focused on both CPGs for which physicians could obtain continuing medical education (CME) credits, and 1-hour intervention-specific AD visits to practices every 6 months. The 4 AD sessions were open to the providers and the clinic staff and were designed to reinforce ATP III or JNC-7 content (depending on the provider's practice's intervention assignment). Each visit was conducted by a GLAD HEART physician-investigator and a study staff member. The second AD visit provided practice-specific feedback regarding their screening rate for lipid levels and appropriate management of lipid levels using data from the baseline medical record abstraction.

We furnished providers in the ATP III practices with a PDA programmed with a CDSS based on the National Heart, Lung and Blood Institute program but modified to include information about LLT dosing, management of triglyceride levels, and a report-printing function (Figure 1). A 1-page report that summarized the patient-specific data that had been entered, the patient-specific ATP III goals for low-density lipoprotein cholesterol (LDL-C) levels, and treatment recommendations could be printed via the PDA infrared port to a compatible printer. Practices that did not have such a printer were provided with an adapter. A tracking program on each device recorded the number of times the CDSS program was used; this information was collected at AD visits to identify infrequent users, who were then encouraged to increase their use. Treatment of High Blood Pressure (JNC-7). Randomization was stratified by practice type and size and block (block size, 8). Providers in both arms participated in CPG dissemination activities, which included distribution of paper copies of the ATP III and JNC-7 guidelines, an initial didactic session focused on both CPGs for which physicians could obtain continuing medical education (CME) credits, and 1-hour intervention-specific AD visits to practices every 6 months. The 4 AD sessions were open to the providers and the clinic staff and were designed to reinforce ATP III or JNC-7 content (depending on their practice's intervention assignment). Each visit was conducted by a GLAD HEART physician-investigator and a study staff member. The second AD visit provided practice-specific feedback regarding their screening rate for lipid levels and appropriate management of lipid levels using data from the baseline medical record abstraction.

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in 2004, which made more persons, especially high-risk patients, eligible for drug treatment and advocated a goal of less than 70 mg/dL for LDL-C levels in a subset of high-risk patients (to convert cholesterol levels to millimoles per liter, multiply by 0.0259). The modified CDSS was distributed to all ATP III providers. The JNC-7 practices received automatic blood pressure measurement devices (HEM9070; Omron Healthcare, Bannockburn, Illinois) at the rate of 1 for every 3 practice providers for use in their clinic.

DATA COLLECTION

We have previously published details regarding data collection, which entailed medical record abstraction at each practice at baseline and follow-up. Briefly, from December 1, 2003, through October 31, 2004 (baseline), and again from December 1, 2006, through September 30, 2007 (follow-up), nurse abstractors from the Carolinas Center for Medical Excellence used a standardized data collection tool and visited practices for medical record abstraction. Abstractors were not informed regarding the practice's intervention arm; they were aware that ATP III and JNC-7 guidance adhered to being assessed. The baseline 2-year data collection window (June 1, 2001, through May 31, 2003) was after publication of the ATP III guidelines but before any research contact with practices. Eligible patients included adults aged 21 to 84 years who visited the practices during the baseline period because the ATP III guidelines recommend screening for all adults 20 years or older every 5 years. The medical record abstraction period extended to September 30, 2003, to allow for follow-up and management decisions to be documented for the patients screened at the end of the window. During the follow-up data abstraction window (May 1, 2004, through April 30, 2006), we used the same eligibility criteria; similarly, the follow-up period extended to August 31, 2006.

We a priori expected the following 3 categories of patients: (1) those receiving LLT before the data abstraction window (for whom testing of lipid levels was to monitor therapy rather than to screen, and no further data abstraction was performed); (2) those not receiving prior LLT and without lipid data during the data collection period; and (3) those not receiving therapy before the window, with testing of lipid levels during the abstraction period (ie, those screened). Data elements collected for categories 2 and 3 included demographics (age, sex, and race/ethnicity) and major comorbidities (CVD and diabetes mellitus). For patients screened, additional variables abstracted included the initial lipid profile values, stroke, peripheral vascular disease, risk factors (ie, smoking, blood pressure, hypertension, prescription of antihypertensive medicine, and family history of heart disease), date of the follow-up lipid profile and lipid values (if measured), and date of prescription of LLT. In addition, documentation of the provider giving advice regarding therapeutic lifestyle changes was recorded. For race/ethnicity and sex, abstractors could record “unknown”; for all other data elements, lack of documentation was recorded as not present (comorbidities), not performed (measurement of lipid levels and blood pressure), or not prescribed (medications). We planned to select independent samples of 140 patient medical records were prepared to reach those practices abstraction goals. Selected records were reabstracted for intraobserver and interobserver reliability, which were 95.2% and 89.9%, respectively, at baseline and 93.0% and 88.2%, respectively, at follow-up.

DEFINITIONS

The ATP III guidelines recommend that all adults undergo screening of lipid levels once every 5 years; for certain high-risk persons (eg, those with diabetes mellitus or known CVD), annual screening is appropriate. We therefore considered all patients not already receiving LLT as eligible to be screened. In low-risk groups, approximately 40% should be screened in a 2-year period. We considered a person to have been screened if (1) they did not previously receive LLT and (2) a lipid profile (including measurement of total cholesterol, triglyceride, high-density lipoprotein cholesterol, and LDL-C levels) report (with values) was obtained during the data collection window and recorded in the medical record. The screening rate consists of the number of patients screened divided by the total number of patients sampled who were eligible for screening. All screened persons were categorized into ATP risk categories on the basis of documented history and, if required, the 10-year risk of CHD calculated using the FRS. Patients were assigned to 1 of the following 4 ATP III risk categories: (1) low risk (defined as 0-1 risk factor for CHD), (2) intermediate low risk (<2 risk factors and a 10-year risk of <10%), (3) intermediate high risk (≥2 risk factors and a 10-year risk of 10%-20%), and (4) high risk (CHD risk equivalent [diabetes, CHD, stroke, or peripheral vascular disease] and/or ≥2 risk factors with a 10-year risk of >20%). At baseline, patients were classified as having dyslipidemia if their LDL-C level exceeded the risk group–specific goal recommended in the ATP III guidelines (160, 130, 130, or 100 mg/dL, respectively). Patients were considered eligible for consideration of drug therapy if their LDL-C level exceeded the therapy-initiation thresholds specific to their risk category (190, 160, 130, or 130 mg/dL, respectively). We considered statins, fibrates, cholesterol absorption inhibitors, niacin, and bile acid sequestrants to be acceptable LLT. At follow-up, we used the modified recommendations, which made drug therapy optional for intermediate high-risk patients with LDL-C levels from 100 to 130 mg/dL, lowered the treatment threshold from 130 to 100 mg/dL for high-risk patients, and made drug therapy optional for high-risk patients with LDL-C levels of greater than 70 mg/dL. Patients were classified as being treated appropriately with respect to their LDL-C level if any of the following criteria were met:

1. The LDL-C level was below the risk stratum–specific LDL-C level goal, and drug therapy was not initiated during the 4 months after initial testing.

2. The LDL-C level was greater than the risk stratum–specific drug therapy initiation cutoff point, and drug therapy was prescribed within 120 days.

3. The LDL-C level was greater than the drug therapy initiation cutoff point, results of a follow-up lipid profile confirmed this finding within 120 days, and, only if the lipid profile was remeasured, drug therapy was prescribed within 150 days of the original lipid profile.

4. The LDL-C level was greater than the drug treatment initiation threshold, was documented during the 120 days after initial testing to have decreased below the LDL-C goal, and drug therapy was not initiated.

5. The LDL-C level was greater than the drug treatment initiation threshold, was documented during the 120 days after initial testing to have decreased below the drug therapy-
initiation point (but still above the goal), drug therapy was not initiated, and advice regarding therapeutic lifestyle changes was documented.  

6. The LDL-C level was greater than the LDL-C goal but below the risk stratum–specific drug treatment initiation threshold, and advice regarding therapeutic lifestyle changes was documented.  

7. The LDL-C level was in a “gray zone” (where the ATP III guidelines indicated that drug therapy was optional) and drug therapy was initiated within 120 days or, if a drug was not prescribed, advice regarding therapeutic lifestyle changes was documented.

Otherwise, patients were classified as being treated inappropriately with respect to their dyslipidemia. Patients were at risk for being inappropriately prescribed LLT if the initial LDL-C level was less than the drug therapy–initiation or drug-optional threshold. Such patients who were prescribed LLT within 4 months were considered to be inappropriately treated. Patients were at risk of being undertreated if their initial LDL-C level was greater than the drug therapy–initiation threshold; patients not treated within 4 months were considered to be undertreated. Patients for whom the FRS was required but could not be calculated owing to missing data were not included in analyses of appropriate management, as were those with elevated triglyceride levels resulting in missing LDL-C levels. We did not collect data on direct measurement of LDL-C levels because the ATP III guidelines recommend addressing elevated triglyceride levels first, then repeating the lipid profile.

**STATISTICAL ANALYSIS**

The primary outcome for this trial was the proportion of patients treated appropriately with respect to LLT within 4 months after testing. The analyses for this study take into account the nested design in which randomization and intervention were performed at the level of the practices, but the actual outcomes data were collected on individual patients within practices. Patients within a practice are more likely to be similar to one another than to patients in other practices, resulting in a positive, nonzero intraclass correlation coefficient (ICC). This correlation results from within-practice similarities in patient characteristics including age, ethnicity, and socioeconomic status and from similarities in provider behavior. We did not assess the additional potential correlation attributable to clustering at the provider level for 2 reasons. First, we had fiscal constraints regarding the number of medical records we could afford to abstract within each practice, making collection of a sufficiently large sample at the provider level infeasible. Second, we recognized the collaborative nature of practice, especially with midlevel providers involved; hence, we judged that practice level correlation was more important and more feasible to address. Practice and patient level statistics were compared by intervention arm using descriptive statistics. The primary and secondary outcomes assessed represent dichotomous variables that are usually reported in terms of the proportion or the odds of success or failure. These include appropriate medication treatment decisions (primary) and the components of appropriate decision making, including appropriate prescribing, overprescribing, and appropriate screening. We performed a stratified analysis of the primary outcome according to ATP III categories, combining the 2 intermediate-risk categories into 1 (thus low, intermediate, and high risk). We analyzed the data using a generalized estimating equation approach with a logit link. Regression models took into account the within-practice correlation, and we used robust variance estimates. To determine sample size, we estimated that appropriate treatment at baseline would be 70% in both arms. Recruiting 32 practices per group (64 total) yielded 80% power to detect a minimum difference of 9% in treatment rates between control and intervention practices at follow-up, with a 5% 2-sided significance level, assuming 30 patients would undergo assessment per practice, a between-practice variance of 0.21, and an ICC of 0.01.

**RESULTS**

**RECRUITMENT AND PRACTICE CHARACTERISTIC**

Our recruitment efforts yielded 68 practices (Figure 2). Two practices withdrew before randomization and an additional 5 practices withdrew after randomization but before the start of the intervention. This resulted in 61 practices entering the intervention period with 29 in the ATP III arm and 32 in the control intervention. One practice was discovered after randomization to have not met 1 inclusion criterion (it had been open for <1 year); we did not drop this practice and it is included in the results. Characteristics of practices recruited are listed in Table 1. The average number of health care providers per practice in the intervention arm was 3 (range, 1-11) in the ATP III arm and 4 (range, 1-14) in the control arm. There were no substantive differences in practice characteristics by arm. At the final AD visit, we ascertained the number of practices that had electronic medical record systems; the proportions were similar across arms (8 [28%] for ATP III vs 11 [34%] for JNC-7 practices \(P=.60\)).

**INTERVENTION FIDELITY**

All 4 AD sessions were completed at all ATP III and JNC-7 practices. Average attendance of the providers (physicians and midlevel staff) in the ATP III arm ranged from 77% to 89% and in the JNC-7 arm from 76% to 83%. Overall attendance was 86% in the ATP III practices and 80% in JNC-7 practices \(P=.15\). In ATP III practices, at AD visit 2, 83% of the providers’ PDAs indicated use of the CDSS. At AD visit 3, 95% of the providers’ PDAs indicated some use of the CDSS; however, 46% of the PDAs indicated that the provider had discontinued use between visits 2 and 3. The most frequent reasons given for discontinued use were related to having learned the ATP III guidelines because of prior use and finding it inconvenient to input data during the clinical encounter. Several providers reported that, once they adopted electronic medical record systems, they were less inclined to enter data into the PDA (to avoid having to interface with 2 different computers).

**PATIENT CHARACTERISTICS AND SCREENING RATES**

We could not obtain complete follow-up data from 2 practices owing to withdrawal from the study after completion of the intervention but before the completion of follow-up medical record abstraction (1 practice in each arm). The characteristics of the 5057 patients at baseline and the 3821 patients at follow-up who were not re-
receiving LLT are presented in Table 2. There were no differences by arm in the average age, the proportion who were women, the racial/ethnic composition of the sample, or the proportion with CVD and/or diabetes mellitus. Race/ethnicity was not available from medical records for about one-third of the overall sample. The patient characteristics were also similar between the baseline and follow-up samples.

At baseline, a similar proportion of patients had been screened for dyslipidemia in both arms; screening rates increased (Table 3) such that about half were screened in each study arm. The net increase in screening was higher in the JNC-7 arm, but this difference was not statistically significant. The ICC for the screening rate was 0.22.

APPROPRIATE MANAGEMENT

Of the 1776 patients screened at baseline and 1658 at follow-up, risk level and appropriate management could be determined for 1697 at baseline and 1480 at follow-up. In the JNC-7 arm, 41.8% of patients at baseline were low risk per the ATP III definition compared with 43.6% at follow-up. The CHD equivalent status was 22.6% prior to and 20.0% during the intervention. Only 24.0% (before) and 25.9% (after) of those screened required LLT. In the ATP III arm, 35.2% were low risk at baseline compared with 43.6% at follow-up. The CHD equivalent status was 22.8% and 16.5%. At baseline, 25.7% of those screened required LLT compared with 26.8% at follow-up. Appropriate management of cholesterol levels was higher in the control arm practices at baseline (Table 3). Appropriate management decreased slightly in the ATP III practices, and more markedly in the control practices. The net difference in appropriate management was 9.7% in favor of the intervention group ($\text{ICC}^{a} = 0.01$); the ICC was 0.01. We observed a reduction in inappropriate prescription of LLT in the ATP III arm, whereas inappropriate prescription increased in the control arm. There was a decline in appropriate prescribing of LLT in both arms of the study (Table 3), with no significant intervention effect on this measure. A sensitivity analysis that includes data from only 58 practices with both baseline and follow-up data yielded similar results (a net difference in appropriate management favoring the ATP III intervention of 9.2% ($\text{ICC}^{a} = 0.02$)).
The impact of the intervention on appropriate management by level of risk is presented in Table 4. The appropriate decision was made for approximately 90% of the low-risk patients in both arms during both periods, with no intervention effect. In moderate-risk patients, appropriate management declined in the JNC-7 arm and remained essentially unchanged in the ATP III arm, resulting in a net difference favoring the intervention. Among high-risk patients, appropriate decision making declined substantially in both arms, although to a slightly lesser extent in the ATP III arm. The ICC was similar in each risk category (0.01 for the low-, intermediate-, and high-risk categories).

These results demonstrate that a multifaceted intervention that included guideline dissemination, AD audit and feedback, and provision of a CDSS resulted in better adherence to the ATP III guidelines than was observed in the control intervention. Stable adherence was observed in the ATP III intervention group, whereas a decline in guideline adherence was observed in the control group. The modest relative improvement in adherence was related to a decrease in overtreatment (prescribing LLT to patients who did not require it, as recommended...
by the ATP III) and to a smaller increase in undertreatment. Screening rates increased in both arms to a similar extent. Appropriate drug treatment was not improved by this intervention.

The ATP III recommends that all adults without CVD or diabetes be screened once every 5 years with a lipid profile; this translates into an expected screening rate of 40% during a 2-year window. Practices were meeting this expectation at baseline. As such, the observed screening rates of approximately 50% at follow-up may represent modest overscreening. It is possible that this screening rate reflects an increased awareness of the need to obtain lipid profiles to ascertain a patient’s status with respect to the ATP III guidelines. Also, providers in both arms were aware that the study focused on cholesterol level management. On the other hand, we did not attempt to limit our medical record review to only those patients who had not been screened in the preceding 5 years, and it was not feasible to determine whether patients had been screened elsewhere; thus, our inferences regarding an appropriate screening rate are limited.

Many patients screened in these primary care practices were at low risk according to the ATP III guidelines. For these patients, the appropriate decision is not to prescribe a drug. A minority of patients were eligible for LLT. Thus, the average patient undergoing examination and screening in primary care had a greater risk of overtreatment than of undertreatment. The proportion of screened patients who were at lower risk increased during follow-up in both arms of the study. The fact that appropriate management decreased in the control arm suggests that screening without concomitant reinforcement of the ATP III recommendations, via AD or a CDSS, may lead to overtreatment.

We observed a decrease in appropriate LLT prescribing in both arms of this study. The analysis of appropriate decision making by risk category suggests one plausible explanation. Among high-risk patients, appropriate management declined markedly between baseline and follow-up in both arms. The criteria for appropriate management at follow-up were the revised ATP III guidelines, which made more high-risk patients eligible for LLT by lowering the drug therapy—initiation threshold from 130 to 100 mg/dL. The change in lipid level management recommendations was made early in the follow-up abstraction window, and we disseminated the revised recommendations to practices; therefore, we held practices to the revised standards at follow-up.

Systematic reviews have noted that many studies, particularly those evaluating single interventions, have failed to demonstrate improved quality. A multifaceted, cluster-randomized trial conducted in 20 community-based primary care practices (a design similar to that of the GLAD HEART Trial) aimed at improving a range of CVD prevention—related quality indicators demonstrated improved quality in both arms (mean indicators at or above the targets in the areas of hypertension, hyperlipidemia, CHD, heart failure, atrial fibrillation, and diabetes mellitus, 11.3%-33.7% in the intervention and 6.3%-22.7% in the control practices) but failed to show a statistically significant intervention effect. In that trial, cholesterol level screening did not appreciably change (50.2%-53.5% in the intervention arm and 45.3%-43.1% in the control arm). A CDSS failed to improve adherence of British primary care providers to recommendations for patients with angina overall, including specifically for statin prescription, compared with no CDSS. A recent German trial randomized primary care physicians to an intervention based on CME, a text with guideline-based recommendations, a paper-based CVD risk calculator, and a patient-physician shared decision-making tool on the patient’s CVD risk compared with a control group featuring CME on non-CVD topics. That trial assessed change in the FRS as the outcome; in both arms the FRS decreased, but there was no difference across study arms. In a Canadian study that randomized patients rather than providers or practices, statin prescription within a 6-month window for

<table>
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<tr>
<th>Quality Indicator</th>
<th>ATP III Practice</th>
<th>JNC-7 Practice</th>
<th>ATP III–JNC-7 Comparison</th>
<th>P Value</th>
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<td>Low risk</td>
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Abbreviations: ATP III, Third Adult Treatment Panel; JNC-7, Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; LLT, therapy to lower lipid levels.
patients with ischemic heart disease did not improve as a result of an intervention using an opinion leader–
generated, patient-specific report faxed to primary care
providers compared with no report (17% in each arm).
However, a recent primary practice–based interven-
tion\textsuperscript{24} aimed to improve physician adherence to Dutch
national lipid level management guidelines suggests that
the timing of decision support is critical and also sug-
gests that a CDSS may be useful in the right setting. All
practices in that study used an electronic medical rec-
dord system; patient-level data were used by the CDSS to
determine which patients required cholesterol level
screening and which met criteria for LLT. Practices were
randomized to receive the CDSS-generated recommenda-
tions automatically when patients were seen in the of-
line (alerting function), when physicians requested the
CDSS-generated advice, or when no CDSS was available
(control). Both CDSS conditions increased screening rates,
but only alerts improved LLT prescribing compared with
a control condition.\textsuperscript{24}

The major strengths of our study are the use of a ran-
domized, controlled design; a substantial sample size; and
data collection in a random sample of patients from prac-
tices. Our study has several limitations. Our practice
sample was limited to practices that agreed to partici-
pate in a quality improvement trial; thus, our results may
not be generalizable to unselected primary care prac-
tices. We experienced withdrawals from the trial. It is not
clear why practices did so before the start of the inter-
vention; however, we suspect that we may not have em-
phasized sufficiently the differences between our study
methods and those of more typical quality improve-
ment studies, specifically that they needed to be willing
to accept the random allocation to the intervention. In
traditional clinical trials, blinding may facilitate partici-
pant adherence, but it was not feasible to mask provid-
ers as to which arm they were in. We could not mandate
or monitor use of the CDSS for every patient who was
screened and could not limit control practice providers
from obtaining the more limited National Heart, Lung,
and Blood Institute version of the CDSS. We did not de-
determine whether the recommendations were being printed
or placed in the medical records. By assessing CDSS use
at AD visits, we determined that many providers discon-
tinued use of the CDSS during the trial. It is possible that
the CDSS was not a significant factor in the observed
intervention effect. Both arms received AD visits; those for
the ATP III arm reinforced using the PDA tool at each
visit and provided updates regarding the ATP III. At least
1 trial\textsuperscript{25} suggests that online CME presenta-
tions increased knowledge about the ATP III and increased phar-
macotherapy for dyslipidemia for high-risk patients of
primary care providers, although traditional in-person
CME presentations did not. Furthermore, in our study,
initial dissemination presentations and the perform-
ance feedback report were not tailored by arm; thus, it
is unlikely that these aspects of the intervention are
related to the differences observed. We also did not ad-
dress potential patient-level barriers to LLT, including con-
traindications (although these are rare), prescrip-
tion drug coverage, and patient preferences. We did not
assess differences in control of dyslipidemia because this
was not a primary aim of our study. By design we were
interested in decision making with respect to screening
lipid profiles, not longer-term results. Another limita-
tion is the possibility that the selection of an active com-
parator (JNC-7 guidelines) had a deleterious effect on prac-
tices in that arm with respect to lipid level manage-
ment. A separate report fully describes the results of the
JNC-7 intervention; in brief, we found no difference be-
 tween the 2 groups in any of the JNC-7 adherence mea-
sures, including the percentage of patients who achieved
their blood pressure goals (intervention group, 49.2%;
control group, 50.6%) or the use of a thiazide-type di-
uretic as first-line therapy (32.0% vs 29.5%).\textsuperscript{26} Therefore,
we do not suspect that the JNC-7 intervention would
affect cholesterol level management.

An alternative view of our results is that the interven-
tion prevented significant deterioration of cholesterol level
management in the ATP III arm, whereas in the JNC-7 arm,
less exposure to the modified ATP III guidelines without
ongoing education or decision support led to worse per-
formance. We had expected our intervention to lead to in-
creased use of LLT in appropriate patients. Our results, how-
ever, still translate into better quality because fewer patients
in the ATP-III arm were offered LLT that they did not need
and because the provision of needed therapy (as recom-
manded by the guideline update) deteriorated less in the
ATP III intervention group. The overall appropriateness of
management indicates substantial room for improvement.
Future efforts focused on enhancing the management of lipid
levels using a CDSS likely need to incorporate features sug-
gested in other trials to enhance success, including provi-
sion of automatic decision support as part of the clinic flow,
especially when and where decisions are made.\textsuperscript{27} Our re-
results, placed in the context of several other quality improve-
ment studies focused on CVD, suggest that requiring pro-
viders to take the initiative to activate a CDSS (whether on
a PDA or within an electronic medical record system) is un-
likely to substantially improve medical decision making.

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REFERENCES