Effectiveness of Academic Detailing in the Managed Care Environment: Improving Prescribing of Lipid-Lowering Agents

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OBJECTIVE:
To determine whether educational intervention with prescribers by a specially trained pharmacist would improve management of lipid-lowering therapies in a health maintenance organization (HMO) population.

DESIGN:
Prospective, blinded, parallel physician groups with retrospective patient data collection.

SETTING:
Independent practice association of physicians in Pennsylvania and New Jersey.

PARTICIPANTS:
390 adult patients cared for by 49 primary care physicians in 26 practices.

INTERVENTIONS:
A single, 20- to 30-minute educational intervention session in each physician's office performed by a specially trained pharmacist who was supported by professionally developed written materials based on guidelines of the National Cholesterol Expert Panel.

MEASUREMENTS:
Over-prescribing and under-prescribing of lipid-lowering drugs, inappropriate use of duplicative therapy, and provision of dietary counseling during therapy.

RESULTS:
Overall error rate (all four criteria combined) for the nonintervention group decreased 4.9% ($p > 0.05$). Overall error rates for the intervention group and the total study, however, significantly decreased 9.8% and 7.8%, respectively. Error rate for over-prescribing increased 3.1% in the total study and 9.4% in the nonintervention group. Error rate for over-prescribing in the intervention group decreased 1.3% ($p > 0.05$). Error rate for under-prescribing decreased 5.4% in the total study, 1.4% in the nonintervention group, and 8.3% in the intervention group ($p > 0.05$). Error rate for dietary counseling decreased in the total study 23.4% ($p < 0.05$), 23.2% in the nonintervention group ($p > 0.05$), and 23.5% in the intervention group ($p < 0.05$). Error rate for duplicative therapy decreased in the total study 5.4% ($p < 0.05$), 4.4% in the nonintervention group ($p > 0.05$), and 6.0% in the intervention group ($p > 0.05$).

CONCLUSION:
Academic detailing can significantly and clinically improve prescribing behavior for the lipid-lowering drugs.

KEY WORDS:
Hypercholesterolemia, Lipid-lowering drugs, Academic detailing, Counterdetailing, Physician prescribing patterns, Interventions, Training.

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Drug therapy for hypercholesterolemia has been shown to reduce significantly both total mortality and the risk of major coronary events in secondary prevention patients. This overall improvement in survival for patients with established coronary-artery disease (CAD), the result of a significantly reduced risk of cardiac mortality, is largely preserved across gender and age stratifications.[1] Additionally, the rapid onset of pharmacologic benefit in secondary prevention has served to reinforce the frequent use of this therapy. Epidemiologic studies have strongly suggested similar benefits of lipid-lowering therapies in primary prevention patients, but the reduction of total mortality with lipid-lowering drugs (LLDs) has not been explicitly established in this population.[2]

Dietary therapy to control hypercholesterolemia is often preferred over drug therapy in primary prevention, especially when the risks of CAD are low. For both primary and secondary prevention, dietary therapy is always recom-

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mended before and in conjunction with LLDs, where its benefit is shown to be additive and its efficacy may be associated with the equivalent of doubling LLD dosage.[3]

Program managers have thus encountered a need to monitor the use of LLDs to achieve optimal therapeutic benefits and cost-effective treatment. This need is driven by the ever-increasing number of LLD products and costs of these agents; it is supported by the incidence of suboptimal prescribing, which has become a major cause of drug-related illness. Unfamiliarity with the pharmacology of LLDs or limited clinical expertise in managing hyperlipidemia may translate into erratic prescribing; physicians may possess an incomplete knowledge of indication, drug selection, optimal dosages, frequency of administration, adverse effects, or contraindications.

The result may be that ineffective drugs are used; dosages are not titrated to individual patient factors; poor combinations of therapy are prescribed; new, expensive, and even more toxic agents are used in place of older, much less costly, or equally effective agents.[4] Contributing to this scenario, the third-party system of reimbursement may enable physicians to prescribe these costly drugs even when unnecessary.[5]

In this article, we present background information on studies of prescriber education programs; discuss the need for such efforts with respect to LLDs; and present a study of academic detailing for LLDs in a managed care setting.

STUDIES OF PRESCRIBER EDUCATIONAL EFFORTS

Much research has investigated why physicians routinely overuse, underuse, or inappropriately prescribe medications. Self-reporting by physicians indicates that the most common nonscientific reasons for prescribing a certain drug are the following[6]:

- ▲ Patient demand (46%);
- ▲ Clinical experience that suggests the medication is the "drug of choice," despite scientific literature indicating otherwise (26%); and
- ▲ Intentional use of the placebo effect (24%).

Studies have demonstrated that physicians are influenced by numerous sources: medical journals, pharmaceutical company advertising, direct mail advertising, professional sales representatives of drug companies ("detail" people), samples, professional meetings, *Physicians' Desk Reference*, pharmacists, patients, and colleagues.[7] Commercial sources of drug information appear to have a greater influence on physicians' perceptions of drug efficacy than does the scientific literature.[8,9] In fact, pharmaceutical sales representatives (PSRs) have been found to be the most important resource for information about new drug therapies.[10] This explains why the largest portion of the pharmaceutical industry's promotional budget is invested in their staff of PSRs.[10] This influence has been tempered in the managed care organization (MCO) market by the advent of drug formularies developed through internal pharmacy and therapeutics committees.

Dissemination of the results of scientific research via traditional passive learning (lectures) has not been effective in changing physicians' prescribing patterns.[10] Physician prescribing is a function of more than the available clinical information. Frequently instilled by skillful PSRs, physicians' attitudes are powerful, as are patient demands resulting from increasingly common lay advertising campaigns. Any attempt to alter prescribing habits, therefore, must provide more than mere information to physicians; efforts must appeal to physicians on a rational and persuasive level to provide a strong incentive to change prescribing behavior.[10]

In an attempt to provide such incentives, Jerry Avorn, M.D., and Steven Soumerai, M.D., pioneered "educational intervention," "academic detailing," or "counterdetailing" programs in the early 1980s. They and other researchers have since demonstrated that specially trained clinical pharmacists or physicians can effectively educate physicians about drug therapy so as to effect changes in prescribing practices. Evidence is strong that the information presented by PSRs are effective determinants of prescribing behavior. Thus, methods of "counterdetailing" mirror these techniques and employ communication principles and behavioral theory, as well as traditional educational theory.[4]

Soumerai and Avorn[11] found that the following techniques are useful tools in educating physicians and promoting improved clinical decision making:

1. Interacting face-to-face with a clinical educator associated with a respected organization and without probable motivation to provide biased information;
2. Establishing credibility by referencing scientifically based research (versus the findings of pharmaceutical companies) and discussing controversial issues surrounding the medications;
3. Encouraging physicians to participate in the discussion by asking questions and referring to case studies;
4. Using illustrative and graphic materials;
5. Being concise in highlighting and repeating key information; and
6. Providing feedback, preferably positive, in follow-up consultations.

Numerous studies have demonstrated a reduction in inappropriate prescribing as well as in unnecessary health care expenditures as a result of "educational outreach" programs employing these strategies. A 1983 study found that educational visits coupled with mailed "unadvertisements" reduced prescribing of target drugs by 14% compared with a control group. Physicians who only received the mailings did not change prescribing patterns, yet these printed materials likely formed an important foundation for face-to-face meetings.[10] The effect of the intervention lasted for more than nine months, and the prescribing of costly substitute medications did not increase significantly.[4]

A 1986 study of counterdetailing on three drugs often prescribed inappropriately produced a 13% decrease in expenditures in a Medicaid population. The ratio of benefits to costs of the program was 1:8.[12] Another study found that a follow-up visit reinforcing the initial contact could double the program's effect, yet the total visit time involved was not rele-

vant; in fact, brief visits (10–15 minutes) were sufficient.[13] Similar studies involving antibiotics have found 30–55% decreases in medication use.[10]

These studies are limited by considerations of generalizability: should the success of "counterdetailing" be expected in different settings, over longer time periods, and when dealing with different drug therapy groups?[12] Research on counterdetailing to improve physician management of drug therapy has been conducted for antipsychotics, antihypertensives, laxatives, analgesics, and other drugs,[5] but to date, no study has addressed physician education regarding LLDs. Given the high use and the high cost of LLD misuse, the promotion of appropriate LLD therapy is an important goal, one that can enhance the quality and cost-effectiveness of dyslipidemia patient care.

IMPORTANCE OF CAD PREVENTION

Incidence of Hypercholesterolemia

CAD is the leading cause of death for both men and women in the United States. Mortality secondary to cardiovascular events accounts for nearly one half of all deaths, and 18–30% of all deaths occurring in Americans less than 65 years of age. Mortality caused by CAD in the U.S. has decreased dramatically since 1968, probably as a result of lifestyle changes. Yet CAD still accounts for approximately 500,000 deaths each year and remains the most common cause of death. CAD prevention is, therefore, of utmost importance, as the disease is a major contributor of morbidity and mortality in the U.S.[14-16]

Use of LLDs

Elevated blood cholesterol levels, more specifically, elevated low density lipoprotein (LDL) levels, have been causally related to increased CAD; the risk of CAD progressively rises with increased LDL blood levels.[17] A substantial body of evidence has clearly demonstrated that lowering total serum cholesterol levels and LDL cholesterol levels will reduce morbidity and mortality associated with CAD in both patients with established CAD and without evidence of CAD. Further, these trials also showed a definite trend in reducing overall patient mortality.[15,18]

Data from primary prevention trials have shown that a 10% reduction in serum cholesterol levels correlated with a 20% change in CAD rate. Therefore, a small change in the serum cholesterol level can have substantial beneficial effects in reducing morbidity and mortality. Schulman et al.[19] noted that, although high blood cholesterol levels can be controlled with diet alone in most patients, 5–10% of middle-aged men in the U.S. will require pharmacologic therapy. The choice of LLD should aim for efficient use of resources, which requires consideration not only of the effectiveness of the agent but also the overall cost of therapy.[19]

Cost of LLDs

Based on an analysis by Weinstein et al., the expected direct care costs for each acute myocardial infarction (AMI) episode were estimated in an effort to determine the impact of CAD on medical care costs in the U.S. In 1987, the average direct cost per admission for AMI was $18,700. The direct, cumulative care costs over the following five-year period (including the acute AMI event) were $22,271. This figure does not consider the total indirect costs (loss of income secondary to disability and societal costs of premature death), which would have more than doubled this estimate. The aftercare costs were, therefore, a fundamental consideration in estimating the overall impact of CAD on health care costs.[16,20]

As pressures to reduce health care costs increase, managers and clinicians must consider the most efficient approach for managing LLDs and CAD.[16,21] Direct costs include primary care costs, hospital costs, and continuing care costs, such as physician visits, LLD acquisition costs, laboratory costs, and diagnostic tests such as electrocardiograms.[16,20] The hallmark study by Avorn and Soumerai[4] indicated that patient counseling and physician education can be cost-effective measures in improving pharmacotherapy; therefore, detailing costs should also be included.[4]

STUDY RATIONALE

Avorn and Soumerai[4] were successful in changing targeted prescribing behaviors of physicians by using academically based detailers. This nontraditional approach to physician education was effective independent of the prescriber's age, prescribing patterns, or board certification status. Academic detailing has been shown to promote the prescribing of antibiotics in a more rational and efficient manner.

Additionally, academic detailing has reduced the unnecessary prescribing of ineffective or expensive drugs in treatments of pain and senile dementia and has reduced prescribing of other targeted agents. Inappropriate prescribing can result in increased costs to the patient, third-party payer, and society; it has the potential to increase the incidence of iatrogenic conditions through drug toxicities and adverse effects without providing additional benefits for the expense incurred.[4,10,22,23]

Payers previously had little interest in the cost-effectiveness of medical decisions for which they were paying. The role of the payer was merely to reimburse costs. Today, however, the attitudes of the third-party payers and MCOs such as health maintenance organizations (HMOs) have changed dramatically. Payers have become interested in the appropriateness, cost, and effectiveness of therapeutic options for enrolled patients. In turn, patients seek HMOs to assist in the payment of expensive drug and medical therapy, including treatment and prevention of CAD.[23]

Previous studies have not addressed the use of academic detailing in improving the prescribing behavior of physicians in the treatment of hyperlipidemia. However, Avorn, Soumerai, and their colleagues[4,10,22] suggested that detailing could be effective in improving many targeted prescribing areas, since the approach used in academic detailing is more important than the drug or drugs targeted. Thus, we present

here the first study to investigate the impact of academic detailing on the appropriate prescribing of LLDs in a managed care setting.

METHODS

The evaluation of changes in physician management of lipid-lowering therapies was based on a comparison of prescribing patterns exhibited before an educational intervention with those exhibited after an educational intervention, in both the educational intervention arm and the control (nonintervention) arm. The study was structured into multiple phases to accommodate both developmental and implementation tasks. These phases included: Materials Development; Physician Selection; Phase I–Preintervention Data Collection; Intervention Activities; Phase II–Postintervention Data Collection; and Data Analysis.

Materials Development

Drug criteria for assessing the usage patterns of the six currently approved LLDs—gemfibrozil, lovastatin, clofibrate, cholestyramine, colestipol, and probucol—were developed by Philadelphia College of Pharmacy and Science (PCPS) clinicians through a review of the pharmacy compendia and medical literature. The criteria were approved by medical representatives of the MCO involved in the project.

Therapy management guidelines used in this project were developed in accordance with the National Cholesterol Expert Panel (NCEP) guidelines[17] and other information obtained as a result of a comprehensive literature review. Data-collection forms corresponding to the drug criteria and therapeutic guidelines were subsequently developed. The data-collection forms were designed to collect information pertaining to the following target areas: under-prescribing of LLDs; over-prescribing of LLDs; inappropriate duplicative therapy; and provision of dietary counseling during pharmacotherapy.

Educational materials for use during the academic intervention sessions globally addressed the therapy management guidelines based on NCEP materials. They were refined to focus on some specific problem areas of concern to the MCO in its physician network. Educational materials were developed in conjunction with a Philadelphia-based university school of medicine; corresponding continuing medical education (CME) credit was made available. The educational materials were incorporated into a professionally designed brochure for presentation to physicians in the study.

Physician Selection

Spreadsheets provided by the MCO describing physician prescribing patterns (according to drug) were used in considering physicians for study inclusion. Per request by the MCO, physicians included in the study were those whose prescribing patterns represented relatively high expenditures for LLDs. A system for matching physicians in the two groups was also used to incorporate several additional selection guidelines:

1. Proportionate distribution of physicians from the two states comprising the geographical range of the study (New Jersey and Pennsylvania);
2. Proportionate match of doctors of osteopathy (DOs) and doctors of medicine (MDs);
3. Prescribing of LLDs to at least 10 different patients by each physician studied; and
4. Proportionate mix of prescriptions for each of the six drugs included in the study.

The study prospectively enrolled 49 primary care physicians to measure the impact of academic detailing on the management of LLDs. These physicians were grouped in 26 practices that served as the units for analysis. The control group (no educational intervention provided) consisted of 11 practices comprising 27 physicians; the intervention group (educational interventions provided) included 15 practices comprising 22 physicians.

Phase I: Preintervention Data Collection

Once a physician was identified for inclusion in the study, corresponding patients were selected on the basis of whether or not the desired mix of drugs was represented. Patient data were collected retrospectively before the educational intervention sessions through a review of 292 patient charts (February to May 1991). The control group consisted of 154 patients and the intervention group included 138 patients. Data were collected, using the collection forms specified above, on the LLDs and therapeutic target areas previously mentioned.

Intervention Activities

Educational intervention activities were designed to mimic the "academic-detailing" programs referenced in the literature. A specially selected and trained pharmacist was scheduled to meet with physicians in the intervention arm of the study for approximately 30 minutes each. The purpose of these meetings was to provide a directed "educational intervention" that would enhance physicians' management of pharmacologic and nonpharmacologic lipid-lowering therapies. Verbally delivered educational intervention activities were supported by printed educational materials, as described earlier.

Appointments in physicians' offices were scheduled by personnel at the MCO in the week preceding the actual visit. The investigators then coordinated visits with the clinical intervener (academic detailer). The educational message of the clinical intervener was directed by a site-specific analysis of individual physician practice patterns obtained from data collected in the preintervention phase of the study. This information was summarized on an intervention summary form that highlighted the appropriate intervention topics to be reviewed at any particular visit.

Educational interventions were delivered to each of 22 physicians in the intervention group over the time period spanning October 19 to December 28, 1992. The 27 physicians in the nonintervention arm of the study received a "placebo" letter in lieu of an educational intervention visit.

Table 1. Student's *t* Tests for Treatment versus Control Baseline Error Rates

Group	No. Practices	Under-Prescribers Mean ± S.D.	P Value[a]	Over-Prescribers Mean ± S.D.	P Value	No Diet Counseling Mean ± S.D.	P Value	Duplicative Therapy Mean ± S.D.	P Value	Overall Error Rate Mean ± S.D.	P Value
Control	11	0.116 ± 0.084		0.005 ± 0.018		0.332 ± 0.219		0.040 ± 0.049		0.123 ± 0.069	
Intervention	15	0.148 ± 0.189	0.5680	0.013 ± 0.036	0.4779	0.306 ± 0.222	0.7704	0.062 ± 0.083	0.4418	0.132 ± 0.061	0.7309

[a] Calculated using Student's *t* test for paired data.

The letter was printed on the MCO letterhead and mailed from the MCO offices. The letter stated that a review of practice patterns was in process and that an analysis would be provided in the future.

Phase II: Postintervention Data Collection

Patients were selected for the postintervention phase of the study if they were newly started on LLDs between January 1 and September 30, 1993, by an MCO physician in either arm of the study. In November 1993, we determined that approximately 100 new LLD patients were available for entry into the postintervention phase of the study. We further decided that further delay in patient selection was unwise because physicians' "memory" of academic detailing messages and resulting changes in prescribing patterns might be limited in duration.[11] Patients in the postintervention phase were followed from January 1 to December 31, 1993. A total of 98 postintervention patients were entered into the study: 48 into the control (nonintervention) group and 50 into the intervention group.

This method was chosen so as to ascertain patterns of prescribing that were uninfluenced by prior therapy experiences in this postintervention time period. The hyperlipidemia treatment histories of these new hyperlipidemia patients were considered to be of equivalent status to patients selected in the preintervention phase of the study because the initiation of LLD therapy was obtained from the patient charts in the preintervention phase.

A data-collection survey was mailed to the identified patients in December 1993, specific retroactively to the January to December 1993 (postintervention) time period. The survey obtained information on the patients' receipt of dietary counseling during LLD therapy. Patient response to the survey was considered complete in May 1994.

Concurrently, a record of LLD usage corresponding to surveyed patients was obtained through electronic claims. New hypercholesteremia patients who returned (by mail) an adequately completed survey and were electronically confirmed to be receiving LLD therapy were entered into the postintervention phase of the study.

Data Analysis

A power analysis for the study was performed according to formulas drawn from the method of Stolley and Strom.[24] At least nine physician groups per study arm would be required to detect a 3% difference in performance between intervention and control groups at $\alpha = 0.05$ and $\beta = 0.10$.

Data for the four management criteria were entered into a suitable database. Comparison of data from the preintervention and the postintervention phases of the study was performed using SAS for Windows, version 6.08 (SAS Institute Inc., Cary, NC). Comparisons were performed using Student's *t* test for paired data and analysis of variance (ANOVA); tables were constructed using the Proc-tabulate function. Two of the original 26 practice groups, one in each arm of the study, were eliminated because of lack of postintervention data. Thus, comparisons of preintervention and postintervention data are based on 24 physician practice groups: 10 control and 14 intervention.

RESULTS

The preintervention sample comprised 292 patient records. The average patient age was 53.5 years. Men made up 62% of the sample. Patient demographics were not available for the postintervention sample because of incomplete data. The treatment and control groups were not significantly different at baseline in any of the four categories (under-prescribing, over-prescribing, dietary counseling, or duplicative therapy) or overall (Table 1).

Error Percentage for the Physician Groups

The error rates reported for the preintervention period are based on 26 physician groups, whereas the error rates reported for the postintervention period, the change in error rate from baseline, and the significance probabilities are based on only 24 physician groups because two groups had no post-test data. The error rates are reported along with their 95% confidence intervals (CI).

Overall Error Rate

The actual mean (± S.D.) error rates in the total study decreased from 12.9 ± 2.5% to 5.2 ± 4.5% overall. The decrease in error rate of 7.8 ± 5.2% was significant, with a p value of 0.0078 (Table 2). The control group error rate decreased from 12.3 ± 4.1% to 7.6 ± 9.4% overall. This decrease of 4.9 ± 10.2% was not significant, with a p value of 0.3749. The intervention group error rate decreased from 13.2 ± 3.1% to 3.5 ± 3.8% overall. The decrease in error rate of 9.8 ± 5.2% was significant, with a p value of 0.0029. If adjustment for multiple comparisons is performed (Bonferroni, $p < 0.004$), then the decrease in error rate remains significant overall and for the intervention group.

Table 2. Overall Study Percent Error Rate in Preintervention and Postintervention Groups in 24 Physician Groups

Group	No. Patients		Under-prescribers			Over-prescribers			No Diet Counseling			Duplicative Therapy			Overall Error Rate		
	Pre	Post	Pre	Post	Change	Pre	Post	Change	Pre	Post	Change	Pre	Post	Change	Pre	Post	Change
Total study	292	98	13.5	8.6	-5.4	1.0	4.2	+3.1	31.8	8.1	-23.4[c]	5.3	0	-5.4[b]	12.9	5.2	-7.8[a]
Control	154	48	11.6	10.0	-1.4	0.5	10.0	+9.4	33.2	10.5	-23.2[a]	4.0	0	-4.4[a]	12.3	7.6	-4.9
Intervention	138	50	14.8	7.6	-8.3	1.3	0	-1.4	30.7	6.4	-23.5[b]	6.2	0	-6.0[a]	13.2	3.5	-9.8[b]

[a] = Pre to post change significant at $p = 0.05$.
[b] = Pre to post change significant at $p = 0.005$.
[c] = Pre to post change significant at $p = 0.0001$.

Table 3. Effects of Interventions on 24 Physician Groups[a]

Group	Under-prescribers			Over-prescribers			No Diet Counseling			Duplicative Therapy			Overall Error Rate		
	Change	CI	*P* Value	Change	CI	*P* Value	Change	CI	*P* Value	Change	CI	*P* Value	Change	CI	*P* Value
Total study	-5.4	±13.2	0.4307	+3.1	±8.3	0.4736	-23.4	±9.5	0.0001	-5.4	±2.9	0.0014	-7.8	±5.2	0.0078
Control	-1.4	±22.6	0.9092	+9.4	±19.8	0.3749	-23.2	±14.6	0.0125	-4.4	±3.1	0.0207	-4.9	±10.2	0.3749
Intervention	-8.3	±16.5	0.3414	-1.4	±1.9	0.1814	-23.5	±13.1	0.0038	-6.0	±4.5	0.0209	-9.8	±5.2	0.0029

[a] Probability (p value) pre- to post-change significant at $p < 0.05$. CI = Confidence interval.

Under-prescribing Error Rate

The actual error rate for under-prescribing in the total study decreased from 13.5 ± 5.8% to 8.6 ± 10.5% overall (Table 2). This decrease in error rate of 5.4 ± 13.2% was not significant, with a p value of 0.4307 (Table 3). The control group error rate decreased from 11.6 ± 5.0% to 10.0 ± 19.6% (Table 2). This decrease in error rate of 1.4 ± 22.4% was not significant, with a p value of 0.9092 (Table 3). The intervention group error rate decreased from 14.8 ± 9.6% to 7.6 ± 12.1% (Table 2). This decrease of 8.3 ± 16.5% was not significant, with a p value of 0.3414 (Table 3).

Over-prescribing Error Rate

The actual error rate for over-prescribing in the total study increased from 1.0 ± 1.1% to 4.2 ± 8.2% overall (Table 2). The increase in error rate of 3.1 ± 8.3% was not significant, with a p value of 0.4736 (Table 3). The control group error rate increased from 0.5 ± 1.05% to 10.0 ± 19.6% (Table 2). This increase of 9.4 ± 19.8% was not significant, with a p value of 0.3749 (Table 3). The intervention group error rate decreased from 1.3 ± 1.82% to 0% (Table 2). This decrease of 1.4 ± 1.9% was not significant, with a p value of 0.1814 (Table 3).

Dietary Counseling Error Rate

The actual error rate for dietary counseling in the total study decreased from 31.8 ± 8.3% to 8.1 ± 5.6% overall (Table 2). This decrease in error rate of 23.4 ± 9.5% was significant, with a p value of 0.0001 (Table 3). The control group error rate decreased from 33.2 ± 12.9% to 10.5 ± 8.3% (Table 2). This decrease of 23.2 ± 14.6% was significant, with a p value of 0.0125 (Table 3). The intervention group error rate decreased from 30.7 ± 11.3% to 6.4 ± 7.6% (Table 2). The decrease in error rate of 23.5 ± 13.1% was significant, with a p value of 0.0038 (Table 3). If adjustment for multiple comparisons is performed (Bonferroni, $p < 0.004$), then the decrease in error rate remains significant only overall and for the intervention group.

Duplicative Therapy Error Rate

The actual error rate for duplicative therapy in the total study decreased from 5.3 ± 2.7% to 0% overall (Table 2). This decrease in error rate of 5.4 ± 2.9% was significant, with a p value of 0.0014 (Table 3). The control group error rate decreased from 4.0 ± 2.9% to 0% (Table 2). This decrease of 4.4 ± 3.1% was significant, with a p value of 0.0207 (Table 3). The intervention group error rate decreased from 6.2 ± 4.2% to 0% (Table 2). This decrease in error rate of 6.0 ± 4.5% was significant, with a p value of 0.0209 (Table 3). If adjustment for multiple comparisons is performed (Bonferroni, $p < 0.004$), then the decrease in error rate remains significant for the two groups combined.

Control versus Intervention Groups

The results of the analysis of variance of change scores (Table 4) indicate that no variables were significantly different between the control group and the intervention group. Statistical significance was likely not reached because of variability in the data; the magnitude of differences between control and intervention groups was considerable.

DISCUSSION

Several conclusions can be made as a result of this randomized, controlled study involving 26 sites, 49 physicians, and a total of 390 patients. The educational outreach program, by providing unbiased pharmacologic and medical information on LLDs, reduced the rate of overall prescribing errors. This was achieved without enticing the prescriber with economic incentives or imposing penalties for inappropriate prescribing.

These results were consistent with previous studies conducted by Avorn et al.[4,10] Our study showed that academic

Table 4. ANOVA of Change Scores

	Under-prescribers	Over-prescribers	No Diet Counseling	Duplicative Therapy	Total Study
Probability > F	0.6219	0.2179	0.9767	0.5927	0.3725

detailing resulted in a statistically significant overall reduction in prescribing errors, from 12.9% to 5.2 %, corresponding to a change of 7.8% in the physician population studied (Table 2). This outcome largely results from the impact of the intervention on improved dietary counseling ($p = 0.0001$) and reduced duplicative therapy ($p = 0.0011$). Face-to-face detailing reduced lack of dietary counseling from 33.2% to 10.5% and 30.7% to 6.4% in the control and treatment groups, respectively. Face-to-face detailing reduced prescribing errors for duplicative therapy from 4.0% to 0% and 6.2% to 0% in the control and treatment groups, respectively. Academic detailing reduced prescribing errors in the control and treatment groups from 12.3% to 7.6% and from 13.2% to 3.5%, respectively (Table 2).

Control versus Treatment Groups

An overall reduction in prescribing errors of 9.8% was statistically significant for the treatment group. This translated into a significant reduction in prescribing errors in the overall study ($p = 0.05$). Although a trend in reduced prescribing errors of 4.9% was seen in the control group, this was not statistically significant (Table 2). This implies that detailing had a greater impact on reducing error rates in the treatment versus the control groups. However, there was no statistically significant reduction in prescribing errors noted in comparisons between the control and treatment groups after academic detailing in any of the four categories (under-prescribing, over-prescribing, lack of dietary counseling, and duplicative therapy) or for the study overall (Table 4).

The lack of impact of face-to-face detailing in reducing errors of prescribing between control and treatment groups is not consistent with studies by Avorn and Soumerai, who found a statistically significant change in prescribing behavior.[4,10] Other factors, possibly independent of academic detailing, may have influenced prescribing behavior in this study. This would also be supported by the statistically significant reduction in prescribing errors seen postintervention in dietary counseling and duplicative therapy for the totaled groups. The improvements in prescribing errors were 23.2% and 23.5% in dietary counseling for control and treatment groups, respectively. The reductions in prescribing errors were 4.4% and 6.0% in duplicative therapy for control and treatment groups, respectively. The changes in prescribing errors appeared to occur together.

The lack of effect detailing had on changing prescribing behavior in the treatment versus control groups cannot be explained by initial differences between the groups, since Student's *t* tests of treatment versus control baseline error rates did not indicate any statistical difference. Although new patient groups were used in the postintervention phase, it would seem unlikely that this resulted in two different baseline groups, given the stability of the HMO population. This would also not explain why prescribing behaviors in the control and treatment groups for duplicative and no dietary counseling were changing together.

One possible explanation for this similarity is the timeliness of the study. Data collection began in February 1991 and continued for two months. During this time, much attention was given to hypercholesterolemia by the NCEP and other authors in the medical literature. A total of 15 articles were published in the literature describing NCEP guidelines in 1991 alone. In February 1991, in *The American Journal of Medicine*, Goodman[25] published "The National Cholesterol Education Program: Guidelines, Status, and Issues." The above mentioned journal had dedicated the second supplement of the journal to cardiovascular and diabetic issues. Since the publication of the first NCEP guidelines in 1988 to the time of the collection of data for the study, just over 11,900 articles were published in English discussing hyperlipidemia in the medical literature. The attention hyperlipidemia received in the medical literature in conjunction with the media attention this national health issue received in this time period may have contributed to the similarities observed between the control and treatment groups in this study.

Another explanation could be the geographic proximity of the study and control groups. Work by Coleman et al.[26] documented that important communication networks exist between prescribers, and these create mutually influential prescribing patterns in a geographic locality. Therefore, prescribing patterns may have improved in the control group of the study because of environmental factors that would also have influenced physician groups in the intervention arm. An extraneous influence on study results was substantiated by at least one physician known to have asked the academic detailer for copies of educational literature to distribute to fellow colleagues. Several copies were issued. It is not known how many photocopies were distributed by the prescriber in question. Nor is it known if, or to what extent, prescribers shared this information. Surveys were not conducted to determine the severity of cross-contamination in the current study.

Avorn and Soumerai[4,27] had consultant practices randomized in clusters to reduce the possibility of cross-contamination between experimental groups. This method was an adaptation of the block randomization used by Coleman et al.[26] Since block randomization was not instituted in the current study, and sharing of educational literature may have occurred, cross-contamination should be considered as a factor possibly blunting beneficial results of academic detailing in the treatment group over that in the control physician groups.

A third explanation could be the short duration of the detailing component of the study and abbreviated number of patients. Data were collected for only nine months, with a total of 390 patients and 26 physician practices. This resulted in

only 98 patients being evaluated in the postintervention phase of the study versus nearly three times that number (292 patients) in the preintervention phase. Avorn and Soumerai,[4] in an early educational detailing study, evaluated more than 800 patients and 435 physicians. The postintervention phase alone was nine months and 141 physicians were evaluated. Therefore, a possibly longer duration of the current study or larger population may have altered some manifest trends into statistically significant results.

Fourth, physicians were visited only once in the current study. Avorn and Soumerai[4] noted a clear "dose–response" relationship between detailer visits with physicians and appropriate prescribing patterns. As a result, we concluded that reinforcement visits may be necessary to enhance economic and clinical benefits. Repetition has also been shown to be valuable in other forms of medical education. If the detailer in the current study had been able to meet with the physicians on more than one occasion, greater changes in prescribing patterns between the control and treatment groups may have been observed.[4]

A fifth possibility involves academic detailer communication skills and qualifications. In this study, only one registered pharmacist was designated as an academic detailer. Avorn and Soumerai in previous studies had used several detailers with higher academic qualifications, including clinical pharmacists with doctor of pharmacy degrees and physicians. Previous studies have shown physicians to be more accepting of information presented by a perceived peer. Therefore, prescribers may have perceived the information presented by a registered pharmacist differently had it been delivered by a doctor of pharmacy or physician. However, in surveying physicians, we found consistent positive reactions to the performance of our academic detailer (data not shown).

Dietary Counseling and Duplicative Therapy

Dietary counseling and duplicative therapy were the only two of the four subgroups with a statistically significant decrease in prescribing errors as a result of academic detailing (Table 2). This may be explained by the high rate of initial prescribing errors associated with these two subgroups. Lack of dietary counseling had the highest error rates of the four categories analyzed (Table 2). This implies that, of the four categories, dietary counseling was the field that prescribers were least knowledgeable about and, therefore, that academic detailers could affect the most.

Dietary counseling had the greatest drop in error rate of the four categories (23.2% and 23.5% in the control and treatment groups, respectively). This was also reflected statistically, the overall change in error rate being 23.4% ($p = 0.0001$).

Duplicative therapy was the third highest in initial error rates; therefore, such a dramatic reduction was not anticipated. The reason the decrease in error rates for this category became significant was that, for every practice group in the study postintervention, error rates were 0% (Table 2). This was the only category where complete success was reported postintervention. These positive results in both the control and treatment groups support the previously stated theory that cross-contamination occurred in the study.

Over-prescribing and Under-prescribing

Since under-prescribing was the category where the second highest number of error rates was recorded, implying an inadequate knowledge by prescribers, a significant reduction in error rates was expected. The error rates hardly changed in the control group postintervention, but in the treatment group the error rates halved from 14.8% to 7.6%, a reduction of 8.3 ± 16.5% (mean change ± confidence interval). This decrease, although dramatic, was not statistically significant, probably because of the high variability in the data indicated by the extremely wide confidence interval.

In under-prescribing, both the control and treatment groups showed a reduction in error rates. The decrease was greater in the treatment (intervention) group: 8.3% and 1.4% reduction in error rate in the treatment and control groups, respectively (Table 2). Over-prescribing decreased in the intervention group by 1.4%, while it increased in the control group by 9.4%. This was the only category in which an increase in error rates occurred postintervention. Cross-contamination and a perfusion of medical literature discussing the new NCEP guidelines may have heightened physician awareness to the importance of LLDs and even stimulated aggressive dosing.

Although the reduction in error rates for the under-prescribing category was not statistically significant, the potential clinical impact of academic detailing should not be underestimated. A clear trend in the reduction of error rates in the treatment group postintervention was seen. If the study had included a greater number of patients, this trend might have become significant.

Clinical Implications

The major impact academic detailing had in this study was to reduce significantly the lack of dietary counseling and inappropriate duplicative therapy postintervention. Studies investigating the impact of coronary disease regression[28] have noted that substantial LDL cholesterol regression can occur by nonpharmacologic means. Three clinical trials have investigated the progression and regression of CAD by purely nonpharmacologic means. Overall, these studies showed a mean reduction in the progression of CAD by 32.6% and an increase in regression of CAD by 32.6%. These benefits were over one to three years. Therefore, the impact dietary counseling can have in reducing LDL cholesterol levels could be important in reducing the risks of CAD. Superko and Krauss[28] support this by stating in a recent publication that, in general, arteriographic benefit has been correlated to decreases in LDL levels. Aiming to achieve a specific LDL cholesterol range may be misleading since specific ranges have been associated with varied benefits.

Pharmacoeconomic Implications

The potential to integrate direct costs (patient prescription claims, physician visit costs, and laboratory costs) with clinical outcomes offers a new method in analyzing HMO health care efficiency. HMO claims databases enable patient outcomes to be analyzed at a minimal cost.[29] Such a study, while not inexpensive, is far less costly than the inefficient use of health care dollars. Payers now have a direct interest in medical decisions that affect their costs,[23] and maximal use of resources does not necessarily equate to improved outcomes. Actually, the literature has shown that increased use of resources may be detrimental to patient outcome, an economic principle called "diminishing marginal return." Inefficient use of resources is costly to the patient as well as the HMO. The ideal treatment is the most cost-effective or optimal use of resources. The pharmaceutical outcome data made available from such studies enable more cost-effective use of resources.[23]

Avorn and Soumerai[10] found that an educational outreach program designed to change antibiotic prescribing patterns reduced direct costs by a factor of 1.8. Additionally, if only physicians with a high turnover of prescriptions were targeted, costs saved would rise threefold.[10] Well-designed educational outreach programs could therefore potentially reduce direct costs incurred to both the HMO and patient. Based on cost savings estimated from prior detailing studies by Avorn and Soumerai, and the change in prescribing behavior found in this study, academic detailing likely resulted in cost savings to the patient group and HMO studied. Avorn and Soumerai have stated that, if there is a net reduction in expenditure to the HMO after accounting for the costs of the detailing program, such a program would be economically self-sufficient.[4]

STUDY LIMITATIONS

Sufficient full-size, randomized clinical trials are not often conducted to provide adequate data for the clinical decisions that prescribers must make. The use of large databases, such as those of HMOs, provides a new opportunity to analyze data for health care research. However, because these databases were designed originally for reimbursement purposes, they do have limitations.[29,30] Because of restrictions imposed by the database used, we could not determine whether patients in the study had reached their goal LDL and HDL levels. Additionally, we would like to have investigated the impact academic detailing had on the clinical appropriateness of LLD prescribing with respect to the indication. This also was not evaluated postintervention because of database limitations.

Other limitations in this study included: cross-contamination between the control and study groups, probably because of lack of block randomization; timing of the study (collection of study data was performed when there was much attention paid to LLDs in the medical literature); lack of information on patient compliance with medication prescribed or directions given by prescribers; and the small number of patients in a substantial proportion of the postintervention physician practice groups.

CONCLUSION

The results of this study support previous work by Avorn and Soumerai that academic detailing can positively affect prescribing behavior.[4,10,27] In this study, a statistically significant reduction from baseline was seen in lack of dietary counseling and prescribing of duplicative therapy. In the four categories investigated (under-prescribing, over-prescribing, duplicative therapy, and dietary counseling) no statistically significant difference was observed between the control or treatment groups after the intervention. Nor was a statistically significant difference seen overall between the control and treatment groups. However, a statistically significant improvement from baseline occurred in the study overall, and there was a greater clinical improvement in the intervention arm versus the control arm for all four categories. Overall, the results of this 26-site study support the concept that prescribing patterns can be changed without financial rewards for positive reinforcement or penalties for negative reinforcement. This has important clinical and economic implications for the patient, the prescriber, and the HMO. ■

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