CONTEMPORARY SUBJECT

Assessment of Clinical Pharmacist Management of Lipid-Lowering Therapy in a Primary Care Setting

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ABSTRACT

BACKGROUND: Pharmacists have been shown to positively impact the outcomes of care for treatment of many different kinds of disease states. In particular, pharmacist-run lipid clinics have enjoyed varying degrees of success, depending on the outcome assessed. At our hospital, when a patient is transferred to the pharmacist-coordinated lipid clinic, the primary care pharmacist is responsible for ordering and interpreting labs and prescribing and monitoring lipid-altering therapy.

OBJECTIVE: This study was designed to assess if there is a statistically significant difference between the magnitude of serum cholesterol reduction for patients receiving lipid-altering pharmacotherapy when clinically trained pharmacists are actively prescribing and adjusting the drug therapy compared to other health care practitioners (usual care).

METHODS: Patient records from the hospital computer databases were retrospectively and randomly selected for analysis. Following evaluation for inclusions and exclusions, 41 patient records remained for statistical analysis for the cohort group, and 47 records remained from the group of patients managed by a clinical pharmacist.

RESULTS: Management of dyslipidemia by a clinical pharmacist was associated with a significant reduction in overall mean low-density lipoprotein (LDL, 18.5%) compared to the cohort that did not have a clinical pharmacist as the primary manager of dyslipidemia (6.5%, *P*=0.049). This suggests improved clinical outcomes, defined as greater LDL reduction, when clinical pharmacists participate in lipid management, including drug prescribing. The magnitude reduction in LDL was found to be related to the number of clinical pharmacy visits (11.4% for 1 visit, 23.2% for 2 visits, and 23.7% for >3 visits), compared to the usual care group (-11.0%, 18.0%, and 7.4%; statistically significant, *P*=0.038, for >3 visits only). These results occurred even though the group of dyslipidemic patients managed primarily by a clinical pharmacist contained a statistically greater number of patients with 2 or more risk factors and high-density lipoprotein (HDL) levels less than 40 mg/dL.

CONCLUSION: Interdisciplinary medical teams that include clinical pharmacists who are actively prescribing and adjusting lipid drug therapy may achieve greater reductions in LDL for patients who have been assessed with multiple risk factors compared to patients managed without clinical pharmacists. Active participation by clinical pharmacists in lipid management for patients with elevated LDL resulted in improved treatment success as measured by the magnitude reduction in LDL. The reduction in LDL was between 5% and 22% per visit greater for patients being treated by clinical pharmacists versus usual care, even in a patient population with more risk factors. These intermediate outcomes may translate into long-term outcomes in fewer cardiovascular events, improved quality of life for patients with dyslipidemia, and lower costs associated with sequelae of dyslipidemias.

KEYWORDS: Pharmacist, Primary care, Lipid therapy, Dyslipidemia

J Managed Care Pharm. 2003(9)3: 269-73

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A relationship between serum cholesterol and the pathogenesis of arteriosclerosis has been supported in many animal, genetic, and epidemiological studies as well as in clinical trials.[1] Additionally, clinical trials that have evaluated the effect of cholesterol-reducing pharmacotherapy on coronary heart disease (CHD) have confirmed a causal relationship between cholesterol and CHD. Patients treated with lipid-lowering medications have increased from 5% in 1997 to 8% in 1999.[2] The Framingham Study demonstrated the increasing risk of developing cardiovascular disease as related to low-density lipoprotein (LDL) elevation.[3] The combined effects of elevated LDL with other nonlipid risk factors (cigarette smoking, hypertension, diabetes, low high-density lipoprotein [HDL] levels) are additive in their contribution to the development of CHD. Thus, it is essential that health care professionals effectively assess their patients for the presence of risk factors, especially LDL, and recommend treatments to reduce or eliminate these risk factors. Recommendations of the National Cholesterol Education Program/Adult Treatment Panel III (NCEP/ATP III) may be used as an evaluation and treatment guide by which health care professionals may assess and provide pharmacotherapeutic treatment for dyslipidemia, thereby reducing the patient's potential of developing CHD.

Pharmacist-run lipid clinics are one way a health care organization can address the health needs of patients, and pharmacist intervention in the treatment of lipid disorders is an area of active research. A study by Simpson et al. showed that the 10-year risk of cardiovascular disease decreased from 17.3 % to 16.4% during the 4 months patients were enrolled in a pharmacist intervention program.[4] Bozovich et al. reported that greater numbers of patients seen in a pharmacist-managed lipid clinic (in conjunction with a cardiologist) achieved their LDL goal as compared to a cardiologist alone.[5] Nola et al. showed that patients in a pharmacist-directed lipid management clinic achieved their cholesterol goals 32% of the time versus 15% of control patients.[6] O'Donnell et al. found that 28 of 60 patients, not at LDL goal when referred to their pharmacist-coordinated lipid clinic, achieved the desired LDL goal after the intervention.[7]

The Primary Care Clinics of the William Jennings Bryan Dorn Veterans Administration Medical Center (WJBD) have attempted to build on the successful experiences of others with pharmacist-coordinated lipid clinics. The WBJD clinics provide care for approximately 35,000 veterans. An interdisciplinary medical team consisting of primary care physicians, nurse practitioners, physician assistants, and clinical pharmacists provide and direct care for this patient population. Clinical pharmacists at this facility have had prescriptive authority for more than 20 years.

TABLE 1 Patient Characteristics

		Total Number of Patients for Both Samples	Number of Patients With		*P* Value*
			Usual Care	Clinical Pharmacist Management	
Number of charts evaluated		88	41	47	
Gender	Male	84 (95%)	40 (98%)	44 (94%)	
	Female	4 (5%)	1 (2%)	3 (6%)	
Age	<50 years old	7 (8%)	3 (7%)	4 (9%)	
	≥50 years old	81 (92%)	38 (93%)	43 (91%)	
Risk Factors	0 risk factors	2 (2%)	1 (3%)	1 (2%)	
	1 risk factor	6 (7%)	5 (12%)	1 (2%)	
	2+ risk factors	80 (91%)	35 (85%)	45 (96%)	0.046
	Hypertension	74 (84%)	32 (78%)	42 (89%)	
	Age	83 (94%)	38 (93%)	45 (96%)	
	HDL<40 mg/dL	48 (55%)	18 (44%)	30 (64%)	0.031
	Smoking	15 (17%)	6 (15%)	9 (19%)	
Comorbid factors	Diabetes	35 (40%)	15 (37%)	20 (43%)	
Framingham 10-Year Risk For CHD	<10%	16 (18%)	9 (22%)	7 (15%)	
	10%-20%	42 (48%)	18 (44%)	24 (51%)	
	>20%	30 (34%)	14 (34%)	16 (34%)	
Average levels at time of hyperlipidemia diagnosis	LDL (mg/dL)		128.7	137.8	
	HDL (mg/dL)		48.0	43.4	
	Total cholesterol (mg/dL)		211.3	224.0	

** Statistically significant (z test), P< 0.05.*

When a patient is diagnosed with dyslipidemia, the health care providers of this team may use NCEP/ATP III recommendations to address lipid management (there is no mechanism to enforce adherence to a protocol). In most cases, recommendations for lifestyle modification (diet and exercise) are rendered unless immediate lipid-altering pharmacotherapy is indicated. When diet and exercise fail to reduce lipid levels to those recommended by NCEP/ATP III, patients are prescribed lipid-altering pharmacotherapy from a list of formulary approved lipid-altering medications.

This study was designed to assess the hypothesis that there is no statistically significant difference between the mean percentages in LDL reduction for patients receiving lipid-altering pharmacotherapy when clinically trained pharmacists are actively prescribing medications as compared to other health care practitioners.

Methods

Patients seen in the pharmacist-coordinated lipid clinic had their lipid-oriented care transferred to the clinical pharmacist. The pharmacist was responsible for ordering and interpreting laboratory values and for prescribing and monitoring lipid-altering pharmacotherapy: the "Clinical Pharmacist Management" cohort in this study. When a pharmacist was not involved, a physician, nurse practitioner, or physician's assistant provided the patient's lipid care: the "Usual Care" cohort in this study.

Patient records from the WJBD patient computer databases were retrospectively and randomly selected for analysis in this study. The patient information was extracted from these databases using data extraction protocols designed with the Fileman program. The first data extraction identified all primary care patients, regardless of the provider type, who received refill prescriptions for lipid-altering medications (HMG-CoA reductase inhibitors, niacin, fibrates, or bile acid sequestrants) during the 6-month period from July 1, 2001, through December 31, 2001. The results of this search included the patient's name, social security number, name of the lipid medication, and service date of the refill prescription.

Following the removal of duplicate patient entries, 9,521 records remained for randomization. The patient records in this file were then randomly selected until 50 records were identified according to the following inclusion criteria for the Usual Care group: (a) patient <80 years and (b) patient's record contains at least one progress note from a physician, nurse practitioner, or physician assistant that addressed lipid management in the SOAP (Subjective, Objective, Analysis, Plan) note format. The same inclusion criteria were used to identify 50 patient records for the Clinical Pharmacist group, except the medical record must have contained a pharmacy progress note addressing lipid management during the time period from July 31, 2001, to December 31, 2001, and had no clinical pharmacy

TABLE 2 *Lipid Values After Intervention*

Lipid Goals Achieved	Total Number of Patients	Number of Patients With		*P* Value
		Usual Care	Clinical Pharmacist Management	
LDL at goal	50 (57%)	24 (59%)	26 (55%)	NS
HDL >40mg/dL	40 (46%)	23 (56%)	17 (36%)	0.037*
Triglycerides <200 mg/dL	65 (74%)	28 (68%)	37 (79%)	NS
Mean LDL (mg/dL)		41 (111.9)	47 (107.7)	NS
Mean HDL (mg/dL)		41 (43.4)	47 (37.7)	0.019†
Mean total cholesterol (mg/dL)		41 (192.2)	47 (175.0)	0.021†
Mean % reduction in LDL		41 (6.5%)	47 (18.5%)	0.049†
Mean absolute LDL reduction (mg/dL)		41 (16.8)	47 (30.1)	0.048†

** Statistically significant (z test); P<0.05.*
† Statistically significant (t test); P<0.05.

TABLE 3 *Change in Lipid Values After Clinical Pharmacist Intervention*

	Number of Consults	Usual Care [Number of Patients]	Clinical Pharmacist Management [Number of Patients]	*P* value*
Absolute LDL reduction	1	4.6 (52.5) [9]	18.2 (27.6) [19]	NS
in mg/dL (SD)	2	28.6 (28.4) [12]	37.7 (35.9) [17]	NS
	≥3	15.3 (34.2) [20]	39.5 (33.2) [11]	0.021
% LDL reduction (SD)	1	-11.0 (68.6) [9]	11.4 (23.3) [19]	NS
	2	18.0 (24.4) [12]	23.2 (22.3) [17]	NS
	≥3	7.4 (25.1) [20]	23.7 (19.0) [11]	0.038

**Statistically significant (z test); P<0.05.*

consult prior to the hyperlipidemia diagnosis. According to the research protocol at our institution, a code was assigned to each patient's record to ensure patient confidentiality by blinding researchers to actual patient names. (The VA policy on identifying patients is based on the U.S. Code of Federal Regulations [45CFR46.101(b)(4)], that says: "(4)…the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.") For each patient record, the information in Table 1 was collected.

The data were then transferred into Microsoft Excel files for analysis. The numeric components of the data were collected at 2 points: at the time of the hyperlipidemia diagnosis and "most recent." The data in both groups were reviewed for completeness. Because this information is essential for statistical analysis and comparison between the groups, incomplete patient records were excluded from statistical analysis. Following evaluation for numerical completeness, 41 patients records from the Usual Care group and 47 records from the Clinical Pharmacist group remained for statistical analysis (88 total records). The null hypothesis of this study was statistically evaluated to a confidence interval of 95% utilizing the "*z* test." The data in which patients were divided into "Number of Consults" subgroups were analyzed via the *t* test. The 2-sample *z* test and its associated confidence interval is employed for inferences concerning the difference between 2 population means and should only be used when both $n_1 \geq 30$ and $n_2 \geq 30$. If one or both of the sample sizes is smaller than 30, then inferences are based on a *t* statistic. Small samples require more assumptions than large samples.[8]

Results

The data were analyzed to provide demographic descriptive information and statistical comparison of the patient groups (Table 1). For all patients in the Clinical Pharmacist group, the average decrease in LDL levels was 30.1 mg/dL, an average reduction of 18.5%. The average LDL reduction in the Usual Care group was 16.8 mg/dL, or 6.5%. Both of the decreases in the Clinical Pharmacist group (absolute and percent) as compared to the Usual Care group were statistically significant ($P<0.05$, Table 2). Additionally, total cholesterol after interven-

tion was significantly lower (P=0.021) for the Clinical Pharmacist group even though the Usual Care group started with a lower absolute serum level of total cholesterol; the relative medical complexity of the patients in the Clinical Pharmacist sample was higher compared to the Usual Care sample. In the Clinical Pharmacist group, there was a significantly greater percentage of patients with 2 or more major risk factors (P=0.046) and patients with <40 mg/dL HDL levels (P=0.031). The Clinical Pharmacist group had a greater prevalence of other risk factors: age (3%), hypertension (11%), smoking (4%), and diabetes (6%).

Table 3 and Figures 1 and 2 show the data for each group as a function of the number of consults. When the data were subdivided into "number of consults," statistical significance was only achieved between the >3 consult groups. The 1 and 2 consult groups did not achieve statistical significance due to low patient numbers and large standard deviations. In general, LDL serum levels were decreased between 5.2% and 22.4% per visit as compared to the group with no clinical pharmacist involvement.

Although the achievement of the NCEP/ATP III LDL goal appeared slightly less common when clinical pharmacists are involved in lipid management—55% versus 59% of patients—this difference in LDL goal achievement was not statistically significant (P=0.38). Postintervention HDL levels were significantly lower (P=0.019) in the Clinical Pharmacist group although each group's HDL levels decreased about 5 mg/dL.

The null hypothesis that there is no statistically significant difference between the LDL reductions for patients receiving lipid-altering pharmacotherapy when clinically trained pharmacists are actively prescribing medications as compared to other health care practitioners was rejected. This result demonstrated that a significant difference exists between the mean LDL reductions of the Clinical Pharmacist and Usual Care patient groups. This suggests improved results, defined as greater LDL reductions, when clinical pharmacists participate in lipid management.

FIGURE 1 Average Percent LDL Reduction by Provider Type and Number of Lipid Consults

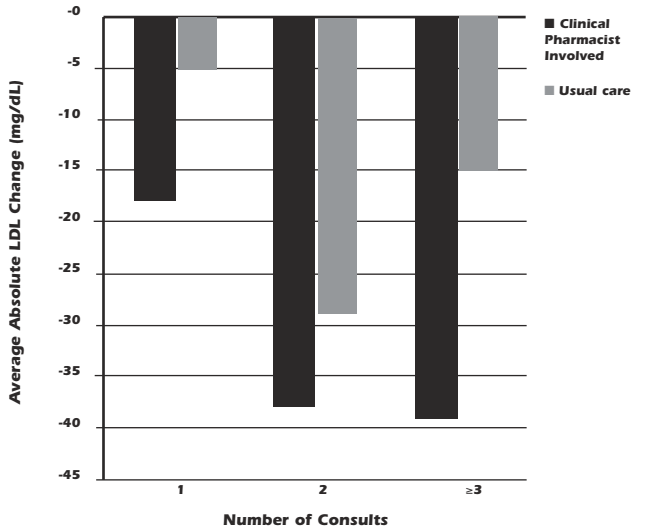
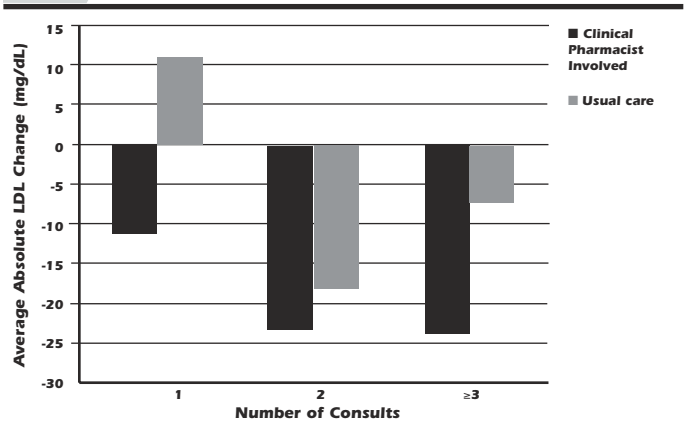


FIGURE 2 Average Absolute LDL Reduction by Provider Type and Number of Lipid Consults



Discussion

Pharmacist involvement in a variety of primary care clinics is increasing in frequency. Studies have shown pharmacists to be successful in several aspects of lowering a patient's cholesterol. Gee et al. found that splitting tablets of HMG-CoA reductase inhibitors was an effective way to reduce costs while having a favorable effect on clinical and service (satisfaction) outcomes.[9] Gerber et al. found 85% of patients in a pharmacist-managed clinic achieved an LDL value of less than 105 mg/dL.[10] Bozovich et al. reported that 69% of patients achieved LDL goals in their pharmacist-run clinics (in conjunction with a cardiologist),[5] and Cording et al. showed that 77% of pharmacist-managed patients achieved LDL goal.[11] Our study complements this previous work, with a somewhat lower overall achievement of LDL goal: 55% of patients in the intervention group. However, there was a statistically significant difference in the absolute and percent reduction of LDL and total cholesterol levels after intervention between the group managed by clinical pharmacists and the control group that did not involve clinical pharmacists in primary management of dyslipidemia.

Our study confirms the favorable impact on LDL reduction when clinical pharmacists are active participants in the interdisciplinary medical team. The patients in the Clinical Pharmacist group had a higher level of disease complexity (i.e., more patients with 2 or more risk factors and <40 mg/dL HDL) compared to the Usual Care group. The reason for the more complex patient being referred to the lipid clinic and clinical pharmacists is unknown, but it may be related to provider confidence in the ability of clinical pharmacists to have a favorable effect in lipid management of higher-risk patients.

Limitations

This was a retrospective analysis that did not have an equal number of patients in the 2 comparison groups. If we had replaced patients not fulfilling the numerical completeness criteria, we would have increased the power of our study. Instead of 100 evaluable patients, we had 88. Additionally, when patients were divided into groups based on number of visits, the number of study subjects was reduced further. We only evaluated lipid profiles at 2 points: at the time of the hyperlipidemia diagnosis and the "most recent" point and, therefore, could not show incremental changes for each patient. We did not record the amount of clinic time spent by the pharmacist versus nonpharmacist on each patient visit. Perhaps the LDL reductions were due to a patient perception of a more caring experience by virtue of the number of minutes spent in the health professional's office, causing them to try harder to lower their cholesterol. We did not conduct cost studies to evaluate dollars per visit or dollars per percent of LDL reduction. Lastly, we did not assess if the LDL reduction was due to factors other than the profession of the individual providing care, such as compliance, patient knowledge of diet, or drug selection.

Conclusion

There is significant potential for clinical pharmacists to contribute to improvement in the efficiency and effectiveness of pharmacotherapy in patients with dyslipidemia. As demonstrated in this study, interdisciplinary medical teams that include clinical pharmacists in lipid management realize greater reductions in LDL for patients who have been assessed with multiple risk factors compared to patients without clinical pharmacist management of dyslipidemia. Active participation (including prescribing) by clinical pharmacists in lipid management for all patients with elevated LDL results in improved intermediate outcomes in the achievement of NCEP/ATP III lipid goals. These intermediate outcomes may result ultimately in reduced long-term cardiovascular events and an improved quality of life for patients with dyslipidemia as well as reduced long-term costs associated with sequelae of dyslipidemia. Increased treatment efficiency in the management of dyslipidemia by clinical pharmacists may permit providers to address and manage other aspects of their patients' health.

DISCLOSURES

No outside funding supported this study. Authors L.Traywick Till, Jr., John C. Voris, and Julian Bourne Horst were employed by the federal government at the time this work was prepared. Till served as principal author of the study and contributed statistical expertise. Study concept and design, analysis and interpretation of data, and drafting and critical revision of the manuscript were provided by all authors.

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