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Collateral Benefits of Improving Glycemic Control on Lipids in a Diabetic Population

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ABSTRACT

Background: Diabetes is an illness with multiple quality indicators. This retrospective cohort study sought to determine if interventions directed at physicians to target improvements in hemoglobin A1c (HgA1c) quality indicators had collateral benefits on similarly measured low-density lipoprotein (LDL) indicators.

Methods: We initially analyzed the primary care diabetic patient electronic databases from 2008 (N = 16,503) and 2010 (N = 23,040). We then identified and selected for the study the cohort of patients who appeared in both databases (N = 11,288) and analyzed various measures of process and outcomes.

Results: Mean HgA1c decreased from 7.34% to 7.21% ($P < .0001$). Mean LDL level also improved from 100.2 mg/dL to 95.6 mg/dL ($P < .0001$). The proportion of patients with poor glycemic control and poor lipid control decreased from 10.3% to 8.42% ($P < .0001$) and from 38.2% to 32.1% ($P < .0001$), respectively.

Conclusions: Sustained interventions directed at the glycemic control of a large population of diabetic patients were associated with significant improvement in their glycemic control and had collateral benefits for indicators of their lipid control. Targeted interventions to improve HgA1c levels may have further benefits in improving other quality measures of diabetic care.

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INTRODUCTION

Diabetes is an illness affecting an ever greater percentage of the United States population and consuming a significant proportion of healthcare expenditures.[1] Multiple healthcare systems, insurance companies, and governmental payers have devised various systems to improve the quality of care delivered to diabetic patients and to increase the value of expenditures in caring for this chronic disease. The Center for Medicare and Medicaid Services, the National Committee on Quality Assurance (NCQA), and the American Diabetes Association have led the way in developing measures to assess the quality of care rendered to diabetic patients.[2,3] These organizations had a major role in the development of the Diabetes Quality Improvement Program (DQIP) healthcare measures that now form the basis of many measures of quality.[4] The DQIP serves as the source of the Healthcare Effectiveness Data and Information Set measures established by NCQA and payment programs such as the Physician Quality Reporting Initiative (PQRI).[3] Healthcare organizations are responding to the call for better care of diabetic patients by implementing various quality improvement initiatives designed not only to improve the quality of care but also to conform to these recognized core standards of care for diabetic patients.[2,5]

Quality improvement efforts by organizations can be quite expensive in terms of financial resources and manpower. Studies to evaluate the cost effectiveness of various quality improvement interventions to improve diabetic core measures may help in directing resources most appropriately. The increasing availability of electronic medical records is one tool for designing and implementing such interventions. Additionally, quality improvement interventions and sustained attention to one diabetic core measure may have a collateral benefit on other core measures. This study was designed to determine whether sustained physician-oriented interventions and attention to improvement in hemoglobin A1c (HgA1c) levels in a large diabetic population had collateral benefits on that population's lipid core measures as measured by low-density lipoprotein (LDL) metrics.

METHODS

The study used the Ochsner Clinic Foundation primary care diabetes database to assemble all diabetic patients of the primary care physicians from the 2008 (N = 16,503) and 2010 (N = 23,040) databases. From these 2 databases, a new database containing only those patients who appeared in both the 2008 and the 2010 databases was created (N = 11,288). The study protocol was approved by the Ochsner Institutional Review Board.

This primary care database identified diabetic patients according to established PQRI definitions for reporting purposes.[6] After identifying the diabetic patients, the query then assigned the patients to a specific primary care physician based on a set of electronic rules. Patients were attributed to a given physician's panel based on which physician they had seen most often during the preceding 12 months. In situations where a patient had seen 2 physicians an equal number of times, the patient was attributed to both physicians' panels.

Over the course of the 2-year study period, we queried the electronic medical record every 6-12 months and generated reports that supplied information regarding HgA1c and LDL testing frequency, as well as values for both of these blood tests. The reports presented overall results, as well as site-specific and physician-specific results. A system of electronic audit and feedback was implemented to inform physicians individually of their results and to monitor the quality improvement trends in their diabetic patient populations. These physician-level reports provided patient-specific information with an emphasis on those patients without HgA1c scores or those with a HgA1c ≥9%. Additional interventions varied with each report and included recommendations that our department had identified as best practices. These interventions included recommendations to prescribe only a 3-month supply of medication, to use ancillary personnel to assist with care, to initiate insulin earlier, and to enroll patients in a diabetic boot camp piloted by one site. Physician education was also provided in the form of literature and a diabetes conference.

All physician-directed interventions were targeted at improving HgA1c values and at improving the testing frequency of HgA1c. No interventions targeted improvement of LDL values or other measures of lipid control. The background efforts by private and government insurers, Ochsner, and quality improvement organizations directed at improvements in both lipid and glycemic control in diabetic patients continued throughout the study period. The interventions studied were those outside of this background quality improvement activity.

The study objectives sought to determine how changes in the core measures of glycemic control correlated with changes in the core measures of lipid control in this diabetic population. The endpoints included preintervention and postintervention measurements of HgA1c and LDL and subgroup analysis of the population based on glycemic control and lipid control. Patients with HgA1c ≥9% were defined as having poor glycemic control. Patients with LDL ≥100 mg/dL were defined as having poor lipid control.

Data were analyzed using SAS Version 9.2 (SAS Institute Inc., Cary, NC). Tests included a 2-group, mean-comparison *t* test and a 2-proportion *z* test. We used a power of 80% and a confidence interval of 95% to evaluate the data. A P value $< .05$ was considered statistically significant.

RESULTS

The study database of 11,288 patients represented all diabetic patients who had seen Ochsner primary care physicians as noted in the 2008 and 2010 electronic databases. Mean HgA1c of these patients during this time decreased from 7.34% (standard deviation [SD] ± 1.51) to 7.21% (SD ± 1.38) ($t = 6.7340$, $P < .0001$) (Table 1). Simultaneously, mean LDL decreased from 100.2 mg/dL (SD ± 33.23) to 95.6 mg/dL (SD ± 30.54) ($t = 10.7413$, $P < .0001$) (Table 2).

Subgroup analysis evaluated those with poor glycemic control and those with poor lipid control. The percentage of the population with poor glycemic control decreased from 10.3% of the population to 8.42% ($z = -6.55$, $P < .0001$). Likewise, the percentage of the population with poor lipid control decreased from 38.2% to 32.1% ($z = -13.43$, $P < .0001$) (Figure).

Process measures of the percentage of the group without an HgA1c measurement during the 2 testing periods showed an increase of 6.4% to 11.1% ($z = -15.87$, $P < .0001$). Likewise, the percentage of the group without an LDL measure during the 2 testing periods showed an increase from 15.1% to 16.8% ($z = -5.35$, $P < .0001$) (Tables 1 and 2).

DISCUSSION

In this observational study, interventions directed to improve HgA1c values in poorly controlled diabetic patients were associated with not only a decreasing percentage of poorly controlled diabetic patients, but also a decreasing percentage of those not achieving LDL goals ≤100 mg/dL. Mean HgA1c and LDL levels also showed statistically significant improvements in both groups. The interventions were directed only toward physicians and did not involve any direct communication with patients.

Table 1. Hemoglobin A1c Values

Year	Variance	Mean (%)	Median (%)	SD	% ≥9%	% No Test	Total N
2008	2.28	7.34	6.9	1.51	10.3	6.4	11,228
2010	1.89	7.21	6.9	1.38	8.42	11.1	11,228

SD, standard deviation.

Table 2. Low-Density Lipoprotein

	Variance	Mean (mg/dL)	Median (mg/dL)	SD	% ≥100 mg/dL	% No Test	Total N
2008	1104.0	100.2	96.2	33.23	38.24	15.1	11,228
2010	932.9	95.6	91.8	30.54	32.09	16.8	11,228

SD, standard deviation.

Studies have shown that physician education can be a successful strategy in improving glycemic control in diabetic populations.[7,8] Audit and feedback programs similar to the program performed in this study have also been effective as long as sustained attention is directed toward the effort.[9,10]

Given the numerous endpoints that are bundled in the various programs designed to improve the care of diabetic patients, discovery of cost-effective methods to bring about improvement in these endpoints will result in better value for the resources expended on these quality initiatives. Electronic medical records were used effectively in this study and are a cost-effective tool for data gathering and analysis.[11] Quality improvement initiatives directed at improving all of the core measures in a bundle have also been shown to improve overall quality of care.[12] The current study indicates that with sustained attention to one important core measure—HgA1c values—improving other core quality metrics may be possible as well. Such improvement may come about because of increased attention by physicians to the need to improve the overall care of their diabetic patient population.

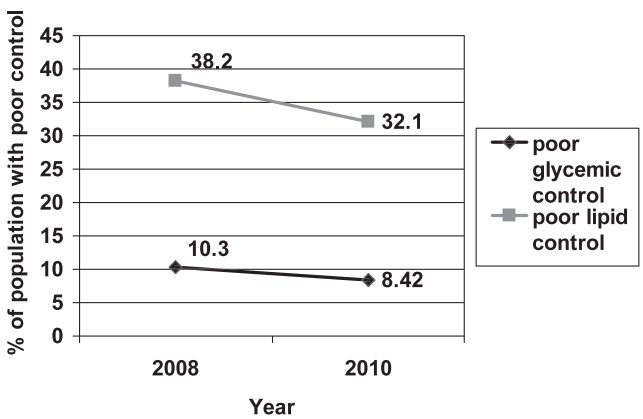

Figure. Glycemic and lipid changes in the poorly controlled diabetic group.

Paradoxically, the testing rate for both HgA1c and LDL decreased between the 2008 and 2010 study periods despite the finding in a previous study that glycemic control is inversely correlated with frequency of testing.[13] The decreased frequency of testing may have been a result of a feeling on the part of physicians or patients that as the patient's glycemic control improved, the need for more frequent testing diminished. Despite the slight decrease in testing rates, testing was still very high, with 88.9% of diabetics having had a HgA1c test performed and 83.2% having had an LDL measurement performed within the past year in the 2010 database.

The correlation between improved lipid control and improvement in glycemic measures may have occurred for reasons unrelated to increased physician awareness of the need for improvement in diabetic core measures. Therapies such as weight reduction, medical therapies, and lifestyle modification would have beneficial effects not only on glycemic control but also on lipid control. The study was unable to distinguish the relative effects of each of these factors in correlating the improvement in lipid control as glycemic control improved. Other limitations of the study included the fact that this retrospective cohort study had no control arm to determine if the background population saw any improvements in diabetic core measures. The study was also unable to determine which of the physician-directed interventions were most effective or which were adopted most frequently.

CONCLUSIONS

Quality improvement efforts guided by electronic medical record query and directed in a sustained manner were associated with improvements in the glycemic

control of a large diabetic population and had the collateral benefit of associated improvements in lipid control as well. Studies of other diabetic core measures may also show collateral benefits from sustained attention to audit, feedback, and physician education initiatives. Such studies can be performed cost effectively with electronic medical record systems that have the appropriate capability for these data queries.

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