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Hypertension and hyperlipidemia management in patients treated at community health centers

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Abstract

Objective: Community health centers (HCs) provide care for millions of medically underserved Americans with disproportionate burdens of hypertension and hyperlipidemia. For both conditions, treatment guidelines recently became more stringent and quality improvement (QI) efforts have intensified. We assessed hypertension and hyperlipidemia management in HCs during this time of guideline revision and increased QI efforts.

Design: Cross-sectional chart review.

Setting and participants: Eleven Midwestern HCs for 2000 and 9 for 2002 provided audit data from 2,976 randomly chosen patients with hypertension and/or hyperlipidemia.

Measurement: Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC VI/VII) and National Cholesterol Education Program Adult Treatment Panel (NCEP-ATP III) guidelines were used to assess management of these conditions.

Results: Hypertension (2000, N=808; 2002, N=692) and hyperlipidemia (2000, N=774; 2002, N=702) outcomes improved for specific clinical subgroups. Hypertensive patients with 1 or more cardiovascular risk factors demonstrated significant improvement (34% vs. 45% controlled at <140/90 mm Hg, p=0.02). Hypertension control for persons with diabetes, renal failure and heart failure increased (16% vs. 28% controlled at <130/85 mm Hg, p=0.006). LDL control increased significantly for patients with 2 or more risk factors (39% vs. 58% controlled at <130 mg/dl, p=0.008). Other clinical subgroups showed trends toward better control, although there was insufficient power to detect significant differences for these groups.

Conclusion: Hypertension and hyperlipidemia outcomes improved for some risk groups; however, ongoing QI is necessary.

Keywords

Community Health Centers; Hypertension; Hyperlipidemia; Quality Improvement; Quality of Care

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Introduction

The over 5,000 federally-funded community health center (HC) sites in the United States play a vital role in caring for poor and medically underserved patients. HCs have a high proportion of patients that are African-American (23.0%) and Hispanic/Latino (36.1%) [1]. African American, Hispanic/Latino, and lower socioeconomic status patients often report inadequate screening rates or poor control of hyperlipidemia and hypertension; although some studies show control at similar rates as non-Hispanic whites, overall the proportion controlled is low for these groups [2-8]. Hypertension and hyperlipidemia management at HCs, however, is not well-described. Understanding the rates of control of these conditions is vital to improving health care quality for the vulnerable patients at HCs.

Hypertension and hyperlipidemia management at HCs must be viewed in light of concurrent changes in the treatment of these conditions. Over the past several years, national treatment guidelines have become more stringent. The Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel [ATP] III) published in 2001 extended the focus of ATP II to identify high-risk patients for heart disease [9,10]. Specific to blood pressure management, in 2002 the American Diabetes Association Clinical Practice Recommendations lowered the target blood pressure goal for patients with diabetes to 130/80 mm Hg [11]. More recently, the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC VII), published in May 2003, included more aggressive treatment for persons with diabetes or renal failure [12] and NCEP-ATP III was later updated in 2004 to encourage even tighter LDL control for very high-risk patients [13].

Quality improvement (QI) efforts at HCs and other clinical settings also intensified in recent years. For health centers, the Health Resources and Services Administration's (HRSA) Bureau of Primary Health Care (BPHC), the part of the federal government that oversees the nation's HCs, established the Health Disparities Collaboratives in 1998. This initiative aims to improve the management of specific chronic diseases and reduce health disparities using techniques of rapid QI, chronic care management, and group learning [14]. Several of these collaboratives focus on improving cardiovascular and diabetes care and include national measures relevant for patients with hypertension and hyperlipidemia.

As hypertension and hyperlipidemia guidelines continue to recommend increasingly stringent control, health centers must continue improvements to meet these standards. Therefore, we examined changes in control of hypertension and hyperlipidemia in health center patients between 2000 and 2002 according to the national treatment guidelines in force at the time of the study. Additionally, changes in control in regards to the recent, more stringent guidelines were examined to provide reference for current necessary levels of control.

Materials and Methods

In 1999, a collaborative research team from the MidWest Clinicians' Network (a consortium of Midwestern health centers), The University of Chicago, and HRSA's Bureau of Primary Health Care invited federally-funded HCs affiliated with the Network to participate in a quality assessment project for patients with hypertension and/or hyperlipidemia. All of the approximately 60 MWCN member health centers as of 1999 were invited to participate in this study by a letter to their Chief Executive Officer; the 11 that applied were selected for the project. The University of Chicago Institutional Review Board approved the study.

The project included two years of chart audits and organizational surveys for 2000 and 2002. At the end of each of the two data collection years, we provided all participating health centers

information on the current JNC and NCEP treatment guidelines, feedback on hypertension and hyperlipidemia performance standards, the specific center's data, average values for the participating centers, and benchmark values from the best performing center for each standard. A random selection of participating centers was asked to participate in a quality improvement intervention to target hypertension and hyperlipidemia control; however, after a series of conference calls discussing potential QI activities, the HCs decided not to engage in any further intervention activities outside of the feedback provided to all enrolled centers. Center personnel stated that time and competing demands were the main reasons that further intervention activities were not desired. Two centers did not provide 2002 data due to time constraints.

Organizational surveys

We collected surveys about the HCs' organizational characteristics from the project team leader at each site for both years of audit collection. The organizational survey inquired about HC demographics, use of quality improvement tools, and whether the center participated in any of the HRSA BPHC Health Disparities Collaboratives.

Chart abstraction

Using administrative and medical records, each HC provided investigators with a list of all patients aged 18 years or older with a diagnosis of hypertension in the given year (2000 or 2002), and an analogous list of patients with hyperlipidemia. Centers typically used ICD-9 codes or other labels in their administrative or medical records to identify all patients with these conditions. Then, as a further validation, we required the patients in the study to meet the following criteria in the chart abstraction: A diagnosis of hypertension required systolic blood pressure of 140 mm Hg or greater (≥2 readings), diastolic blood pressure of 90 mm Hg or greater (≥2 readings), or systolic blood pressure of 140 mm Hg or greater on 1 reading and diastolic blood pressure of 90 mm Hg or greater on a different reading; or taking antihypertensive medication. A diagnosis of hyperlipidemia required total cholesterol 240 mg/dL or greater, LDL cholesterol 160 mg/dL or greater, or LDL cholesterol 130 mg/dL or greater among patients with two or more cardiovascular risk factors; or taking an antihypercholesterolemia medication. We excluded pregnant patients since the treatment of these patients differs. Investigators then randomly selected 80 patients per site from each of the two conditions for both data collection years. Due to institutional review board privacy requirements, we were unable to track patients across years. Therefore, cross-sectional samples were drawn each year, so that t he study design was longitudinal with respect to health centers, but not with respect to individual patients. The HCs were instructed on how to complete the chart abstractions by the project manager and then abstracted the charts retrospectively for the 2000 and 2002 calendar years. Although we did not perform checks of abstraction reliability, our previous study on diabetes in HCs showed good reliability for chart abstraction by HC employees [14] and the methods employed in the current study were similar. The audits were completed in 2001 and 2003-4, respectively.

For both years, chart abstractors at each center used a simple 1-page audit form for each condition with an accompanying guidebook that gave standardized variable definitions. The chart audit forms asked for patient demographic, medical, and laboratory information to assess adherence to the JNC VI/VII and NCEP-ATP III guidelines. Additionally, the audit asked for process of care measures, comorbidities, and complications. We gathered 808 hypertension audits from eleven HCs in 2000 and 692 audits from nine HCs in 2002. For hyperlipidemia, 774 audits were collected from ten HCs in 2000 and 702 from nine HCs in 2002.

Statistical analyses

The main study outcomes were achievement of JNC VI/VII and NCEP-ATP III guidelines for blood pressure and LDL cholesterol, respectively, and we grouped the outcomes as follows.

The JNC VI set guidelines for blood pressure levels included in four major risk categories: 1) <140/90 mm Hg: "No Major Risk Factors & No Target Organ Damage/Clinical Cardiovascular Disease (TOD/CCD)"; 2) < 140/90 mm Hg: "One or More Major Risk Factors & No TOD/CCD"; 3) <140/90 mm Hg: "TOD/CCD: myocardial infarction, peripheral vascular disease, or stroke"; 4) <130/85 mm Hg: "TOD/CCD: diabetes, renal disease, or heart failure" [15]. Although JNC VII was published in 2003, after the data collection years, we also analyzed adherence to the new blood pressure level (<130/80 mm Hg) for patients with diabetes and/or renal failure to provide information on control as determined by the increasingly stringent standards [12]. We analyzed LDL cholesterol levels according to initial NCEP-ATP III guidelines as well as updated guidelines for persons at very high risk. The initial NCEP-ATP III risk strata and LDL target levels were: 1) CHD or CHD Risk Equivalents: <100 mg/dL; 2) Two or More Risk Factors: <130 mg/dL; 3) One or No Risk Factors: <160 mg/dL [10]. The updated guidelines from 2004 set LDL<70 mg/dL as the target for persons with established coronary heart disease (CHD) or risk equivalents, and LDL<100 mg/dL for patients with 2 or more risk factors [13].

The primary analysis assessed whether the proportion of patients meeting hypertension (HTN) and hyperlipidemia (HL) guideline targets improved from 2000 to 2002. Analyses were conducted separately for hypertension and hyperlipidemia, and were stratified by the risk categories identified in the guidelines. Additionally, pooled outcomes across strata were created for both blood pressure and LDL, with the outcome equaling 1 if the participant met the blood pressure or LDL guideline specific to their risk category and 0 if they did not. Initially, models were fit to estimate the effect of time on hypertension and hyperlipidemia outcomes, unadjusted for site and patient characteristics. Then, potential confounding of the time effect by rural vs. urban location, gender, age, race/ethnicity (white vs. other), and insurance (yes/no) were examined, one at a time, with confounding considered present if the covariate modified the odds ratio for 2002 vs. 2000 by 10% or more. Finally, a backward selection process was used to determine which, if any, covariates were independent predictors of the HTN-HL outcomes, with year included in all models. In addition to year, final models included all covariates significant at $p<0.05$ as well as any confounders of the time effect.

The analysis was implemented using 3-level hierarchical logistic regression with health center and the health center by time interaction as random effects. We used this approach in order to incorporate clustering of patients within health centers at two different time points. Hierarchical analyses were conducted using HLM 5.05 [16].

The analysis was based on the 9 health centers that provided chart audit data for 2000 and 2002. Additionally, we examined baseline control for the HCs that did not provide follow-up data to identify possible differences due to attrition. Descriptive statistics were computed for health center characteristics, patient characteristics, and medication use. Results were stratified by condition (hypertension, hyperlipidemia) and year (2000, 2002) when applicable.

Results

Health center characteristics and patient demographics

Table 1 displays health center characteristics, programs, and activities for 2000. Table 2 presents patient demographic and clinical characteristics for the 11 participating health centers, by year and condition. In general, patient characteristics were similar in 2000 and 2002. Medication frequency did not change between 2000 and 2002 (Table 3), although fewer hyperlipidemia patients took aspirin in 2000 ($p = 0.001$, not shown). About half of the patients with hypertension were on at least two hypertension medications, and 60% of the patients with hyperlipidemia were taking a statin.

Hypertension management

Achievement of JNC VI and JNC VII guidelines for blood pressure is presented in Table 4. Between 2000 and 2002, patients within the different risk strata either showed improvement or no change in control. Proportion controlled in 2002 ranged from 20% (patients with diabetes or renal disease - JNC VII) to 49% (no major risk factors and no target organ damage). For patients with one or more risk factors and no target organ damage or clinical cardiovascular disease (TOD/CCD), 34% in 2000 compared to 45% in 2002 met the JNC VI recommended guideline of <140/90 mm Hg (p=0.02). For patients with diabetes, renal problems or heart failure, 16% in 2000 and 28% in 2002 met <130/85 mm Hg based on the JNC VI recommendations that were in force at the time of the study (p=0.006). When the more stringent JNC VII level of <130/80 mm Hg was used as the target outcome, there was also tighter control in 2002 (p=0.04); however, this revised guideline does not include patients with heart failure and was not the guideline in place during the study years. Achievement of risk-specific targets for all patients improved from 31% to 40% (p=0.03). Change in blood pressure control between 2000 and 2002 was not modified by patient or health center characteristics.

Hyperlipidemia management

LDL cholesterol control generally improved between 2000 and 2002 for all risk strata (Table 5). Achievement of risk-specific LDL targets for all patients improved from 42% in 2000 to 51% in 2002 (p=0.01). For patients with two or more risk factors, 39% in 2000 compared to 58% in 2002 met the guideline of <130 mg/dL (p=0.008). For the two other risk groups, there were non-significant improvements in control between 2000 and 2002. Patients with one or no risk factors showed the highest levels of control at 64% in 2000 and 71% in 2002 (<160 mg/dL). Change in LDL control between 2000 and 2002 was not modified by patient or health center characteristics.

Comparison to drop-out centers

Baseline achievement of target guidelines in the nine centers with complete data and the two that dropped out differed significantly in none of the risk categories for LDL cholesterol and in only one of the five risk categories for hypertension – namely, the JNC VII target of <130/80 for the highest risk level (diabetes, or renal or heart failure). In this case, the dropout HCs had higher levels of achievement in 2000 (27% vs 12%, p = 0.03). Conservatively assuming dropout centers did not improve yielded results that were qualitatively the same as those presented in Table 4 (2002 vs 2000: 21% vs 14%).

Discussion

This study provides important information on the management of hypertension and hyperlipidemia at nine Midwestern community health centers at a time of rapid guideline change and national QI initiatives. Control significantly improved for both conditions in specific clinical subgroups; additionally, some other subgroups showed trends towards improved control as well, although we lacked the sample size to detect whether these differences were significant. Despite these changes, absolute levels of control can be improved further. Fewer than half of patients in 2002 with hypertension (all risk categories) met JNC VI recommended levels. For the highest risk hypertension patients with target organ damage/clinical cardiovascular disease, under one-third had controlled blood pressure. Similarly, only half of patients with hyperlipidemia met NCEP-ATP III guidelines for LDL cholesterol in 2002. LDL cholesterol was most poorly controlled in high risk patients with coronary heart disease (CHD) or CHD risk equivalents; within this group approximately two-thirds of patients in 2002 were still uncontrolled. Given that patients with the most serious risk factors are at highest risk for complications, these populations may be the most suitable patients to target for intensive hyperlipidemia and hypertension interventions.

HCs face difficult challenges caring for particularly high-risk persons who are poor and have various barriers to accessing care [17]. Nonetheless, patients with hypertension and hyperlipidemia in our study showed similar and sometimes better levels of control than those in many other health care settings, including primary care clinics, Veterans Affairs sites, health management organizations (HMOs), health systems, and general medicine and cardiology clinics, and among other at-risk populations [4,18-26]. The improvements seen for some risk groups occurred during a time when the majority of the centers began participation in a HRSA BPHC sponsored Health Disparities Collaborative [14]. By the follow-up year of 2002, seven of the nine remaining centers were enrolled in a Collaborative and each center implemented multiple QI techniques. Although the improvements in management cannot necessarily be attributed to Collaborative efforts, these changes in hypertension and hyperlipidemia control are encouraging for future quality improvement efforts in health centers.

Our study has certain limitations. First, we have limited power for some clinical subgroup analyses due to small sample sizes. Second, although the centers comprised a mixture of urban/rural sites and different racial and ethnic groups, we studied only health centers in the Midwest. Third, by the end of the study, the majority of the centers had participated in a Health Disparities Collaborative (HDC). Consequently, our results may not be generalizable to non-participating centers in other regions. Landon et al. found that improvements in hypertension outcomes in HDC centers from 1 year pre-Collaborative to 1-year post-Collaborative did not differ significantly from internal and external control centers [27]. However, we have previously shown that it took four years for hemoglobin A1c values to improve for patients with diabetes in the HDC, so it may take sustained quality improvement and longer follow-up to show improvements in hypertension outcomes from the HDC [28]. In any case, participation in the Collaboratives has extended to 915 health centers as of December 2007 (personal communication: Charles Daly, Health Resources and Services Administration, December 10, 2007), and thus our study is relevant for many of those sites. Fourth, since centers were provided feedback on performance standards after each year of data collection, these results may have motivated some centers to improve care of hypertension and hyperlipidemia.

Our LDL risk categories were based on NCEP-ATP III, which came into place in 2001, after the first year of data collection. Subsequent years may have found increased adherence to these new guidelines due to more widespread guideline dissemination. Also, we did not follow the same patients longitudinally because institutional review board confidentiality requirements made this approach unfeasible; however, the patient mix was very similar between 2000 and 2002. The two health centers that did not complete the 2002 chart audit were excluded from the primary analysis, which could result in dropout bias. Comparison of the two centers that dropped out to the remaining nine, however, resulted in only one significant difference in baseline prevalence of guideline achievement among 12 risk specific and pooled comparisons, and sensitivity analysis indicated this difference would have a minor impact on the estimated change over time.

In addition, it is difficult to identify an appropriate control group of organizations treating similarly vulnerable patients in resource-constrained settings. Organizations other than HCs may not be appropriate controls because of the differences in patient mix and resources. Also, since many HCs have now participated in the Collaborative initiative, comparison to non-HDC health centers may not be appropriate due to differences from participating centers. Estimates from the National Health and Nutrition Examination Study suggest that the hypertension control rate improved in the United States among all adults with hypertension from 1999-2000 to 2001-2, and improved significantly from 1999-2000 to 2003-4 [29]. There may be a secular trend towards better control of these conditions in our study not apparent without a comparison group.

Our study provides a snapshot of the quality of general hypertension and hyperlipidemia care at community health centers and demonstrates the need for further improved treatment as in other settings. Future research on QI efforts such as the Health Disparities Collaboratives will require long-term studies with appropriate comparison groups to understand the effectiveness of these programs in the face of improvements over time.

Conclusion

In summary, we found that care of patients with hypertension and hyperlipidemia is generally improving in Midwestern health centers, but opportunities for quality improvement remain. Continuing the efforts of the HRSA BPHC Health Disparities Collaboratives provides one way to improve care further [28]. By targeting patients, providers, and the overall healthcare organization through the Chronic Care Model and rapid QI techniques, the Collaboratives aim to create and institutionalize systemic change leading to the delivery of high quality care. A combination of these quality improvement techniques, along with assuring that health centers and patients have sufficient resources, will allow centers to continue making improvements in care for the vulnerable patients who rely upon them for their medical treatment and health.

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Table 1

Health Center Characteristics in 2000 (N = 9)

Organizational: N (%)		
University affiliation	2 (22)	
Hospital affiliation	4 (44)	
Public	5 (56)	
Non profit	9 (100)	
Rural	4 (44)	
Services and Programs: N (%)		
Patient education programs or counseling	4 (44)	
Group or cluster visits	0	
Protocol for verifying patient's blood pressure if elevated	4 (44)	
Blood testing in house	6 (66)	
Cardiologist services		
On-site	2 (22)	
Part of system	1 (11)	
Outside of system	6 (67)	
Participated in a quality improvement collaborative	7 (78)	
Use of Quality Improvement Techniques: N (%)	**Hypertension**	**Hyperlipidemia**
Practice guidelines or clinical protocols	7 (77)	5 (56)
Flow sheet that tracks condition	2 (22)	2 (22)
Computerized reminders for processes of care	0	1 (11)
Non-computerized reminders for processes of care	2 (22)	3 (33)
Chart audit of quality of care	8 (88)	7 (78)
Feedback of chart audit results to providers	8 (88)	7 (78)
Continuing education for providers	5 (56)	5 (56)
Provider profiling	1 (11)	2 (22)
Patient registry	5 (56)	5 (56)
Dedicated time for quality improvement	5 (56)	5 (56)

Table 2

Patient Demographics, Comorbidities, and Complications

	Hypertension		Hyperlipidemia	
	2000 (N = 808)	**2002 (N = 692)**	**2000 (N = 774)**	**2002 (N = 702)**
Demographics (%)				
Age, years (mean [SD])	60.8(15.3)	61.2 (15.4)	60.3(13.9)	58.1 (14.2)
Female	62	63	61	60
Race / Ethnicity				
White	64	62	70	67
African American	32	31	26	26
Latino/Hispanic	2	3	3	6
Other	1	3	1	1
Insurance *				
Medicaid	19	22	18	19
Medicare	41	37	43	33
Private	44	26	45	36
Self-Pay	13	11	11	13
Other	6	6	7	1
Payment system †				
Fee for service	41	30	56	28
Managed care/HMO	25	25	29	18
Sliding Fee Scale ‡	10	12	6	12
Other	8	10	7	11
Cardiovascular Risk Factors, Comorbidities, and Complications (%)				
Body mass index (kg/m^2)				
< 24.9 (normal) §	16	17	12	15
25.0 - 29.9 (overweight)	31	29	34	31
> 30.0 (obese)	54	54	54	55
Family history of early coronary heart disease	36	38	40	44
Provider documented assessment of				
hypertension control	65	67	41	36
hyperlipidemia control	17	26	59	47
Diabetes	24	27	23	32
Myocardial infarction	5	4	7	7
Angina	13	3	18	3
Asthma	7	7	6	6
Peripheral vascular disease	4	3	5	3
Cerebrovascular accident / stroke or transient ischemic attack	6	7	6	5
Renal failure / insufficiency	4	6	3	4
Coronary heart disease	6	6	5	5
Deceased	1	1	2	0

	Hypertension		Hyperlipidemia	
	2000 (N = 808)	2002 (N = 692)	2000 (N = 774)	2002 (N = 702)

*Percentages sum to more than 100% because some patients have more than one insurer.

†Percentages sum to less than 100% because of missing information.

‡Most self-pay patients pay through a sliding fee scale, which is based on income.

§Includes underweight (<18.5 kg/m^2) patients who comprise less than 2% of each patient group.

Table 3

Medications

Hypertension	**Percent of Patients**	**Prescribed Medication**
	2000 (N=808)	**2002 (N=692)**
Diuretic	43	44
Beta blocker	30	33
Calcium channel blocker	31	32
Angiotensin converting enzyme (ACE) inhibitor	36	39
Angiotensin receptor blocker	8	10
Alpha blocker	7	7
Adrenergic blocker	1	1
Number of Hypertension Medications	**Percent of Patients**	
0	10	7
1	41	42
2	34	32
3	13	13
≥ 4	2	4
Hyperlipidemia	**Percent of Patients**	**Prescribed Medication**
	2000 (N = 774)	2002 (N = 702)
Statins	60	60
Fibric acids	4	3
Niacin	2	1
Bile sequestrants	1	1
Number of Hyperlipidemia Medications	Percent of Patients	
0	38	37
1	61	61
2	2	2

Table 4

Comparison of Blood Pressure Control Stratified by Risk Category

Risk Category	Target Blood Pressure (mm/Hg)	2000 N (%)†	2002 N (%)†	Odds Ratio (95% C.I.) ‡	p-value
No major risk factors TOD/CCD	< 140/90	67 (48)	49 (49)	1.00 (0.47-2.13) §	0.995 §
One or more major risk factors and No TOD/CCD	< 140/90	304 (34)	354 (45)	1.54 (1.12-2.13) §	0.02 §
TOD/CCD: Myocardial Infarction, Peripheral Vascular Disease or Stroke	< 140/90	89 (47)	55 (47)	1.14 (0.55-2.36) §	0.72 §
TOD/CCD: Diabetes, Renal, or Heart Failure – JNC VI *	< 130/85	212 (16)	228 (28)	2.16 (1.34-3.48)	0.006
TOD/CCD: Diabetes, or Renal – JNC VII *	< 130/80	187 (12)	205 (20)	1.99 (1.10-3.60)	0.04
Pooled Risk Categories	Target reached for category	672 (31)	686 (40)	1.42 (1.07-1.88) §	0.03 §

TOD/CCD = Target Organ Damage/Clinical Cardiovascular Disease

* TOD/CCD measures are given according to JNC VI and JNC VII guidelines for both 2000 and 2002 data. For JNC VI, the target guideline for patients with diabetes, renal failure and heart failure is <130/85 mm Hg. For JNC VII, this guideline changed for diabetes and renal failure patients to a target of <130/80 mm Hg.

† N = number of patients in risk category; % = percent achieving blood pressure target.

‡ From hierarchical logistic regression, this incorporates correlation among patients in the same health center. Odds Ratio and p-value given are for year effect.

§ Ethnicity found to be significantly or marginally associated with outcome and included as a covariate in model.

Table 5

Comparison of LDL Cholesterol Control Stratified by Risk Category

Risk Category	LDL (mg/dL)	2000 N (%)†	2002 N (%)†	Odds Ratio (95% CL)‡	p-value
One or no risk factors	< 160	173 (64)	158 (71)	1.65 (0.84-3.23)	0.17
Two or more risk factors	< 100§ <130	128 (16) 145 (24)	128 (39) 145 (58)	1.72 (0.87-3.42) 2.23 (1.35-3.66)//	0.141 0.008//
Coronary Heart Disease, (CHD) or CHD risk equivalents	< 70§ <100	229 (4) 229 (27)	208 (8) 208 (32)	2.31 (0.92-5.81)¶ 1.29 (0.85-1.96)	0.096¶ 0.25
Pooled Risk Categories	Target reached for category	530 (42)	511 (51)	1.48 (1.13-1.93)	0.01

*Number of patients in risk category.

†Percent of patients achieving LDL target.

‡From hierarchical logistic regression, which incorporates correlation among patients in the same health center. Odds Ratio and p-value given are for year effect.

§Recent more stringent guidelines not in effect at the time of the study (<100 mg/dL for two or more risk factors and <70 mg/dL for CHD or CHD risk equivalents); gender controlled for in model.

//Age found to be significantly associated with outcome and included as a covariate in model.

¶Gender controlled for in model.