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Multiple Measurement of Serum Lipids in the Elderly

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Abstract

Background—Although there is considerable interest in underutilization of lipid testing, little is known about the prevalence and factors associated with overtesting of serum lipids.

Methods—We assessed the number of different days in which outpatient lipid testing was performed in a 5% national sample of patients with parts A and B Medicare in 2006. Covariates included patient characteristics (age, race, prior diagnosis of lipid disorder, and other indications for lipid testing), number of usual care physicians (UCP), type of UCP, total outpatient physician encounters, and health referral region (HRR) characteristics (average per-patient Medicare expenditures and percent of patients seeing multiple UCPs).

Results—Among the 1,151,891 patients, 11.9% underwent 3 or more outpatient measurements of serum lipids. In multivariable analyses, the total number of UCPs providing care for the patient was associated with multiple lipid testing, independent of patient characteristics, indications for lipid testing, and total outpatient encounters. There was a strong association among HRRs between the rate of multiple lipid testing and average Medicare expenditures ($r = 0.56$). This was reduced after including the percentage of patients with more than 2 medical subspecialist UCPs in the HRR in a partial correlation ($r = 0.31$).

Conclusions—Multiple lipid testing is associated with the presence of multiple providers, independent of indications for testing, comorbidity, and total physician visits. Much of the association of multiple lipid testing with medical expenditures at the level of HRR appears to be explained by differences in exposure to multiple providers.

Keywords

lipids; multiple testing; overutilization; Medicare

A number of studies have documented underutilization of lipid testing, either screening or monitoring of therapy.^{1–9} Minority ethnicity, low income and education, and lack of a regular source of medical care are all associated with lower likelihood of being screened or monitored.^{1–7} To our knowledge, there have been no studies on overutilization of lipid testing—testing at more frequent than recommended intervals. Overutilization of procedures and treatments has received increasing attention as a cause both of increased medical spending and of variations in medical spending between different areas of the United States^{10–12} though few current quality indicators deal with overutilization.¹³

We assessed measurement of serum lipids in men and women aged 65 years and older enrolled in fee-for-service Medicare in a 5% national sample. We focused on patients who underwent lipid testing on 3 or more occasions during that year. Administrative data do not contain sufficient information to determine which individual instances of multiple lipid testing may be appropriate versus overutilization. Our interest was rather to examine the overall patterns of multiple lipid testing and any associations of multiple testing with multiple providers and possible fragmentation of care.

METHODS

We used a 5% national sample of Medicare claims data for 2005–2006, including Medicare enrollment files, Medicare Provider Analysis and Review files, Outpatient Statistical Analysis File, and Carrier files. The study was approved by the UTMB Institutional Review Board.

Establishment of the Study Cohort

Medicare beneficiaries aged 65 years and older by January 1, 2005 with Medicare Parts A and B coverage between 2005 and 2006 and who were not enrolled in a health maintenance organization (HMO) during that time were selected (n = 1,151,891).

Measures

Patient age, gender, and ethnicity were obtained from Medicare enrollment files. The Medicaid indicator was a proxy of low socioeconomic status or disability. Residential hospital referral region (HRR) was identified by the zip code crosswalk provided by the Dartmouth Atlas of Health Care. Size of residential area was categorized by Rural-Urban Continuum Codes.

A prior diagnosis of any lipid disorder (ICD 9: 277.0–277.4), or other indications for lipid testing including hypertension, hypertensive heart disease, ischemic heart disease, stroke, atherosclerosis, peripheral vascular diseases, and diabetes were generated using inpatient and outpatient billing data in 2005 and 2006. Also, any hospitalization during 2005–2006 with a primary discharge diagnosis for a cardiovascular or cerebrovascular disease, or diabetes, was recorded.

We identified outpatient visits using American Medical Association-Common Procedure Terminology evaluation and management codes 99201 to 99205 (new patient), 99221 to 99215 (established patient encounters), and 99241 to 99245 (outpatient consultation). Individual providers were identified by their Unique Provider Identification Number. Physician specialty was based on Part B. Those with multiple specialty codes were assigned the specialty that appeared most often in the claims. Primary care physicians were defined as general practitioner, family physician, internist, or geriatrician. A usual care physician (UCP) was defined as the one who examined the patient on 3 or more occasions in an outpatient setting during the year.¹⁴ Total number of physician visits and total number of UCPs seen in 2006 (2005 in some analyses) were calculated for each beneficiary. We also retrieved 2006 total Medicare expenditures for each HRR from the Dartmouth Atlas of Health Care.¹⁵

Study Outcomes

Total days during which outpatient lipid tests were performed (Common Procedure Terminology 4: 80061, 83715, 83716) from either Outpatient Statistical Analysis File or Carrier files in 2006 were counted for each beneficiary.

Statistical Analyses

We calculated the percentage of beneficiaries who received 0, 1, 2, or 3 lipid tests in 2006, and stratified the results by selected patient characteristics, indications for lipid testing, and outpatient physician care. The effect of patient characteristics, type of outpatient care received, and clinical indications for lipid testing on receipt of multiple lipid testing (defined as 3 or more lipid tests) was evaluated using logistic regression models. Least square regression models were built to explore the association between multiple lipid testing, the percent of beneficiaries who saw 3 or more UCPs, and total Medicare expenditures across HRRs. All analyses were performed with SAS version 9.1 (SAS Inc., Cary, NC).

RESULTS

Table 1 presents the characteristics of the 1,151,891 men and women aged 66 years and older who comprised the final sample and the percentages of subjects who underwent 0, 1, 2, or 3 or more measurements of serum lipids in an outpatient setting in 2006. Overall, 11.9% of subjects underwent multiple testing. There was a little change with age up to 80 years, with some reduction in those aged more than 80 years. Differences by gender and race were also small. Given the large number of subjects, even small differences will be statistically different. Therefore, it is more important to focus on the magnitude of any changes rather than tests of significance.

Patients with a diagnosis of a lipid disorder were more likely to undergo multiple testing, as were patients who had specific indications for screening, such as diagnoses of hypertension, diabetes, and cardiovascular or cerebrovascular disease. There was a very strong relationship between multiple lipid testing and the number of different physicians seen in an outpatient setting during the year, ranging from 5.7% in patients who saw 0 or 1 outpatient physicians to 20.2% for those who saw 5 or more different physicians. There were similar patterns between multiple testing and total number of outpatient physician encounters during the year.

The rate of multiple testing increased with the number of different UCPs providing care for a patient. We further categorized patients by the type of UCPs caring for them, such as generalists, medical subspecialists, surgeons, or other physicians. The relationship between the number of UCPs and multiple testing was strongest for medical subspecialist and generalist UCPs (Table 1).

For patients who underwent lipid testing on 3 or more different occasions in 2006, the mean number of physicians ordering these tests was 1.4 ± 0.7 (standard deviation). This increased to a mean of 2.1 ± 1.3 for patients who underwent 6 or more lipid tests.

The geographic variation in multiple lipid testing is shown in Figure 1. Rates of multiple testing varied from <4% in Casper, WY and Grand Junction, CO to >24% in Fort Lauderdale and Miami, FL and McAllen, TX. We also assessed the temporal stability of rates of multiple testing. The rates in any given HRR varied little from 2005 to 2006.

Table 2 presents the results of 2 multivariable analyses looking at the independent association of patient and medical care characteristics on multiple lipid testing. Model 1 contains the number of different generalist UCPs seen, while Model 2 adds the total number of outpatient provider visits and the number of UCPs who were internal medicine subspecialists. All 3 measurements (generalist UCPs, subspecialist UCPs, and total physician visits) were associated with multiple lipid testing independent of each other and of patient characteristics and clinical indications.

We repeated the analyses (indicated in Table 2) using the number of UCPs seen and the total number of physician encounters generated from 2005 data and used to predict multiple testing in 2006. In those analyses, the number of UCPs seen and total outpatient visits in 2005 was a significant predictor of receipt of multiple testing in 2006. For example, patients who had a 0, 1, or 2 internal medicine subspecialists as UCPs in 2005 had 1.00 (reference), 1.29 (95% confidence interval = 1.27, 1.31), and 1.63 (1.58, 1.67) odds of undergoing multiple lipid testing in 2006.

Finally, we assessed the relationship at the level of the HRR between the rate of multiple outpatient lipid testing and overall Medicare expenditures. This is plotted for the 306 HRRs in the United States in Figure 2. There is close association between the 2 measures, with a Pearson correlation coefficient of 0.56. There was also a strong relationship between multiple lipid testing and the percent of patients seeing 2 generalist UCPs or 2 medical subspecialist UCPs during the year ($r = 0.45$ and 0.62 , respectively). To assess whether the presence of multiple providers mediated the relationship between rate of multiple lipid testing and Medicare spending, we performed a partial correlation between multiple testing and total Medicare expenditures while adjusting for the percent of patients in the HRR who saw 2 generalist UCPs or 2 subspecialist UCPs in the year (partial $r = 0.43$ and 0.31 , respectively).

DISCUSSION

Inappropriate or duplicative medical testing has been a subject of concern for several decades.^{16,17} Studies documenting unnecessary testing and the development of interventions to reduce such behavior greatly expanded with the growth of managed care.^{18–24} Duplication of testing involves different issues from the broader issue of inappropriate testing. In particular, the issues of fragmentation of care and impaired access to relevant information by treating physicians would seem to be more important.

Some studies have documented duplication of testing across transitions in medical care, particularly from outpatient to hospitalization and back.¹⁶ In this study, we did not include lipid measurements of patients while hospitalized. Our data on repetitive testing are based only on outpatient testing, and thus underestimate total repetitive testing.

Of course, not all repetitive testing of lipids is inappropriate. One can imagine clinical situations where obtaining 3 or more tests in a year is consistent with good medical practice; for example, when lipid-lowering therapy is initiated or adjusted. Because of that, we can conclude very little from the absolute rates of repetitive testing. What is more of interest is the pattern of repetitive testing, and the role of multiple providers.

Two different components appear to be associated with the patterns of multiple testing, with different implications. The first is different providers ordering the test on the same patient. Multiple testing increased with the number of UCPs, independent of the total number of outpatient physician visits. Such testing could be caused by impaired access to laboratory results across different physician groups. The second component of multiple lipid testing seems to relate to a general increased utilization of medical resources. The level of average Medicare expenditures explained 31% of the variance in multiple lipid testing at the level of the HRR. These 2 components have different implications. The popular response for problems stemming from impaired access to information is the electronic medical record.^{25–28} The ability of an electronic medical record to reduce test duplication depends to the extent it is accessible by providers across different organizations, which remains a challenge.²⁹

The finding that multiple testing of lipids reflects increased medical expenditure in general was expected. Sirovich et al^{30,31} have shown that physicians in high cost areas are more likely to order tests of questionable benefit. Medicare enrollees moving from low cost to high cost areas are more likely to undergo testing and receive more diagnoses.¹² The relationship between spending and multiple testing appeared to be mediated in part via the presence of multiple providers, particularly multiple subspecialty providers. Although Medicare expenditures explained 31% of the variation in multiple outpatient lipid testing among HRRs, this dropped to 9% after the percentage of patients with 2 or more UCPs who were medical subspecialists was added to the analysis.

This study has a number of limitations. The absence of information on lipid testing while hospitalized has been mentioned. We also discussed above the inability to determine what portion of the lipid testing might be medically appropriate. In addition, we only assessed testing in patients enrolled in fee-for-service Medicare. Medicare managed care patients may well have different results. The indications for lipid testing were based on diagnoses included in physician charges, which may be incomplete. Different health referral regions in the United States may differ somewhat in the percent of Medicare enrollees with indications for testing.

The studies of overutilization of medical care have evolved from the seminal work by the Dartmouth group on supply side factors^{10,11} to include consideration of variations in practice styles among physicians in different regions.^{12,30,31} This present study suggests that organizational factors resulting in multiple providers might interact with these other factors in influencing medical expenditures.

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REFERENCES

1. Nelson K, Norris K, Mangione CM. Disparities in the diagnosis and pharmacologic treatment of high serum cholesterol by race and ethnicity. Data from the Third National Health and Nutrition Examination Study. *Arch Intern Med.* 2002; 162:929–935. [PubMed: 11966345]
2. Massing MM, Foley KA, Carter-Edwards L, et al. Disparities in lipid management for African Americans and Caucasians with coronary artery disease: a national cross-sectional study. *BMC Cardiovasc Disord.* 2004; 4:15. [PubMed: 15317654]
3. Michalowski KM, Gold JA, Morse DL, et al. Reducing disparities in lipid testing for African-Americans with diabetes: interim report. *J Health Hum Serv Adm.* 2003; 26:363–381. [PubMed: 15704639]
4. Saaddine JB, Cadwell B, Gregg EW, et al. Improvements in diabetes processes of care and intermediate outcomes: United States, 1988–2002. *Ann Intern Med.* 2006; 144:465–474. [PubMed: 16585660]
5. Nau DP, Mallya U. Sex disparity in the management of dyslipidemia among patients with type 2 diabetes mellitus in a managed care organization. *Am J Manag Care.* 2005; 11:69–73. [PubMed: 15726854]
6. Massing MM, Henley NS, Carter-Edwards L, et al. Lipid testing among patients with diabetes who receive diabetes care from primary care physicians. *Diabetes Care.* 2003; 26:1369–1373. [PubMed: 12716790]
7. Davis SK, Ahn DK, Fortmann SP, et al. Determinants of cholesterol screening and treatment patterns. Insights for decision-makers. *Am J Prev Med.* 1998; 15:178–186. [PubMed: 9791635]
8. Gill JM, Chen Y. Quality of lipid management in outpatient care: a national study using electronic health records. *Am J Med Quality.* 2008; 23:375–381.

9. Abookire SA, Karson AS, Fiskio J, et al. Use and Monitoring of “statin” lipid-lowering drugs compared with guidelines. *Arch Intern Med*. 2001; 161:53–58. [PubMed: 11146698]
10. Fisher ES, Wennberg DE, Strukel TA, et al. The implications of regional variations in Medicare spending. Part I: the content, quality and accessibility of care. *Ann Intern Med*. 2003; 138:273–287. [PubMed: 12585825]
11. Fisher ES, Wennberg DE, Strukel TA, et al. The implications of regional variations in Medicare spending. Part II: health outcomes and satisfaction with care. *Ann Intern Med*. 2003; 138:288–298. [PubMed: 12585826]
12. Song Y, Skinner J, Bynum J, et al. Regional variations in diagnostic practices. *N Engl J Med*. 2010; 363:45–53. [PubMed: 20463332]
13. McGlynn EA, Asch SM, Adams J, et al. The quality of health care delivered to adults in the United States. *N Engl J Med*. 2010; 348:2635–2645.
14. Sharma G, Fletcher KE, Zhang DD, et al. Continuity of outpatient and inpatient care for hospitalized older adults. *JAMA*. 2009; 301:1671–1680. [PubMed: 19383958]
15. The Dartmouth Atlas of Health Care. [Accessed May 19, 2010] Medicare reimbursements. Available at: <http://www.dartmouthatlas.org/data/table.aspx?ind=124&loct=3&tf=10&ch=35>, 19-download Xls <http://www.dartmouthatlas.org/Downloads.aspx>.
16. Stump G. Are diagnostic tests repeated unnecessarily on hospital admission? *Can Med Assoc J*. 1983; 128:1185–1186. [PubMed: 6839241]
17. Williams SV, Eisenberg JM, Pascale LA, et al. Physicians’ perceptions about unnecessary diagnostic testing. *Inquiry*. 19:363–370. 198. [PubMed: 6218090]
18. Riegert-Johnson DL, Macaya D, Hefferon TW, et al. The incidence of duplicate genetic testing. *Genet Med*. 2008; 10:114–116. [PubMed: 18281918]
19. Balas EA, Boren SA, Brown GD, et al. Effect of physician profiling on utilization. Meta-analysis of randomized clinical trials. *J Gen Intern Med*. 1996; 11:584–590. [PubMed: 8945689]
20. Kwok J, Jones B. Unnecessary repeat requesting of tests: an audit in a government hospital immunology laboratory. *J Clin Pathol*. 2005; 58:457–462. [PubMed: 15858114]
21. van Walraven C, Raymond M. Population-based study of repeat laboratory testing. *Clin Chem*. 2003; 49:1997–2005. [PubMed: 14633870]
22. van Walraven C, Cernat G, Austin PC. Effect of provider continuity on test repetition. *Clin Chem*. 2006; 52:2219–2228. [PubMed: 17053154]
23. Soloman DH, Hashimoto H, Daltroy L, et al. Techniques to improve physicians’ use of diagnostic tests. *JAMA*. 1998; 280:2020–2027. [PubMed: 9863854]
24. van Walraven C, Naylor CD. Do we know what inappropriate laboratory utilization is? A systematic review of laboratory clinical audits. *JAMA*. 1998; 280:550–558. [PubMed: 9707147]
25. Collin S, Reeves BC, Hendy J, et al. Implementation of computerised physician order entry (CPOE) and picture archiving and communication systems (PACS) in the NHS: quantitative before and after study. *BMJ*. 2008; 337:a939. [PubMed: 18703655]
26. White RE. Health information technology will shift the medical care paradigm. *J Gen Intern Med*. 2007; 23:495–499. [PubMed: 18373152]
27. Duncan JR, Evens RG. Using information to optimize medical outcomes. *JAMA*. 2010; 301:2383–2385. [PubMed: 19509387]
28. Kahan NR, Waitman D, Vardy DA. Curtailing laboratory test ordering in a managed care setting through redesign of a computerized order form. *Am J Manag Care*. 2009; 15:173–176. [PubMed: 19298098]
29. Sprivulis P, Walker J, Johnston D, et al. The economic benefits of health information exchange interoperability for Australia. *Aust Health Rev*. 2007; 31:531–539. [PubMed: 17973611]
30. Sirovich BE, Gottlieb DJ, Welch G, et al. Variation in the tendency of primary care physicians to intervene. *Arch Intern Med*. 2005; 165:2252–2256. [PubMed: 16246991]
31. Sirovich B, Gallagher PM, Wennberg DE, et al. Discretionary decision making by primary care physicians and the cost of U.S. health care. *Health Aff*. 2008; 27:813–823.

FIGURE 1.
Proportion of Medicare enrollees aged 66 and older who had lipid measurements on 3 or more occasions in 2006, by Health Referral Region.

FIGURE 2.

Plot of average total Medicare reimbursement per enrollee versus the percent of Medicare recipients receiving 3 or more lipid tests, by health referral region, in 2006.

Characteristics of 5% Medicare Sample, and Percentage of the Sample Receiving Serum Lipid Testing on 0, 1, 2, or >3 Different Occasions in 2006

TABLE 1

	No. Lipid Tests*			
	No. Subjects	Percent Receiving Test		
		0	1	2 3
Total sample	1,151,891	39.1%	31.4%	17.7% 11.9%
Age				
66–69	261,459	37.2%	32.4%	18.3% 12.0%
70–74	287,568	34.9%	32.6%	19.3% 13.2%
75–79	254,780	35.0%	32.4%	19.2% 13.4%
80–84	193,089	40.3%	31.3%	17.0% 11.5%
85	154,995	55.0%	25.7%	11.9% 7.4%
Sex				
Male	473,958	40.0%	30.6%	17.5% 12.0%
Female	677,933	38.4%	31.9%	17.8% 11.8%
Race				
White	1,017,283	38.6%	31.6%	17.9% 11.9%
Black	83,106	44.0%	29.7%	15.5% 10.8%
Other	51,502	40.1%	29.1%	17.1% 13.7%
Medicaid eligible				
Yes	140,076	44.3%	28.0%	16.0% 11.7%
No	1,011,815	38.3%	31.8%	17.9% 11.9%
Prior diagnosis of lipid disorder				
Yes	510,210	17.1%	35.1%	27.3% 20.5%
No	641,681	56.5%	28.4%	10.0% 5.1%
No. other indications for lipid testing				
0	265,910	64.8%	23.8%	8.1% 3.3%
1	420,218	35.7%	36.6%	18.2% 9.6%
2	282,833	27.8%	32.3%	22.8% 17.1%
3	182,930	26.7%	28.9%	22.8% 21.6%

	No. Lipid Tests*				
	No. Subjects	Percent Receiving Test			
		0	1	2	3
Hospitalization [†]					
Yes	52,814	34.4%	29.1%	19.7%	16.8%
No	1,099,077	39.3%	31.4%	17.6%	11.7%
Region					
New England	63,938	37.0%	32.9%	18.5%	11.6%
Middle Atlantic	157,230	34.3%	30.2%	19.8%	15.7%
East North Central	207,553	39.3%	32.5%	17.9%	10.3%
West North Central	90,019	45.2%	32.8%	14.4%	7.7%
South Atlantic	239,725	35.4%	30.6%	19.6%	14.3%
East South Central	77,980	41.1%	30.2%	17.6%	11.1%
West South Central	123,372	40.8%	31.0%	17.1%	11.1%
Mountain	62,587	47.1%	31.7%	13.8%	7.4%
Pacific	122,303	40.4%	32.3%	15.8%	11.5%
Rural/Urban					
Metro	857,159	37.7%	31.8%	18.2%	12.4%
Non-metro urban	247,406	42.9%	30.5%	16.5%	10.2%
Rural	33,919	45.5%	30.4%	15.3%	8.8%
No. different physicians seen					
0-1	385,812	59.1%	24.5%	10.8%	5.7%
2	234,036	34.2%	35.8%	18.9%	11.1%
3	186,375	29.8%	35.8%	20.9%	13.5%
4	131,947	27.0%	35.1%	22.2%	15.7%
>5	213,721	23.7%	32.8%	23.3%	20.2%
Total no. physician visits					
0-1	231,989	74.3%	18.2%	5.2%	2.4%*
2-5	358,646	36.9%	37.3%	18.2%	7.7%
6-9	257,793	27.5%	35.1%	22.4%	15.0%
10	303,463	24.5%	31.3%	22.7%	21.5%

No. Lipid Tests*				
	No. Subjects	Percent Receiving Test		
		0	1	2 3
No. usual care providers				
0	473,360	56.2%	28.9%	11.3% 3.7%*
1	439,019	28.8%	34.1%	21.7% 15.3%
2	164,983	24.9%	32.2%	22.8% 20.2%
3	74,219	21.8%	29.1%	23.2% 25.9%
Among Medicare beneficiaries who had at least 1 UCP				
Type of usual care provider				
Generalist				
0	147,704	34.8%	33.1%	18.8% 13.4%
1	497,801	25.2%	33.3%	23.0% 18.5%
2	32,726	21.4%	29.9%	23.9% 24.7%
Internal medicine specialist				
0	479,962	27.6%	34.3%	22.2% 15.9%
1	161,777	26.9%	30.8%	22.0% 20.4%
2	46,492	22.0%	27.3%	22.4% 28.3%
Surgeon				
0	577,688	26.6%	33.1%	22.4% 17.9%
1	93,907	30.1%	33.0%	20.6% 16.3%
2	6656	26.6%	32.0%	22.2% 19.2%
Other				
0	580,726	26.9%	33.0%	22.3% 17.8%
1	89,898	28.8%	33.9%	21.0% 16.3%
2	7607	26.8%	31.9%	21.7% 19.6%

Information on diagnosis of lipid disorder or other indications for lipid testing were obtained from all diagnoses in all inpatient and outpatient encounters in 2005–2006. Information on number and type of outpatient providers seen was from 2006.

* All differences in percent receiving lipid testing by characteristics are significant at $P < 0.001$ by χ^2 .

† Any hospitalization in 2005 or 2006 with primary discharge diagnosis of cerebrovascular or cardiovascular disease or diabetes.

TABLE 2

Multivariable Analysis of Factors Associated With Repetitive Measurement of Serum Lipids

	Model 1 OR (95% CI)	Model 2 OR (95% CI)
Age		
66–69	1.00	1.00
70–74	1.00 (0.98, 1.02)	0.97 (0.96, 0.99)
75–79	0.93 (0.91, 0.94)	0.89 (0.87, 0.91)
80–84	0.76 (0.75, 0.78)	0.73 (0.72, 0.75)
85	0.54 (0.53, 0.55)	0.55 (0.53, 0.56)
Sex		
Male	1.00	1.00
Female	1.00 (0.99, 1.01)	1.01 (1.00, 1.03)
Race		
White	1.00	1.00
Black	0.85 (0.83, 0.87)	0.90 (0.88, 0.92)
Other	1.10 (1.07, 1.14)	1.13 (1.10, 1.17)
Prior diagnosis of lipid disorder		
No	1.00	1.00
Yes	3.16 (3.12, 3.20)	2.98 (2.94, 3.02)
No. other indication for lipid test		
0	1.00	1.00
1	1.87 (1.82, 1.91)	1.67 (1.63, 1.71)
2	3.11 (3.03, 3.18)	2.61 (2.55, 2.68)
3	3.91 (3.81, 4.01)	2.97 (2.89, 3.05)
Hospitalization *		
No	1.00	1.00
Yes	0.78 (0.76–0.80)	0.78 (0.76–0.80)
No. UCP generalists seen		
0	1.00	1.00
1	2.43 (2.40, 2.46)	1.92 (1.89, 1.95)
2	2.98 (2.89, 3.07)	2.09 (2.03, 2.15)
Total no. provider visits		
0–1		1.00
2–5		1.60 (1.55, 1.65)
6–9		2.25 (2.18, 2.32)
10		2.45 (2.37, 2.54)
No. UCP internal medicine specialists seen		
0		1.00
1		1.45 (1.43, 1.47)
2		1.90 (1.85, 1.95)

Information on diagnosis of lipid disorder or other indications for lipid testing were obtained from all diagnoses in all inpatient and outpatient encounters in 2005–2006. Information on number and type of outpatient providers seen was from 2006.

* Hospitalization in 2005 or 2006 associated with a primary discharge diagnosis of cerebrovascular disease, cardiovascular disease, or stroke.

CI, confidence interval; OR, odd ratio.