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Low Primary Lipid Screening among Medicare Patients with Rheumatoid Arthritis

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Abstract

Objective—Although reports demonstrate suboptimal preventive cancer screening in RA patients, primary lipid screening performance has not been systematically examined. We examined associations between primary lipid screening and visits to primary care providers (PCPs) and rheumatologists among a national sample of older RA patients.

Methods—This retrospective cohort study examines a 5% Medicare sample including 3,298 RA patients without baseline cardiovascular disease (CVD), diabetes, or hyperlipidemia, that were considered eligible for primary lipid screening (2004–2006). The outcome was probability of lipid screening by the relative frequency of primary care and rheumatology visits, or seeing a PCP at least once each year.

Results—Primary lipid screening was performed in only 45% of RA patients. Overall, 65% received both primary and rheumatology care, and half saw a rheumatologist as often as a PCP. Any primary care predicted more lipid screening than lone rheumatology (26%, 95% CI=21, 32). As long as a PCP was involved, lipid screening performance was similar regardless of the balance between primary and rheumatology visits, (44–48%, CI=41–51). Not seeing a PCP at least annually decreased screening 22% (adjusted risk ratio [ARR]=0.78, 0.71, 0.84).

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Conclusion—Primary lipid screening was performed in fewer than half of eligible RA patients, highlighting a key target for CVD risk reduction efforts. Annual PCP visits improved lipid screening, though performance remained poor (51%). Half of RA patients saw their rheumatologist as often, or more often, than a PCP, illustrating the need to study optimal partnerships between primary care and rheumatologists for screening CVD risks.

Although patients with rheumatoid arthritis (RA) are most often cared for by both primary care providers (PCPs) and rheumatologists, preventive screening remains suboptimal (1,2), and the mortality gap between RA patients and peers has widened (3,4). Cardiovascular disease (CVD) is the leading cause of death for patients with RA. These patients experience a 10-year risk of CVD events that is 50–60% higher than age-matched peers (5,6). Reductions in cardiovascular mortality seen in the general population in recent decades (7) have not been seen among patients with RA (3–5), and cardiovascular risk has not equilibrated even with aggressive RA treatments (8). Consequently, adequate screening for traditional CVD risk factors is strongly indicated for RA patients.

Primary preventive screening is key to identify modifiable traditional CVD risk factors. To date primary preventive lipid screening performance has not been systematically examined in a national RA sample. Compounding the challenge, no widely known RA-specific CVD preventive guidelines exist despite increased CVD risk in RA. The European League Against Rheumatism (EULAR) has issued recommendations for an annual CVD risk review (9). For all adults, the National Cholesterol Education Program (NCEP) recommends lipid screening in those with CVD risk factors "*more frequently* than every 5 years" (10).

Prior reports suggest that RA patients frequently experience unidentified and uncontrolled traditional modifiable CVD risk factors including hyperlipidemia and hypertension (11–13). Though not studied specifically in RA, according to the recent JUPITER trial, C-reactive protein elevations may also merit consideration of lipid-lowering therapy (14,15). RA patients see multiple physicians annually, with rheumatology visits often outnumbering primary care encounters (16). The influence of multisource care and competing comorbidities raise questions of whether the process of care can be optimized to improve primary preventive screening for patients with RA and other chronic conditions (17). Older adults, in particular, are receiving aggressive RA treatment (18) but are at greatest absolute risk for coronary events. They may also be most vulnerable to lapsed prevention due to competing comorbidities and multisource care. As a result, older RA patients represent a key target population for CVD risk factor modification.

In this study we investigated the impact of rheumatology and primary care outpatient visit patterns upon primary preventive lipid screening among a group of older adults with RA. We specifically examined whether individual likelihood of lipid screening differed by types of providers seen each year and relative proportions of visits to primary care and rheumatology. Reflecting the more conservative NCEP recommendation versus EULAR recommendations, we examined lipid screening over a three-year window.

PATIENTS AND METHODS

Setting and Participants

In this retrospective cohort study, beneficiaries age 65 and older that were continuously enrolled and alive from January 1, 2004 through December 31, 2006 were identified from a national 5% random Medicare sample. Patients were determined to have RA if they had two or more International Classification of Diseases, Ninth Edition (ICD-9) codes for RA (714.0–714.33) on inpatient or outpatient claims at least two months apart during a 24-month period January 1, 2004 through December 31, 2005 based upon a previously

validated algorithm (1,19). Exact correlation with the American College of Rheumatology (ACR) diagnostic criteria was not determined due to data limitations. Enrollment and claims data (2004–2006) were extracted for 29,425 patients meeting the RA definition. The Medicare denominator file was used to exclude beneficiaries a) without continuous Medicare Part A or B coverage, b) with supplemental HMO or railroad benefits, or c) who died prior to December 31, 2006 (n=3,970). The Institutional Review Board at the University of Wisconsin approved this study with a waiver of consent.

Given more strict standards for secondary lipid testing intervals, patients were excluded if they had pre-existing CVD or diabetes indicated by a flag for those conditions dated before January 1, 2004 in the Medicare Chronic Condition Warehouse (CCW) dataset (n=17,707), or if they had lone baseline hyperlipidemia (n=3,675). The CCW contains flags created using validated algorithms applied bi-annually since 1999 to define 21 chronic diseases (20–25). Exclusion flags from the CCW dataset were pre-existing CVD (myocardial infarction, stroke, heart failure, or ischemic heart disease) (21–24,26) or diabetes, a CVD risk equivalent (20,25). Baseline hyperlipidemia was identified and excluded based on more than one ICD-9 code 272.0–272.4 in 24 months 2004–2005 (27). Given that the outcome of interest was outpatient lipid screening we also excluded those without any outpatient encounters 2004–2006 (n=775). Ultimately, our remaining 3,298 patients eligible for primary prevention lipid screening from this 5% sample represented nearly 66,000 Medicare RA patients nationwide.

Variables

All variables were obtained from Medicare data. The main dependent variable was receiving screening for hyperlipidemia during the three-year period (2004–2006). This time period was selected based on existing recommendations, although no RA-specific cardiovascular screening guidelines exist. Lipid screening was identified by current procedural terminology (CPT) codes indicating lipid panel testing (80061), low density lipoprotein (LDL) cholesterol (83721), electrophoretic lipoprotein (83715), high resolution lipoprotein (e.g., NMR) (83716), electrophoretic or high resolution lipoproteins (83700, 83701, or 83704), or calculated LDL components (82465, 83718, and 84478) (28). The patient was considered to have had a lipid screen if any of these CPT codes was present at least once over the three years.

The main explanatory variables were relative frequency of rheumatology and primary care visits, or a dichotomous representation of seeing a primary care provider at least once each year. The first was a categorical representation of primary care and rheumatology visit patterns determined by examining relative proportions of Medicare visit claims reflecting type of practitioner. Primary care providers were defined as family medicine or internal medicine physicians, physician assistants, or nurse practitioners.(29,30). Combined care from a rheumatologist and a primary care provider was subdivided into “PCP≥Rheum” if annual average primary care visits equaled or outnumbered rheumatology visits, and “Rheum>PCP” if rheumatology visits predominated. Patients who had primary care visits without any rheumatology visits over the three-year period were considered “Lone Primary Care”, and those with rheumatology visits and no primary care visits were called “Lone Rheumatology”. A second analysis examined likelihood of lipid testing in those who saw a primary care provider at least once each of the three years 2004–2006, compared to those who did not.

Individual sociodemographic characteristics were included as other potential explanatory variables. These included age, sex, race, designation of ever receiving Medicaid, and residence grouped using US Department of Agriculture census-based Rural Urban Commuting Area codes (31). Claims for a gait assistance device or qualifying orthopedic

surgery (32,33) in the study period were used as RA disease surrogates to compare severity. Additionally, patient comorbidities were assessed using the Centers for Medicare and Medicaid Services - Hierarchical Condition Categories (HCC) scale (34). This validated measure uses inpatient and ambulatory claims in the baseline year (2004) to calculate predicted expenditures, reflecting comorbidities that increase healthcare utilization, wherein a score of one represents the predicted cost of an average Medicare patient. Measures of utilization included average annual number of outpatient visits and total number of unique providers (primary care, rheumatology, and non-rheumatology specialists), as well as ever being hospitalized between 2004–2006.

Statistical Analysis

Logistic regression with robust estimates of the variance was used to analyze the relationship between explanatory variables and ever receiving lipid screening. Adjusted and unadjusted probabilities of screening were estimated by visit pattern. Age, gender, race, Medicaid status, prior hospitalization status, prior orthopedic surgery, prior gait-assistance device, HCC comorbidity, and average numbers of annual providers and annual visits were included within logistic models based upon theoretical importance. Given prior work demonstrating optimal cancer screening among RA patients with both rheumatology and primary care (1), the “PCP≥Rheum” category served as the referent group for the visit pattern variable.

Analyses were conducted using SAS version 9.1.3 (SAS Institute, Inc., Cary, NC) and Stata version 10.0 (StataCorp, College Station, TX). Results of logistic regression were reported as adjusted predicted probabilities, adjusted risk ratios (ARR), and 95% confidence intervals (35). Adjusted predicted probabilities were estimated based on the recycled predictions approach using the Stata margins command. This approach predicts the outcome (lipid screening) assuming that everyone in the data was treated as if they had a certain visit pattern. Confidence intervals were calculated using the delta method and allowed correlation among observations analogous to the robust option to estimate the logistic regression.

Role of the Funding Sources

External funding sources supported data management but had no role in the design, analysis, or reporting of this study.

RESULTS

Descriptive Characteristics

As expected, our sample consisted of predominantly white women with RA who were generally healthy, though other patient characteristics varied significantly by visit patterns. Among the final sample of 3,298 RA patients, 58% were age 65–74 years, 83% were female, and 90% were white (Table 1). During the three-year period, 39% were hospitalized at least once. The HCC baseline comorbidity score was 0.81, suggesting that our primary cardiovascular prevention RA patients were predicted to have lower than average Medicare expenditures. Sixty five percent saw both a primary care provider and rheumatologist over the observed period. As classified, the entire sample included 27% who received lone primary care (N=886), 34% who received at least the same number of primary care visits as rheumatologist visits (N=1139), 31% who received fewer primary care visits than rheumatologist visits (N=1,017), and 8% who received lone rheumatology care (N=256). All patient characteristics varied by visit pattern. Patients without any primary care were younger, more rural, and had lower HCC risk adjustment scores than those with a PCP. They were less likely to be hospitalized or to have orthopedic surgery or gait devices.

Patients saw an average of six providers in an average of almost nine annual visits (Table 2). The mean number of primary care visits exceeded the mean number of other non-rheumatology specialty visits (3.4 compared to 2.8 visits annually). Both outnumbered the average of 2.4 annual visits to rheumatology among this RA group. Those without primary care saw fewer total providers (3.3 SD=2.1 versus 6.2 SD=3.6) in fewer annual visits (5.4 SD=4.7 versus 8.6 SD=5.5). Overall ratios of primary care to rheumatology visits varied widely, although approximately half of all patients saw their rheumatologist at least as often as their primary care provider (Figure 1).

Lipid Screening

Adjusted results show that lipid screening occurred in 45% of eligible patients (Table 3, Top). Adjusted predicted probabilities of lipid screening ranged from 26% (CI=21, 32) of patients with lone rheumatology care to 44–48% (CI=41–51) of patients with at least some primary care visits. These percentages differed only slightly from the unadjusted results. When compared to the “PCP≥Rheum” referent group, patients with lone rheumatology care demonstrated significantly lower lipid screening (ARR=0.55, CI=0.42–0.67). There was no difference in lipid screening between the “Lone PCP,” “Rheum≥PCP,” and the “PCP≥Rheum” groups by either statistical method.

In our second analysis those who did not see a primary care provider at least annually were less likely to have lipid testing, 39% versus 51% (Table 3, Bottom). Adjusted risk ratio calculations predicted 22% lower likelihood of lipid screening in RA patients who did not see a PCP at least once each year (ARR=0.78, 0.71, 0.84).

Predictors of Lipid Screening

Among our other explanatory variables, a higher provider quartile (reflecting more total unique providers) predicted higher lipid screening (Table 4). Older age, greater risk-adjustment scores (reflected by higher HCC quartile), large town residence, and lowest annual visit quartile (reflecting least number of outpatient visits) were associated with a lower likelihood of lipid screening.

DISCUSSION

Recognizing CVD as the leading cause of death in RA, we sought to examine primary preventive screening for hyperlipidemia as a modifiable cardiac risk among RA patients in relationship to primary care and rheumatology outpatient visits. Overall, lipid testing occurred in fewer than half of all those eligible over three years. Patients with lone rheumatologic care had substantially less lipid screening when compared to patients with any primary care: 22% for lone rheumatologic care compared to 43–51% with other visit patterns that included at least some primary care. Those who saw a primary care provider at least once each year faired best with 51% testing. This finding was consistent with a study done in 2000 reporting lower routine cancer screening among RA patients without primary care contact, and a 2010 report examining multiple preventive services in RA (1,26). However in our study, even with primary care involvement, observed rates of lipid screening remained poor regardless of visit proportions, suggesting a need to systematically improve preventive cardiovascular care for patients with RA.

We found that primary lipid screening for RA patients was significantly less frequent than reported rates in average ambulatory Medicare beneficiaries, estimated at 50–55% each year (36). Our low observed screening performance also contrasts with the aforementioned 2010 RA study that reported 5-year lipid testing performance at 83.5% (26). However that study did not separately examine primary versus secondary CVD risk screening populations or

control for prevalent hyperlipidemia, CVD, or risk equivalents. Maintenance testing among secondary prevention populations, versus actual primary lipid screening, likely inflated observed rates in that study, though longer observation may have also influenced results. Performance in our primary prevention RA cohort was more analogous to screening in younger average-risk HMO populations whose three-year LDL testing was ~40% (37). Our observed screening performance below general HMO and Medicare population rates suggest that RA patients were not receiving routine screening. This suggests possible impediments to routine care delivery, uncertainty regarding the complex relationship between lipids and CVD risk in RA (38,39), or under-recognition of RA itself as a cardiovascular risk factor.

In our study, other predictors of poor lipid screening demonstrate opportunities to improve care for those who are older, sicker and have the fewest outpatient visits. Patients with more visits and a higher number of unique providers were more likely to be screened, consistent with a report citing that relevant specialist involvement may improve screening in complex patients (40). Conversely, the finding of low screening among patients from large towns may reflect lower provider density, or smaller group practices that report lower quality than larger group practices (29).

Universally, addressing the elevated CVD risk from inflammatory arthritis requires additional knowledge and vigilance to capture care delivery opportunities. In our sample, half of patients saw their rheumatologist at least as often as their PCP, and other reports suggest that rheumatology encounters often outnumber PCP visits (16). Rheumatologists may feel that prevention is the role of primary care providers and may not want to interfere, even though they may be more familiar with CVD risk in RA. Primary care providers may be stretched to invoke disease specific prevention in limited encounters with patients also receiving specialty care. Coordinating the expertise of both the rheumatologist and primary care providers may be useful to improve preventive cardiovascular care.

Collaboration with specialists has been shown to improve the quality of preventive care for patients with complex conditions (41,42); this collaboration may mitigate the common finding that patients with competing comorbidities often receive less preventive care than healthier patients (17,40). One multi-specialty health network with a well-integrated electronic health record reported superior lipid and osteoporosis screening among patients with RA compared to the total network cohort, suggesting that optimal system support and multispecialty collaboration can enhance care delivery to complex populations (43).

An optimal partnership between rheumatology and primary care to address cardiovascular risk has not been defined. Rheumatologists are familiar with RA disease-specific risks and could play a more active role in this process. Rheumatologists could educate patients and primary care clinicians regarding increased CVD risk in RA, or actively order screening, and/or co-manage modifiable risk factors. For instance, in contrast to low frequency lipid screening noted in our study, one academic rheumatology clinic that implemented routine screening practices reported 88% lipid testing at five years, highlighting the potential impact of specialty-driven protocols (44). A pivotal parallel example of shifting prevention roles is the move in recent years to include osteoporosis within the relevant scope of specialty practice. Studies demonstrate that screening rates and treatment of routine and glucocorticoid-induced osteoporosis improve with rheumatologist collaboration (45,46). Moreover, the 2010 study examining multiple evidence-based preventive services in RA showed that combined rheumatology and primary care predicted higher overall performance (26). Our finding of improved lipid testing among those who saw a PCP at least once each year may suggest a role for rheumatologists to advocate annual PCP visits for RA patients.

Formal specialist roles have also been examined amidst the expanding dialogue regarding the "patient-centered medical home" (47,48). The American College of Physicians (ACP) identifies rheumatologists caring for RA patients as a possible specialty-based medical home if first-contact, whole person, continuous, and integrated care is provided. However, the ACP Committee of Subspecialty Societies proposed an alternative specialist role as a "medical neighbor," expanding the prior idea of a coordinated health system as a "medical neighborhood" (49). As medical neighbors, specialists are not required to assume first-contact primary care responsibilities, but to promote co-management within the health system (47). As such, rheumatologists may advocate annual PCP visits or co-manage cardiovascular prevention as good medical neighbors without assuming all primary care responsibilities. As research regarding the patient-centered medical home expands, and health systems increasingly assume responsibility for promoting health among populations, the role of specialists as medical neighbors for cardiovascular preventive care should be explored further.

As with any scientific analysis, this study has some limitations. First, there is the potential for misclassification of RA and other diagnoses. To address this concern, previously validated algorithms were used (1,19). Though the strictest validation study used only rheumatologist-reported RA coding (19) which demonstrated high correlation with audited ACR criteria, we adopted the convention of subsequent authors who used more than one RA code in 24 months (1,2,18) to ensure including RA patients exclusively receiving primary care. Misclassification of osteoarthritis (OA) as RA may have occurred more frequently in the lone primary care group, but low screening rates appear consistent with rates among those receiving combined rheumatology and primary care suggesting that if OA patients were included it did not appear to have influenced observed screening. Second, there may be unmeasured differences between patients who see only a rheumatologist, such as patient preferences. We approached this concern by limiting our scope to primary prevention, stratifying and adjusting for a wide range of variables including number of visits, unique providers, overall comorbidity, and RA severity surrogates, though RA disease activity measures and treatments were not available. We found that the lone rheumatology group was least likely to receive orthopedic surgery or gait devices, suggesting that they did not have historically worse RA to justify lapsed screening. However, in the absence of acute disease activity measures or medications, we cannot exclude rational delays in screening given lipid fluctuations in patients with acute inflammation and steroid treatment (39). We also acknowledge that ICD algorithms may underestimate hyperlipidemia if patients receive medications without coding the diagnosis. Quality measures recommend annual lipid testing among such secondary prevention patients even with statin treatment, so poor screening among potentially misclassified secondary risk patients on statins would reflect even more poorly. Third, the sample was limited to older adults with RA prior to 2006. It is unclear if our results are generalizable to younger patients or more recent years. However, it remains possible that with less comorbidity triggering health system contacts, younger RA patients may have even lower rates of lipid screening.

Finally, given that current RA-specific recommendations for CVD prevention are not explicit, and the exact role of lipids in CVD risk may be non-linear, our choice of a three-year versus five-year window for assessing lipid screening could be questioned (12,50). However, it is unlikely that the poor observed screening rates would drastically improve by using a five-year window. As a simple exercise, if we consider our screening rate over three years, the inclusion of two more years boosts screening rates to 71% at best, still leaving more than one in four unscreened. Future work could examine a longer period, and should include a comprehensive assessment of all traditional CVD risk factors, as well as actual CVD outcomes.

In this primary CVD prevention cohort of RA patients, lipid screening was frequently overlooked. When examining visit patterns, as long as a primary care provider was involved, no significant difference in screening probabilities emerged regardless of the balance between primary and rheumatology specialty care. A 22% improvement in testing among those seeing a PCP at least once each year suggests a role for advocating annual PCP visits for patients with RA, though performance improved only to 51%. The remaining gap suggests that lapses in prevention may be one potential mechanism explaining why patients have not fully benefitted from declines in CVD seen in the general population despite aggressive RA treatment (3–5,7). The observed gap in lipid screening highlights a key target for CVD risk reduction efforts. In addition, the finding that half of RA patients see their rheumatologist at least as often as primary care suggests a need to study optimal partnerships between primary care providers and specialists for screening CVD risk factors in high-risk populations within their medical homes and neighborhoods.

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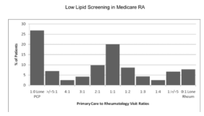

FIGURE 1.

Distribution of Primary Care to Rheumatology Visit Ratios (n=3,298). Ratio of primary care to rheumatology care visits calculated over 3 years to the nearest integer. 1:0 (left) denotes lone primary care, 0:1 (right) represents lone rheumatology care, and 1:1 (center) indicates individuals with equal proportions of visits. PCP = Primary care provider, Rheum = Rheumatologist

Table 1

Characteristics of Medicare beneficiaries with RA eligible for primary lipid screening, overall and by visit patterns (N=3,298)

Characteristic	All Patients (n=3,298)	Lone PCP (n=886)	PCP≥Rheum (n=1,139)	Rheum>PCP (n=1,017)	Lone Rheum (n=256)
Age, % (n)					
65–74 years	58.4 (1,927)	49.8 (441)	56.1 (639)	67.1 (682)	64.5 (165)
75–84 years	35.3 (1,163)	40.9 (362)	37.2 (424)	29.7 (302)	29.3 (75)
85+ years	6.3 (208)	9.4 (83)	6.7 (76)	3.2 (33)	6.3 (16)
Female, % (n)	83.4 (2,750)	82.2 (728)	86.7 (988)	82.3 (837)	77.0 (197)
Race/ethnicity, % (n)					
White	90.0 (2,967)	85.8 (760)	91.1 (1,038)	92.2 (938)	90.2 (231)
Black	6.4 (212)	8.4 (74)	6.2 (70)	5.1 (52)	6.3 (16)
Other	3.6 (119)	5.9 (52)	2.7 (31)	2.7 (27)	3.5 (9)
Medicaid, % ever (n)	10.3 (341)	16.9 (150)	8.3 (95)	6.6 (67)	11.3 (29)
Hospitalization, % ever (n)	39.0 (1,285)	43.3 (384)	45.3 (516)	31.2 (317)	26.6 (68)
Orthopedic surgery, % ever (n)	26.9 (888)	22.8 (202)	29.0 (330)	30.1 (306)	19.5 (50)
Gait device, % ever (n)	20.0 (660)	23.3 (206)	22.5 (256)	15.8 (161)	14.5 (37)
HCC comorbidity score, mean (SD)	0.81 (0.45)	0.80 (0.44)	0.83 (0.50)	0.80 (0.42)	0.78 (0.37)
Rural urban commuting areas, % (n)					
Urban	60.5 (1,990)	54.8 (484)	60.3 (685)	66.6 (677)	56.5 (144)
Suburban	9.9 (327)	10.3 (91)	10.3 (117)	9.6 (97)	8.6 (22)
Large town	13.7 (452)	17.0 (150)	14.8 (168)	10.9 (111)	9.0 (23)
Small town	15.9 (522)	17.9 (158)	14.7 (167)	12.9 (131)	25.9 (66)

RA = Rheumatoid arthritis; PCP = Primary care provider; Rheum = Rheumatologist; HCC = Hierarchical Condition Categories scale; SD = Standard deviation

Table 2

Unique provider totals* and annual† average visits for lipid screening by visit patterns (N=3,298)

Characteristic	All Patients (n=3,298)		Lone PCP (n=886)		PCP≥ Rheum (n=1,139)		Rheum>PCP (n=1,017)		Lone Rheum (n=256)	
	Mean	(SD) Range	Mean	(SD) Range	Mean	(SD) Range	Mean	(SD) Range	Mean	(SD) Range
Total unique providers	6.2	(3.6) 1–30	5.1	(3.0) 1–18	7.6	(3.8) 2–30	6.4	(3.4) 2–27	3.3	(2.1) 1–13
Unique PCPs	2.1	(1.6) 0–17	2.3	(1.4) 1–16	2.8	(1.7) 1–17	1.8	(1.2) 1–10	N/A	N/A
Unique rheumatologists	0.8	(0.7) 0–7	N/A	N/A	1.2	(0.5) 1–6	1.3	(0.6) 1–7	1.1	(0.3) 1–3
Unique other specialty	3.2	(2.6) 0–21	2.8	(2.4) 0–13	3.7	(2.8) 0–21	3.3	(2.8) 0–12	2.2	(2.0) 0–12
Annual outpatient visits	8.6	(5.5) 0.3–56	6.8	(4.6) 0.3–41	10.2	(5.8) 0.7–56	9.1	(5.3) 1.3–51	5.4	(4.7) 0.3–54
Annual PCP visits	3.4	(3.0) 0–35	4.4	(3.2) 0.3–28	4.9	(3.1) 0.3–35	1.8	(1.3) 0.3–8	N/A	N/A
Annual rheumatology visits	2.4	(2.8) 0–51	N/A	N/A	2.2	(1.4) 0.3–10	4.4	(3.2) 0.7–46	3.3	(3.4) 0.3–52
Annual other specialty visits	2.8	(3.1) 0–38	2.4	(2.7) 0–21	3.2	(3.3) 0–38	2.8	(3.1) 0–25	2.1	(2.5) 0–17

RA = Rheumatoid arthritis; PCP = Primary care provider; Rheum = Rheumatologist; SD=Standard deviation

*Unique provider totals reflect a 3 year total wherein physician assistant and nurse practitioner visits were attributed to primary care.

†Annual mean indicates annualized values determined dividing visit totals from 2004–2006 by 3 years.

Table 3

Analysis of effect of visit pattern and seeing PCP annually on multivariate adjusted predicted probability, adjusted risk ratio, and 95% confidence intervals (CI) for logistic regression predicting lipid screening (n=3,298).

Characteristic	Unadjusted Probability (%)	Adjusted† Predicted Probability (%)	Adjusted 95% CI	Adjusted Risk Ratio	Adjusted 95% CI
All Patients	**45.1**	**45.1**	**(43.3, 46.7)**		
Screening by visit pattern					
Lone PCP (n=886)	43.1	47.4	(44.0, 50.8)	0.99	(0.89, 1.08)
PCP≥Rheum (n=1,139)	50.7	48.1	(45.1, 51.1)	1.00	Reference
Rheum>PCP (n=1,017)	46.5	44.1	(41.0, 47.1)	0.92	(0.83, 1.0)
Lone Rheum (n=256)	21.5	26.3	(20.5, 32.2)	0.55	(0.42, 0.67)†
Screening by seeing PCP at least annually					
<1PCP visit/yr (n=1,671)	39.4	39.4	(37.0, 41.9)	0.78	(0.71, 0.84)†
>/=1PCP visit/yr (n=1,627)	50.9	50.8	(48.3, 53.3)	1	Reference

PCP = Primary care provider; Rheum = Rheumatologist

*Final logistic models included either visit pattern or dichotomized annual PCP visit status, and all of the following: categorical age, gender, race, Medicaid status, HCC, residence, and annual total visit and provider quartiles.

†Statisically significant within group variation by 95% CI.

Table 4

Multivariate adjusted predicted probability, adjusted risk ratio, and 95% confidence intervals (CI) for logistic regression predicting lipid screening (n=3,298)

Characteristic	Unadjusted Probability (%)	Adjusted† Predicted Probability (%)	Adjusted 95% CI	Adjusted Risk Ratio	Adjusted 95% CI
All Patients	**45.1**	**45.1**	**(43.3, 46.7)**		
Lone PCP	43.1	47.4	(44.0, 50.8)	0.99	(0.89, 1.08)
PCP≥Rheum	50.7	48.1	(45.1, 51.1)	1.00	Reference
Rheum>PCP	46.5	44.1	(41.0, 47.1)	0.92	(0.83, 1.0)
Lone Rheum	21.5	26.3	(20.5, 32.2)	0.55	(0.42, 0.67)†
Age Categories					
Age 65–74	49.9	49.3	(47.1, 51.6)	1.00	Reference
Age 75–84	40.4	40.6	(37.9, 43.5)	0.82	(0.76, 0.89)†
Age 85+	26.9	29.8	(23.3, 36.2)	0.60	(0.47, 0.74)†
Gender					
Female	44.9	44.6	(42.7, 46.4)	0.94	(84.9, 1.03)
Male	46.0	47.6	(43.4, 51.7)	1.00	Reference
Race/ethnicity					
White	45.1	44.8	(43.0, 46.6)	0.93	(0.75, 1.11)
Black	44.8	46.5	(39.6, 53.4)	0.96	(0.74, 1.20)
Other	46.2	48.3	(39.1, 57.4)	1.00	Reference
Medicaid (ever)	38.1	42.4	(36.8, 47.9)	0.93	(0.81, 1.06)
HCC comorbidity quartiles					
Lowest quartile	49.9	48.8	(45.2, 52.4)	1.00	Reference
Second quartile	47.0	47.7	(44.4, 51.0)	0.98	(0.88, 1.08)
Third quartile	45.1	44.8	(41.3, 48.3)	0.92	(0.82, 1.02)
Highest quartile	39.3	39.8	(36.5, 43.0)	0.82	(0.72, 0.91)†
Residence categories					
Urban	47.4	47.2	(44.9, 49.3)	1.00	Reference
Suburban	43.1	42.3	(37.1, 47.5)	0.90	(0.78, 1.02)
Large town	39.1	38.6	(34.2, 42.9)	0.82	(0.72, 0.92)†
Small town	42.3	44.7	(40.4, 48.9)	0.95	(0.85, 1.05)

Characteristic	Unadjusted Probability (%)	Adjusted† Predicted Probability (%)	Adjusted 95% CI	Adjusted Risk Ratio	Adjusted 95% CI
Annual total visit quartiles					
Lowest quartile (1–<5)	32.6	40.7	(36.5, 44.9)	0.85	(0.75, 0.95)†
Second quartile (5–<8)	45.7	47.7	(44.5, 51.0)	1.00	Reference
Third quartile (8–< 11)	46.7	46.7	(43.0, 50.4)	0.98	(0.88, 1.08)
Highest quartile (≥11)	52.9	44.8	(40.9, 48.6)	0.94	(0.83, 1.05)
Total provider quartiles					
Lowest quartile (0–<3)	37.2	35.1	(30.8, 39.4)	0.64	(0.53, 0.74)†
Second quartile (3–5)	43.2	42.6	(39.2, 45.9)	0.77	(0.68, 0.86)†
Third quartile (>5–8)	50.1	46.8	(43.5, 50.0)	0.85	(0.76, 0.93)†
Highest quartile (≥8)	51.2	55.2	(50.9, 59.5)	1.00	Reference

PCP = Primary care provider; Rheum = Rheumatologist; HCC = Hierarchical Condition Categories scale

*Final logistic model included visit pattern, categorical age, gender, race, Medicaid status, HCC, residence, and annual total visit and provider quartiles

†Notes statistically significant within group variation by 95% CI.