Patient and Physician Predictors of Hyperlipidemia Screening and Statin Prescription

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ABSTRACT

OBJECTIVES: Appropriate lipid management has been demonstrated to reduce cardiovascular events, but rates of hyperlipidemia screening and statin therapy are suboptimal. We aimed to evaluate patient and physician predictors of guideline-concordant hyperlipidemia screening and statin prescription.

STUDY DESIGN: Retrospective study of patients with primary care provider (PCP) visits from 2014 to 2016 at the University of Pennsylvania Health System.

METHODS: Data on patients, screening orders, and prescriptions were obtained from the electronic health record. Multivariate logistic regression models were fit to binary outcomes of lipid screening and statin prescription.

RESULTS: Among 97,189 eligible patients, 79.9% had an order for hyperlipidemia screening. In adjusted models, significant patient predictors of greater odds of having screening ordered included a history of diabetes (odds ratio [OR], 1.19; 95% CI, 1.10-1.29; *P* <.001) or hypertension (OR, 1.16; 95% CI, 1.10-1.23; *P* <.001). Significant provider predictors of lower odds of having screening ordered were being a resident PCP (OR, 0.63; 95% CI, 0.43-0.93; *P* = .021) or being trained in family medicine (OR, 0.37; 95% CI, 0.30-0.47; *P* <.001). Among 40,845 eligible patients, 56.1% were prescribed a statin. In adjusted models, significant patient predictors of greater odds of being prescribed a statin were if they had a history of diabetes (OR, 2.70; 95% CI, 2.32-3.13; *P* <.001) or clinical cardiovascular disease (OR, 2.26; 95% CI, 1.85-2.76; *P* <.001). Significant provider predictors of lower odds of being prescribed a statin were being a physician assistant (OR, 0.65; 95% CI, 0.52-0.81; *P* <.001) or female (OR, 0.82; 95% CI, 0.70-0.96; *P* = .01).

CONCLUSIONS: Both patient and provider factors significantly predicted guideline-concordant care for hyperlipidemia screening and statin therapy.

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Cardiovascular disease (CVD) is the leading cause of morbidity and mortality in the United States.[1,2] Management of hyperlipidemia has been demonstrated to reduce cardiovascular mortality and events by more than 30%.[3-8] National guidelines have been established to provide recommendations for hyperlipidemia screening and statin therapy.[9-11] Despite these benefits and guidelines, many patients do not receive guideline-recommended management.[12-15] In national evaluations, nearly one-third of eligible patients were not screened for hyperlipidemia[16] and more than 40% of patients with established atherosclerotic cardiovascular disease (ASCVD) were not taking a statin.[15]

The steps toward improved lipid management involve both patients and physicians.[17] Although several studies have investigated patient predictors of statin use,[13-15] none have adequately adjusted for physician factors, such as demographics, training, and experience. Even less is known about patient and physician predictors of hyperlipidemia screening.[16,18,19]

The objective of this study was to evaluate patient and physician factors that predict guideline-concordant lipid management, including lipid screening and statin prescription. We examined patients with a primary care provider (PCP) visit during a 2-year period at a large academic medical center.

METHODS

The University of Pennsylvania Institutional Review Board approved this study. A waiver of informed consent was granted because the study posed minimal risks and would have otherwise been infeasible.

Participants

The sample was composed of patients aged 40 to 75 years with a PCP at the University of Pennsylvania Health System (Philadelphia, Pennsylvania) and at least 1 clinic visit with the PCP between October 1, 2014, and September 30, 2016. Patients with a PCP who completed residency during the study period and those with incomplete clinical or demographic data from the electronic health record (EHR) to

TAKEAWAY POINTS

Both hyperlipidemia screening and guideline-concordant statin prescription rates are suboptimal. This study investigated predictors affecting hyperlipidemia screening and, specifically, physician predictors of guideline-concordant statin prescription.

- The findings from this study can be used to better target interventions at a health-system level based on physician factors, like level and type of training, and patient factors, like race or clinical comorbidity. In addition, these findings should be validated in other practice settings.
- This study builds on previous work to advance our understanding of factors that affect hyperlipidemia screening rates, an area previously poorly understood.

establish if guidelines were met for hyperlipidemia screening or statin prescription were excluded.

For the lipid screening cohort, we used the 2008 US Preventive Services Task Force (USPSTF) guidelines,[11] which recommend screening men 35 years or older and women 45 years or older or those with CVD (myocardial infarction, stroke, cerebrovascular disease, peripheral vascular disease, and history of percutaneous coronary intervention/coronary artery bypass graft [PCI/CABG]) or a risk factor for that disease (diabetes, hypertension, obesity, and/or current tobacco use).

To identify patients who meet evidence-based guidelines for the statin prescription cohort, we used the 2013 American Heart Association/American College of Cardiology (AHA/ACC) guidelines for patients aged 40 to 75 years.[10] These criteria identified 4 benefit groups: (1) patients with evidence of clinical CVD (as defined above), (2) patients with low-density lipoprotein cholesterol (LDL-C) levels of at least 190 mg/dL, (3) patients with diabetes and without clinical CVD aged 40 to 75 years with LDL-C levels between 70 and 189 mg/dL, and (4) patients without clinical CVD or diabetes with LDL-C levels between 70 and 189 mg/dL and estimated 10-year ASCVD risk of more than 7.5%. Patients with EHR documentation of statin allergy or adverse reaction were excluded. Because the AHA/ACC guidelines do not comment on patients with end-stage renal disease, we excluded patients with a glomerular filtration rate (GFR) less than 30 mL/min. In addition, because the AHA/ACC guidelines comment on adults aged 40 to 75 years, the cohort for screening was restricted to men 40 years and older.

Data

Patient data were obtained using Clarity, an Epic reporting database, including demographics, comorbidities, lipid levels, statin prescription, PCP, number of clinic visits during the study period, presence of a visit with a cardiologist, and insurance type. Clinical comorbidities were assessed using *International Classification of Diseases, Ninth Revision* or *Tenth Revision* diagnosis codes. Statin prescription was determined via broad search and then manual review. Household income was estimated by zip code of residence from 2015 US Census data.[20] PCPs were from internal medicine and family medicine and included faculty attending physicians, residents, physician assistants, and nurse practitioners. Data on PCP training and experience were based on information from the National Provider Index and included clinical degree, years of practice, and specialty.

Statistical Analysis

In unadjusted comparisons, we estimated the proportion of eligible patients screened and prescribed a statin by each patient and physician factor. The outcome measure for lipid screening was based on the presence of an order for an LDL-C blood test captured in the EHR at any point since 1999. The outcome measure for statin prescription was an order for a statin captured in the EHR since 1999. Multivariate logistic regression models were fit to the outcome measures and adjusted for patient demographics (age, sex, race/ethnicity and median household income), insurance, number of visits with a PCP, presence of a visit with a cardiologist, clinical characteristics or diagnoses (diabetes, hypertension, congestive heart failure [CHF], CVD, tobacco use, body mass index, and GFR), and Charlson Comorbidity Index (CCI) score,[21] as well as physician demographics, provider type, medical degree, specialty, and years of experience. Similar to a prior study,[15] the CCI was modified to reduce collinearity by excluding acute myocardial infarction, cerebrovascular disease, CHF, diabetes, and peripheral vascular disease. The patient factors either were clinically relevant to the guidelines[10,11] or were shown to affect statin prescription in previous work.[15] The provider factors were chosen because they were felt to characterize the providers in the ways that provider training could influence statin prescription. The statin prescription model was further adjusted for liver function tests and history of PCI or CABG. We used 2-sided hypothesis tests and a significance level of 0.05; analyses were conducted using Stata, version 12.1 (StataCorp LP; College Station, Texas).

RESULTS

Lipid Screening

There were 97,189 patients with 521 PCPs who were eligible for lipid screening, among whom 76,641 (78.9%) had an order placed for screening. In unadjusted comparisons, patients with CVD, CHF, diabetes, and hypertension had greater lipid screening order rates than patients without those conditions (**Table 1**). PCPs with an allopathic medical degree had greater lipid screening order rates (82.9%) than those with an osteopathic degree (68.9%) or other degree (67.6%). PCPs in internal medicine had greater lipid screening order rates (88.6%) than those in family medicine (69.8%) (Table 1).

In adjusted models (Table 1), significant patient predictors of greater odds of having lipid screening ordered included black race (odds ratio [OR], 1.77; 95% CI, 1.54-2.03; $P < .001$), visit with a cardiologist (OR, 1.71; 95% CI, 1.54-1.91; $P < .001$), and a history of diabetes (OR, 1.19; 95% CI, 1.10-1.29; $P < .001$) or hypertension (OR, 1.16; 95% CI, 1.10-1.23; $P < .001$). Significant patient predictors of lower odds of having lipid screening ordered were female sex (OR, 0.93; 95% CI, 0.87-0.99; *P* = .016), Medicaid insurance (OR, 0.64; 95% CI, 0.56-0.73; *P* <.001), Medicare insurance (OR, 0.72; 95% CI, 0.66-0.78; *P* <.001), and chronic kidney disease (CKD) with a GFR of 45 to 59 mL/min (OR, 0.74; 95% CI, 0.62-0.88; *P* <.001) or 30 to 44 mL/min (OR, 0.58; 95% CI, 0.47-0.72; *P* <.001).

Significant physician predictors of lower odds of a patient being ordered for lipid screening included being a resident (OR, 0.63; 95% CI, 0.43-0.93; *P* = .021), having an osteopathic degree (OR, 0.73; 95% CI, 0.55-0.96; *P* = .026), and specializing in family medicine (OR, 0.37; 95% CI, 0.30-0.47; *P* <.001).

Statin Prescription

There were 40,845 patients eligible for statin therapy, among whom 22,906 (56.1%) were prescribed a statin. In unadjusted comparisons, patients with elevated ASCVD 10-year risk scores, CVD, history of a PCI/CABG, CHF, diabetes, and hypertension had greater statin prescription rates than patients without those conditions. PCPs with an allopathic medical degree had greater statin prescription rates (56.7%) than those with an osteopathic degree (52.6%) or other degree (53.8%). PCPs in internal medicine had greater statin prescription rates (57.6%) than those in family medicine (54.0%) (**Table 2**).

In adjusted models (Table 2), significant patient predictors of greater odds of statin prescription included age (OR, 1.05 for each year of age; 95% CI, 1.03-1.06; *P* <.001), history of hypertension (OR, 1.58; 95% CI, 1.38-1.81; *P* <.001), diabetes (OR, 2.70; 95% CI, 2.32-3.13; *P* <.001), CVD (OR, 2.26; 95% CI, 1.85-2.76; *P* <.001), PCI/CABG (OR, 4.16; 95% CI, 1.98-8.75; *P* <.001), and stage IIIB CKD (OR, 1.71; 95% CI, 1.02-2.86; *P* = .041). Significant patient predictors of lower odds of statin prescription included black race (OR, 0.72; 95% CI, 0.59-0.86; *P* = .001) and female sex (OR, 0.84; 95% CI, 0.72-0.98; *P* = .029).

Significant physician predictors of lower odds of statin prescription included being a female PCP (OR, 0.82; 95% CI, 0.70-0.96; *P* = .015), training as a physician assistant (OR, 0.65; 95% CI, 0.52-0.81; *P* <.001), and more years of experience (OR, 0.99 for each year; 95% CI, 0.98-0.99; *P* <.001).

Most patients received moderate-intensity treatment, and the most common statin prescribed was atorvastatin (Lipitor) (**Table 3**).

TABLE 1. Patient and Physician Characteristics and Adjusted Predictors Among Patients Eligible for Hyperlipidemia Screening

Characteristic	Total Population n (%)	Subgroup With Ordered LDL-C Test n (%)	OR (95% CI)	*P*
Total	97,189 (100.0)	76,641 (79.9)		
Patient Demographic				
Age, years[a]			1.01 (1.01-1.02)	<.001
40-49	20,922 (21.5)	15,023 (71.8)		
50-64	49,402 (50.8)	39,668 (80.3)		
65-75	26,865 (27.6)	22,950 (85.4)		
Race				
Non-Hispanic black	23,470 (24.1)	20,880 (89.0)	1.77 (1.54-2.03)	<.001
Non-Hispanic white	62,521 (64.3)	48,692 (77.9)	1 [reference]	
Other	11,198 (11.5)	8069 (72.1)	0.91 (0.81-1.02)	.092
Sex				
Female	44,089 (45.4)	35,912 (81.5)	0.93 (0.87-0.99)	.016
Male	53,100 (54.6)	41,729 (78.6)	1 [reference]	
Insurance type				
Medicaid	5419 (5.6)	4219 (77.9)	0.64 (0.56-0.73)	<.001
Medicare	25,181 (25.9)	21,518 (85.5)	0.72 (0.66-0.78)	<.001
Private	66,589 (68.5)	51,904 (77.9)	1 [reference]	
Cardiologist providing care				
No	79,989 (82.3)	61,731 (77.2)	1 [reference]	
Yes	17,200 (17.7)	15,910 (92.5)	1.71 (1.54-1.91)	<.001
Median number of primary care visits (IQR)	4 (2-6)		1.05 (1.04-1.06)	<.001
Median household income, $ (IQR)	77,392 (48,015-89,058)		1.00 (1.00-1.00)	.239
Patient Clinical				
BMI[a]			1.00 (1.00-1.01)	.025
<25	19,626 (20.2)	15,599 (79.5)		
25.1-30	33,658 (34.6)	26,955 (80.1)		
30.1-40	35,161 (36.2)	28,210 (80.2)		
>40	7556 (7.8)	6283 (83.2)		
Unknown	1188 (1.2)	594 (50.0)		
Hypertension				
No	49,844 (51.3)	37,343 (74.9)	1 [reference]	
Yes	47,345 (48.7)	40,298 (85.1)	1.16 (1.10-1.23)	<.001
Congestive heart failure				
No	92,934 (95.6)	73,832 (79.4)	1 [reference]	
Yes	4255 (4.4)	3809 (89.5)	0.91 (0.81-1.03)	.141
Clinical CVD				
No	85,626 (88.1)	67,316 (78.6)	1 [reference]	
Yes	11,563 (11.9)	10,325 (89.3)	1.09 (1.00-1.20)	.057
Diabetes				
No	78,965 (81.2)	61,822 (78.3)	1 [reference]	
Yes	18,224 (18.8)	15,819 (86.8)	1.19 (1.10-1.29)	<.001

(continued)

TABLE 1. *(Continued)* Patient and Physician Characteristics and Adjusted Predictors Among Patients Eligible for Hyperlipidemia Screening

Characteristic	Total Population n (%)	Subgroup With Ordered LDL-C Test n (%)	OR (95% CI)	*P*
ASCVD[b]			Excluded	
<7.5	38,069 (39.2)	32,782 (86.1)		
≥7.5	34,572 (35.6)	30,961 (89.6)		
Unknown	24,548 (25.3)	13,898 (56.6)		
CKD				
GFR <30	1041 (1.1)	916 (88.0)	0.58 (0.47-0.72)	<.001
GFR 30-44	1429 (1.5)	1277 (89.4)	0.74 (0.62-0.88)	<.001
GFR 45-59	6048 (6.2)	5492 (90.8)	1.01 (0.90-1.12)	.923
GFR ≥60	73,995 (76.1)	65,994 (89.2)	1 [reference]	
No GFR in EHR	14,676 (15.1)	3962 (27.0)		
History of smoking				
Never	50,971 (52.4)	41,040 (80.5)	1 [reference]	
Former	33,660 (34.6)	27,247 (80.9)	0.90 (0.86-0.95)	<.001
Current	12,291 (12.6)	9194 (74.8)	0.82 (0.76-0.88)	<.001
Unknown	267 (0.3)	160 (59.9)		
Modified CCI score, median (IQR)	0 (0-1)		0.98 (0.95-1.00)	.028
Physician Demographic				
Provider gender				
Female	42,073 (43.3)	32,918 (78.2)	0.88 (0.70-1.12)	.310
Male	55,116 (56.7)	44,723 (81.1)	1 [reference]	
Provider type				
Attending	81,051 (83.4)	66,125 (81.6)	1 [reference]	
Resident	7784 (8.0)	3206 (62.6)	0.63 (0.43-0.93)	.021
NP	5121 (5.3)	2442 (75.5)	0.81 (0.52-1.27)	.359
PA	3233 (3.3)	2438 (75.4)	1.08 (0.79-1.47)	.621
Provider degree				
MD	76,763 (79.0)	63,662 (82.9)	1 [reference]	
DO	11,541 (11.9)	7955 (68.9)	0.73 (0.55-0.96)	.026
N/A	8354 (8.6)	5648 (67.6)	Omitted [collinearity]	
Provider practice				
Family medicine	45,089 (46.4)	31,459 (69.8)	0.37 (0.30-0.47)	<.001
Internal medicine	52,100 (53.6)	46,182 (88.6)	1 [reference]	
Provider years of experience[a]			1.01 (1.00-1.02)	.199
<5	9412 (9.7)	7527 (80.0)		
5-9	13,896 (14.3)	10,030 (72.2)		
≥10	71,667 (73.7)	58,243 (81.3)		
Unknown	2214 (2.3)	1841 (83.2)		

ASCVD indicates atherosclerotic cardiovascular disease; BMI, body mass index; CCI, Charlson Comorbidity Index; CKD, chronic kidney disease; CVD, cardiovascular disease; DO, doctor of osteopathic medicine; EHR, electronic health record; GFR, glomerular filtration rate; IQR, interquartile range; LDL-C, low-density lipoprotein cholesterol; MD, medical doctor; N/A, not applicable; NP, nurse practitioner; OR, odds ratio; PA, physician assistant.

[a]Continuous variables of age, BMI, and provider years of experience were separated into increments for demographic information but were run as continuous variables in the model. For the model, 1-year increments were used for age and provider years of experience and 1 kg/m^2 increments for BMI.

[b]ASCVD was excluded from the model as it both influences LDL-C screening rates and can conceivably be influenced by hyperlipidemia screening.

DISCUSSION

It is widely accepted that guideline-concordant hyperlipidemia management is effective at reducing cardiovascular events and mortality across a broad range of patients. This study has 3 main findings. First, a substantial proportion of nearly 100,000 patients in the primary care and cardiology practices of a large academic medical center had no evidence of lipid screening. Second, a substantial proportion of those patients meeting criteria for statin therapy were not prescribed a statin. Third, both patient and physician factors significantly predicted guideline-concordant management.

Our findings regarding low rates of adherence to guideline-concordant statin prescription are in line with findings by other groups.[12-15] However, there is less information about national rates of hyperlipidemia screening,[16] and our work has contributed to identifying and providing insight into this issue.

Our findings have important implications for health systems, ambulatory clinics, and other stakeholders looking for ways to improve cardiovascular care across populations of patients. To our knowledge, this is among the first studies to simultaneously examine patient and physician factors related to evidence-based hyperlipidemia screening and statin prescription. Salami et al investigated national trends in statin use and found that patient predictors of statin use include increased age, racial/ethnic minority, and having qualifying clinical conditions for statin use (ie, ASCVD, clinical CVD), consistent with our findings.[15] Al-Kindi et al found that age was the most important predictor for statin prescription, with other independent predictors including nonwhite race and self-pay status.[13] However, these studies did not simultaneously examine or adjust for physician factors. The information found from this analysis can be used by other healthcare systems to inform their investigations into provider and patient demographics to better target interventions and improve screening and primary/secondary prevention rates for CVD. For example, our findings about lower rates of statin prescription based on training and experience of PCPs could prompt interventions at the health-system level as part of continued medical training. However, these findings should be confirmed in other health systems and regions.

TABLE 2. Patient and Physician Characteristics With Adjusted Predictors Among Patients Eligible for Statin Therapy

Characteristic	Total Population n (%)	Subgroup Prescribed Statin n (%)	OR (95% CI)	*P*
Total	40,845 (100.0)	22,906 (56.1)		
Patient Demographic				
Age, years[a]			1.05 (1.03-1.06)	<.001
40-49	3553 (8.7)	1538 (43.3)		
50-64	18,181 (44.5)	9652 (53.1)		
65-75	19,111 (46.8)	11,716 (61.3)		
Race				
Non-Hispanic black	12,723 (31.1)	7128 (56.0)	0.72 (0.59-0.86)	.001
Non-Hispanic white	24,794 (60.7)	13,935 (56.2)	1 [reference]	
Other	3328 (8.1)	1843 (55.4)	0.94 (0.72-1.22)	.627
Sex				
Female	18,493 (45.3)	10,386 (56.2)	0.84 (0.72-0.98)	.029
Male	22,352 (54.7)	12,520 (56.0)	1 [reference]	
Insurance type				
Medicaid	2597 (6.4)	1500 (57.8)	0.85 (0.64-1.12)	.253
Medicare	17,024 (41.7)	10,567 (62.1)	0.87 (0.73-1.04)	.119
Private	21,224 (52.0)	10,839 (51.1)	1 [reference]	
Cardiologist providing care				
No	31,720 (77.7)	16,575 (52.3)	1 [reference]	
Yes	9125 (22.3)	6331 (69.4)	1.21 (0.96-1.52)	.102
Median number of primary care visits (IQR)	4 (3-7)		1.01 (0.99-1.03)	.227
Median household income, $ (IQR)	68,806 (42,610-88,287)		1.00 (1.00-1.00)	.780

(continued)

We found that disparities in care existed. African American patients were more likely to be screened but less likely to be prescribed a statin. Patients with Medicaid or Medicare were less likely to be screened or prescribed a statin than those with private insurance, findings in line with previous work.[22-24] Although patients with clinical conditions related to CVD, such as diabetes or hypertension, were more likely to be screened and prescribed a statin, patients with CKD and higher CCI scores were less likely. Physician characteristics were also associated with differences in outcomes, even after adjusting for patient characteristics. However, greater physician continuity was associated with higher rates of ordering lipid screening and prescribing a statin.

Limitations

Our study has several limitations. First, our findings are limited to a single health system; however, it is a large multihospital system and we examined more than 90,000 patients and more than 500 providers. Second, several practice guidelines exist, but our findings are limited to those used in this study. The guidelines used in this study were chosen because they were the most commonly practiced consensus guidelines during the study period. However, the USPSTF updated its guidelines in 2016, after the study period was over, to narrow the group of adults for whom primary screening is recommended. Future studies could evaluate these measures several years after the updated USPSTF guidelines to measure differences in care. Third, our screening outcomes are limited to ordering a lipid screening test in our system. Some patients may have received an LDL-C measurement elsewhere that was communicated to the index physician, eliminating the need for retesting, although this study did not have the data to quantify the number of patients to whom this would apply. Conversely, some may have had screening ordered many years before the study period. However, the USPSTF does not have an evidence-based guideline for the frequency of testing and allows for shared decision making based on the physician's assessment of risk. If guidelines were to become more specific about screening frequency in the future, one could investigate with more granularity when tests were ordered. Fourth, we measured the ordering of a statin, not patients' adherence to it. Incomplete medication adherence is profound and represents a large opportunity for health improvement. Although currently not possible, in the future it may be possible to combine information about a statin prescription with pharmacy data about refills to provide a better picture about adherence. Finally, although we evaluated a broad set of patient and physician factors, other data elements in the EHR, such as those within physician notes,[25] might add further insight. An example in which physician notes may prove useful is in the evaluation of lower-risk patients for whom patient–physician decision making may have led to deferred lipid testing or lack of

TABLE 2. *(Continued)* Patient and Physician Characteristics With Adjusted Predictors Among Patients Eligible for Statin Therapy

Characteristic	Total Population n (%)	Subgroup Prescribed Statin n (%)	OR (95% CI)	*P*
Patient Clinical				
BMI[a]			1.01 (0.99-1.02)	.326
<25	7648 (18.7)	3696 (48.3)		
25.1-30	14,226 (34.8)	8020 (56.4)		
30.1-40	14,976 (36.7)	8812 (58.8)		
>40	3672 (9.0)	2213 (60.3)		
Unknown	323 (0.8)	165 (51.1)		
LDL-C, mg/dL[b]			Excluded	
<70	3998 (9.8)	3295 (82.4)		
70-189	34,867 (85.4)	18,430 (52.9)		
≥190	1482 (3.6)	900 (60.7)		
No LDL-C in EHR	498 (1.2)	281 (56.4)		
Hypertension				
No	15,228 (37.3)	6879 (45.2)	1 [reference]	
Yes	25,617 (62.7)	16,027 (62.6)	1.58 (1.38-1.81)	<.001
Congestive heart failure				
No	38,408 (94.0)	21,031 (54.8)	1 [reference]	
Yes	2437 (6.0)	1875 (76.9)	1.38 (0.98-1.96)	.068
Clinical CVD				
No	31,191 (76.4)	15,848 (50.8)	1 [reference]	
Yes	9654 (23.6)	7058 (73.1)	2.26 (1.85-2.76)	<.001
Diabetes				
No	27,590 (67.5)	13,623 (49.4)	1 [reference]	
Yes	13,255 (32.5)	9283 (70.0)	2.70 (2.32-3.13)	<.001
ASCVD[b]			Excluded	
<7.5	4436 (10.9)	2189 (49.3)		
≥7.5	31,206 (76.4)	16,669 (53.4)		
Unknown	5203 (12.7)	4048 (77.8)		
PCI or CABG				
No	39,706 (97.2)	21,831 (55.0)	1 [reference]	
Yes	1139 (2.8)	1075 (94.4)	4.16 (1.98-8.75)	<.001
CKD				
GFR 30-44	986 (2.4)	736 (74.6)	1.71 (1.02-2.86)	.041
GFR 45-59	3713 (9.1)	2433 (65.5)	1.14 (0.92-1.43)	.234
GFR ≥60	33,258 (81.4)	18,307 (55.0)	1 [reference]	
No GFR in EHR	2888 (7.1)	1430 (49.5)		
History of smoking				
Never	20,581 (50.4)	10,990 (53.4)	1 [reference]	
Former	13,997 (34.3)	8597 (61.4)	1.02 (0.86-1.20)	.851
Current	6238 (15.3)	3301 (52.9)	1.12 (0.91-1.37)	.277
Unknown	29 (0.1)	18 (62.1)		
LFTs				
Normal	5601 (13.7)	3240 (57.8)	1 [reference]	
1-3× upper limit of normal	402 (1.0)	216 (53.7)	0.78 (0.58-1.03)	.081
>3× upper limit of normal	35 (0.1)	17 (48.6)	0.81 (0.43-1.50)	.498
No LFTs in EHR	34,807 (85.2)	19,433 (55.8)		
Modified CCI score, median (IQR)	0 (0-1)		0.96 (0.91-1.01)	.085

(continued)

TABLE 2. *(Continued)* Patient and Physician Characteristics With Adjusted Predictors Among Patients Eligible for Statin Therapy

Characteristic	Total Population n (%)	Subgroup Prescribed Statin n (%)	OR (95% CI)	*P*
Physician Demographic				
Provider gender				
Female	16,914 (41.4)	9345 (55.3)	0.82 (0.70-0.96)	.015
Male	23,931 (58.6)	13,561 (56.7)	1 [reference]	
Provider type				
Attending	34,504 (84.5)	19,152 (55.5)	1 [reference]	
NP	1751 (4.3)	979 (55.9)	0.89 (0.62-1.28)	.521
PA	1110 (2.7)	561 (50.5)	0.93 (0.70-1.24)	.643
Resident	3480 (8.5)	2214 (63.6)	0.65 (0.52-0.81)	<.001
Provider degree				
MD	33,465 (81.9)	18,970 (56.7)	1 [reference]	
DO	4306 (10.5)	2267 (52.6)	1.13 (0.97-1.32)	.123
N/A	2861 (7.0)	1540 (53.8)	Omitted (collinearity)	
Provider practice				
Family medicine	17,235 (42.2)	9312 (54.0)	0.89 (0.76-1.03)	.127
Internal medicine	23,610 (57.8)	13,594 (57.6)	1 [reference]	
Provider years of experience[a]			0.99 (0.98-0.99)	<.001
<5	4295 (10.5)	2684 (62.5)		
5-9	5497 (13.5)	3017 (54.9)		
≥10	30,121 (73.7)	16,721 (55.5)		
Unknown	932 (2.3)	484 (51.9)		

ASCVD indicates atherosclerotic cardiovascular disease; BMI, body mass index; CABG, coronary artery bypass graft; CCI, Charlson Comorbidity Index; CKD, chronic kidney disease; CVD, cardiovascular disease; DO, doctor of osteopathic medicine; EHR, electronic health record; GFR, glomerular filtration rate; IQR, interquartile range; LDL-C, low-density lipoprotein cholesterol; LFT, liver function test; MD, medical doctor; N/A, not applicable; NP, nurse practitioner; OR, odds ratio; PA, physician assistant; PCI, percutaneous coronary intervention.

[a]Continuous variables of age, BMI, and provider years of experience were separated into increments for demographic information but were run as continuous variables in the model (for the model, 1-year increments were used for age and provider years of experience, and 1 kg/m^2 increments for BMI).

[b]LDL-C and ASCVD were excluded from the model as they both influence the rate of statin prescription and are directly influenced by a statin prescription.

TABLE 3. Distribution of Statin Prescription and Intensity

Statin Characteristic	Patients Prescribed a Statin n (%)
Statin generic name	
Rosuvastatin	2456 (10.7)
Atorvastatin	11,728 (51.2)
Pravastatin	2304 (10.1)
Lovastatin	579 (2.5)
Pitavastatin	25 (0.1)
Simvastatin	5786 (25.2)
Fluvastatin	28 (0.1)
Statin intensity	
High	6617 (28.9)
Moderate	13,980 (61.0)
Low	2201 (9.6)
Unknown	108 (0.5)

statin prescription. This likely applied to a portion of our population, and further studies can help elucidate the degree to which shared decision making affects statin prescription rates.

CONCLUSIONS

Overall, we found that rates of hyperlipidemia screening and statin prescription were suboptimal; the gaps were large enough to recommend broad, rather than targeted, efforts to close them. Both patient and physician factors significantly predicted greater guideline-concordant care. Further investigating physician factors that influence lipid screening and statin prescription will likely provide insights that can improve clinical outcomes. In addition, some of the disparities found in this work regarding screening and statin prescription among patient groups warrant further characterization to better target interventions. ■

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