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Increasing statin prescription rates to prevent cardiovascular disease among high-risk populations: a quality improvement intervention centred on a novel interactive tool

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ABSTRACT

Statins are indicated for primary and secondary prevention of atherosclerotic cardiovascular disease (ASCVD). Our previous study of 1042 consecutive patient encounters at our large urban academic institution found that one in five patients were not prescribed an appropriate statin therapy. Only one-third of patients had follow-up cholesterol levels ordered to monitor treatment efficacy. In order to improve adherence to cholesterol guidelines at our institution, a quality improvement project was undertaken. We implemented interventions over a 4-month period to improve statin prescription rates: (a) development of an online interactive tool, (b) physician education on updated cholesterol guidelines and utilisation of the tool, (c) display of guideline summary in the workspace and (d) a documentation reminder in the electronic health record. We randomly selected encounter dates, from which 622 consecutive patient encounters were analysed. The primary outcome measures were prescription rates of statins, documentation of a 10-year ASCVD risk score and follow-up cholesterol levels ordered to monitor treatment efficacy. Out of the 622 patient encounters, 232 met statin indication. In this post-intervention group, statin prescription rates improved when compared with the pre-intervention group (90.5% vs 82.3%, p=0.006). Among patients who met statin indication solely via a 10-year ASCVD risk score ≥7.5%, there was an increase in documentation of the calculated 10-year ASCVD risk score (72.3% vs 57.8%; p=0.039) and in statin prescription rate (90.8% vs 67.6%; p<0.001). In addition, there was an increase in follow-up cholesterol levels ordered in all patients included in our study who met statin indication (64.1% vs 33.3%; p<0.001). Our quality improvement project showed higher rates of statin prescription, 10-year ASCVD risk score documentation and treatment monitoring after multiple interventions, centred on an easily accessible online interactive tool.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Atherosclerotic cardiovascular disease (ASCVD) is the leading cause of death with over 600 000 annual deaths and statin therapy is one of the most well-established medications shown to reduce cardiovascular events and death. Despite the 2018 ACC/AHA blood cholesterol guidelines recommendations, gaps in evidence-based treatment and adoption in real-life clinical practice vary.

WHAT THIS STUDY ADDS

⇒ Our quality improvement project implemented multiple interventions, (ie, an online interactive tool, physician education sessions, display of guidelines in the workspace, and a reminder in the electronic health record) at our academic internal medicine clinic and noted improvement in statin prescriptions rates and overall adherence to the cholesterol guidelines.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our project shows that simple interventions can improve adherence to guideline-based medical care.

PROBLEM

Atherosclerotic cardiovascular disease (ASCVD) is the leading cause of death with over 600 000 deaths annually and statin therapy is one of the most well-established treatments shown to reduce cardiovascular events and death.[1] Despite the 2018 American College of Cardiology/American Heart Association guidelines recommending statin and other lipid-lowering agents for primary and secondary prevention of ASCVD, gaps in evidence-based treatment for hyperlipidemia and disparities in statin prescription rates persist.[2 3] In our previous retrospective analysis of 1042 consecutive patient encounters between August 2018 and August 2019 at our academic primary care practice, our data showed lower prescription rates among younger patients, those who identified as black, and those who met statin-eligibility solely via a 10-year ASCVD risk score ≥7.5%.[4] In order to improve adherence to cholesterol

guidelines at our academic institution, a quality improvement (QI) project was undertaken between 1 July and 15 November 2020.

Our academic primary care practice and the hospital's catchment area primarily provide services for the racially diverse and socioeconomically underserved populations of Newark, New Jersey, United States of America metropolitan areas. Demographically, Newark has 28.6% white, 50.1% black and 36.3% Hispanic population. Additionally, only 15.3% of the population has a higher education, with median household income of US$35 199 (£26 862) with 27.4% of the population living below the poverty line.[5] This, along with limited health literacy, lack of adequate social support, and language barriers make it difficult for patients to have longitudinal follow-up to address preventative healthcare. Despite these disparities and the time constraints of a resident-run clinic, interventions were proposed to improve statin prescription rates for primary and secondary prevention of ASCVD based on guidelines. Daily clinic attendance on average was around 66 patients. We created tools to aid in clinician's decision-making to efficiently support appropriate statin prescription and subsequent dose adjustments based on the guidelines on cholesterol management during patient encounters. The project's aim was to increase the statin prescription rates by at least 10% and of the appropriate intensity, increase the ASCVD 10-year risk calculation documentation and increase the follow-up cholesterol measurements to assess for statin treatment efficacy.

BACKGROUND

Statins are competitive inhibitors of hydroxymethylglutaryl CoA reductase that reduce the hepatic cholesterol synthesis and upregulate low-density lipoprotein (LDL)-receptors, causing an increase in hepatic uptake of LDL-cholesterol from the circulation.[6] They are indicated for the primary (ie, diabetes mellitus, LDL-C ≥190 mg/dL) and secondary prevention (ie, recent acute coronary syndrome, ischaemic stroke) of ASCVD. Common side effects include myopathy, rhabdomyolysis and hepatotoxicity, which can reduce compliance rates.[6] Multiple large landmark studies have confirmed the benefits of statins in primary and secondary prevention of cardiovascular disease (ie, myocardial infarction, ischaemic heart failure) and strokes as well as having a mortality benefit.[7–11] Additionally, non-statin agents, such as ezetimibe and PCSK9 inhibitors, have also been proven to be effective mainly for secondary prevention of ASCVD.[12]

The 2018 guidelines emphasise primary and secondary prevention via lifestyle modifications (ie, aerobic exercise), reduction of risk factors (ie, metabolic syndrome) as well as prescription of appropriate intensity statins for lipid reduction (ie, high intensity for LDL-C ≥190 mg/dL). It also emphasises adjunct agents (ie, ezetimibe) if goal LDL-C reduction (ie, ≥50% reduction with high-intensity statin) is not achieved in 4–12 weeks.[2] However, many studies demonstrate that there is a clear gap between guideline recommendations and their implementation in real-world practice. Furthermore, there are clear health disparities that are disproportionately affecting the ASCVD outcomes of certain racial and age demographics.[13] The compounding effect of delay in adoption of the guidelines and disparities on statin prescription leads to suboptimal patient care in vulnerable populations.[14] Consistent with the literature, there is typically a time gap in the adoption of clinical guidelines in real-life practice. Furthermore, we hypothesise that in our clinic, similar to other training settings, other barriers including lack of awareness of all the details and practical steps in adoption of guidelines and time constraints in the clinical practice. Thus, in order to increase adherence to the cholesterol guidelines among physicians in our clinic and address disparities in prescription rates, we implemented multiple interventions, over a 4-month period to support clinical decision-making of guideline-directed statin therapy centred on an easily accessible online interactive tool at our large urban academic institution.

MEASUREMENT

Our previous quality assessment of 1042 consecutive patient encounters between August 2018 and August 2019 at our academic internal medicine clinic showed gaps in adherence to the 2018 blood cholesterol guideline prompting a QI project. Our study showed that an appropriate statin was not prescribed in 32.4% of statin-eligible patients who qualified based only on a 10-year ASCVD risk of ≥7.5%. Specifically, statin underprescription was seen in approximately one out of five eligible patients and was independently associated with black race, younger age, fewer comorbidities and eligibility via 10-year ASCVD risk only.[4] As outlined in our methodology, the QI measures were executed in our clinic over a 4-month period during which each resident physician within the residency programme had spent a 2-week time period in the clinic. During this time period, the residents learnt about the guidelines and the interventions. In order to assess the effectiveness of the interventions, the primary outcomes were derived based on the 2018 blood cholesterol guidelines where deficiencies had been previously identified on our baseline quality assessment project and included: (a) post-intervention prescription rates of statins based on appropriate indication (ie, very high risk ASCVD, LDL-C ≥190 mg/dL), (b) documentation of a 10-year ASCVD risk score and (c) follow-up cholesterol level blood test ordered to monitor treatment efficacy. At the conclusion of the 4 months, a random number generator was used to select 10 dates within the 4-month period. Data from all consecutive patient encounters in those selected 10 dates were collected and managed in Research Electronic Data Capture (REDCap), a secure web-based software platform hosted at Rutgers New Jersey Medical School.[15] Analyses were performed using R statistical software V.3.6.1, R Foundation for Statistical Computing, Vienna, Austria. Our goal was to provide insight into possible interventions

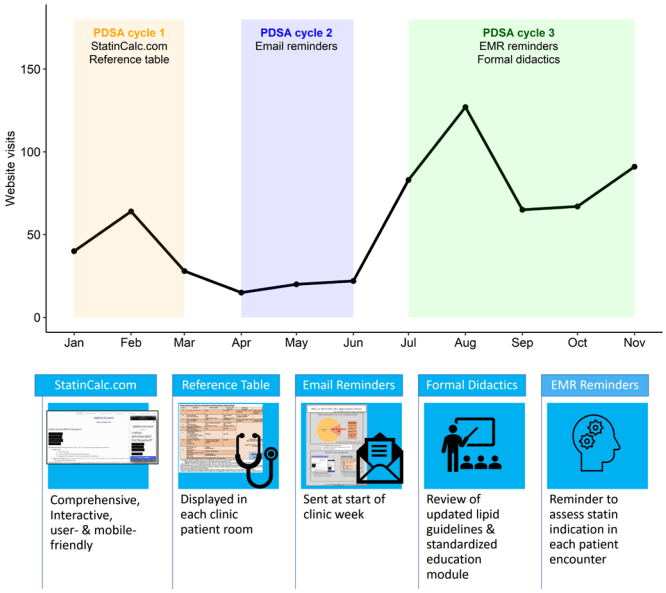

Figure 1 Various interventions were implemented during each stage of the Plan Do Study Act (PDSA) cycle in an attempt to increase adherence rates to blood cholesterol guidelines during the year 2020. StatinCalc.weebly.comm website traffic was measured at completion of each PDSA cycle to assess success of the interventions. EMR, electronic medical record.

aimed at improving statin prescription rates with hopes of reducing ASCVD in our patient population.

DESIGN

Given that our previous study showed clear disparities in cholesterol management at our academic clinic, we identified the areas for improvement and created a QI team of resident and attending physicians and implemented multiple interventions over a 4-month period to improve clinical decision-making and adherence to guideline-directed statin therapy via physician education based on several tools as follows (figure 1):

1. StatinCalc website (online interactive tool): we developed and implemented an interactive, user-friendly, digital platform for physicians to use at the point of care and follow an interactive algorithm to determine appropriate statin indication based on guideline-directed medical therapy.[16] This innovative tool supported clinical decision-making by the physicians during the patient encounter through using their respective patient demographics and comorbidities to determine (a) if a patient meets statin criteria, (b) appropriate statin intensity and (c) criteria for optimisation therapy (ie, adding second line therapies such as ezetimibe or PCSK9-inhibitors and rechecking LDL-C levels for reduction).
2. Physician education sessions led by a core academic physician educator on updated cholesterol guidelines and utilisation of the interactive tool. Physicians were also instructed to complete standardised education modules on hyperlipidaemia management.[17] Each physician attended one 2-hour educational session.
3. Reference documentation with a summary table of cholesterol management guidelines displayed at each physician workstation.
4. Embedded tool in the electronic health record as a reminder to assess statin indication in each preventative patient encounter.

The QI team met every 2 weeks to monitor the implementation of the interventions in a standardised manner. This included speaking with the other providers and seeing how the implementations have changed the workflow and if there were any issues that needed troubleshooting. Overall, the resident physicians were amenable to the interventions and the QI team received positive verbal feedback on improvement in the efficiency of workflow during patient encounters; however, the project was not designed to include this as an outcome measure. Further studies can assess how these multifaceted interventions influence workflow efficiency. We consistently took feedback and incorporated those changes on a rolling basis.

STRATEGY

Our SMART (Specific, Measurable, Applicable, Realistic, and Timely) aim was to improve adherence to cholesterol guidelines through multiple interventions. The improvement in guideline adherence was measured by documentation of 10-year ASCVD risk calculation, statin prescription rates and follow-up blood lipid panel ordered. Therefore, we undertook three test PDSA cycles.

In our first PDSA cycle, our initial intervention was to share our online interactive tool (StatinCalc website) and an easy-to-follow table format of the guidelines as a static version of the interactive tool that was shared via email and placed next to each physician workstation as a reminder among the physicians. We advertised these interventions through emails and word of mouth. We saw a modest increase in use of the website (ie, 1–3 visits of the website each clinic day among 10–12 resident physicians per day). The website traffic was used as a surrogate marker for use of other interventions.

In our second PDSA cycle, we continued to promote the interventions through an email reminder and a group text message reminder sent the day prior to the physician's starting their clinical outpatient time. However, this was during the height of the COVID-19 pandemic, where the clinic in-person visits were initially cancelled and later converted to 'tele-health' visits over the phone, and, thus, we saw a significant decrease in usage of the StatinCalc website . Although we received positive verbal feedback, we only saw modest usage of the interactive website.

In our third PDSA cycle, we reintroduced our interventions at the start of each 2-week block, we sent frequent email reminders of the StatinCalc website tool with attachment of the table guideline summary, each resident attending the required education session of hyperlipidaemia management and how to use the StatinCalc

website. The electronic medical record (EMR) was updated to include a reminder to determine whether each patient met a statin indication. Each physician was required to complete a standardised module [16] on hyperlipidaemia management. At the conclusion of the 4 months, we measured statin prescription rates, calculation of 10-year ASCVD risk score, ordering rate of follow-up lipid profile orders to monitor treatment efficacy. We noted an increase in website traffic and a statistically significant improvement in the above measures (figure 1).

RESULTS

Out of the 622 patient encounters in the postintervention group, 232 met an indication for a statin (online supplemental appendix A). Online supplemental appendix B describes the characteristics of our study population and illustrates that when compared with the preintervention group, the demographic data of the postintervention group were similar (ie, race, comorbid conditions, primary language, etc). Among the 232 statin-eligible patients, the average age was 61.0+10.1 and 52.0% of them were women. Most patients identified as black (44.0%), followed by 42.0% Hispanic or Latinx, white (6.5%), and Asian (3.0%). Additionally, only 56% of the patients had insurance, 44% (102 patients) reported a language other than English as their primary language and 40% preferred interpreter services during the encounter. The most common comorbidities were hypertension (81.5%), diabetes mellitus (54.7%), coronary artery disease (20.3%), chronic kidney disease (16.8%), cerebrovascular disease (13.8%), and congestive heart failure (11.6%). The average hemoglobin A1c among diabetic patients was 7.5% (IQR 6.57, 9.62). A lipid profile was available for 95.7% of the patients and the median LDL-C was 81 (IQR 57, 116).

In the postintervention group, statin prescription rates improved when compared with the preintervention group (90.5% vs 82.3%, p=0.006). The most common statin indication in the postintervention group was diabetes mellitus in ages 40–75 (40.9%) as opposed to the preintervention group, where the indication was 10-year ASCVD risk of≥7.5% (40.0%).

Among the patients who met statin indication solely via a 10-year ASCVD risk score ≥7.5%, there was an increase in documentation of the calculated 10-year ASCVD risk score (72.3% vs 57.8%; p=0.039) and in statin prescription rate (90.8% vs 67.6%; p<0.001; figure 2). Additionally, these patients also tended to have a higher rate of insurance (56.9% vs 42.2%, p=0.04). There was also an increase in follow-up cholesterol levels ordered in all patients included in our study who met statin indication (64.1% vs 33.3%; p<0.001).

In the preintervention group, a multivariate analysis, when adjusting for gender and insurance status, appropriate statin prescription correlated positively with older age, hypertension and CKD.[4] However, lower rates were

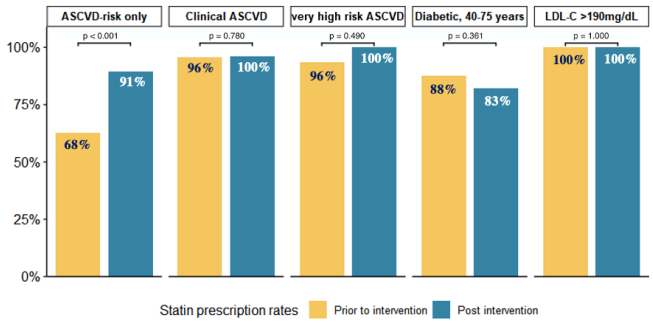

Figure 2 Statin prescription rates in the postintervention group showed an improvement in statin prescription rates in those patients who met statin indication solely via a 10-year ASCVD risk score ≥7.5% (90.8% vs 67.6%; p<0.001). ASCVD, atherosclerotic cardiovascular disease; LDL-C, low-density lipoprotein cholesterol.

noted for black race and a 10-year ASCVD score of ≥7.5%. In the postintervention group, a similar multivariable analysis showed no correlation between appropriate statin prescription and black race or 10-year ASCVD score of ≥7.5%. However, it did maintain a positive correlation with age and hypertension (figure 3).

LESSONS AND LIMITATIONS

The project's aim was to improve the primary and secondary prevention of ASCVD in our practice by increasing adherence to the 2018 cholesterol guidelines. In order to achieve this at our academic internal medicine practice, we implemented multiple interventions for the physicians to choose their preferred intervention for efficiency. Although physician knowledge was not measured pre-interventions and post-interventions, all physicians received formal education sessions on the 2018 cholesterol-lowering guidelines as part of our intervention for the QI study, this project showed that simple interventions can make a measurable improvement. Although there was an improvement in our primary outcomes after our interventions were implemented, we realise that we measured the outcomes immediately within a short time frame of the implementation, and the long-term durability of the effect of our interventions cannot be assumed. Additionally, we are unable to address the individual effectiveness of each intervention (ie, StatinCalc website vs table guideline summary). Thus, it is unclear which intervention was the most or least effective. However, anecdotally, resident physicians expressed the most positive feedback for the StatinCalc website. Furthermore, although every effort was made to increase validity of the study (ie, randomisation), we acknowledge that this is a single-centre study without a control group and with a smaller sample size which can introduce bias. We also recognise that the individuals in the preintervention and post-intervention group are different patients and there is no control group in our study. Additionally, the statistically significant improvement in

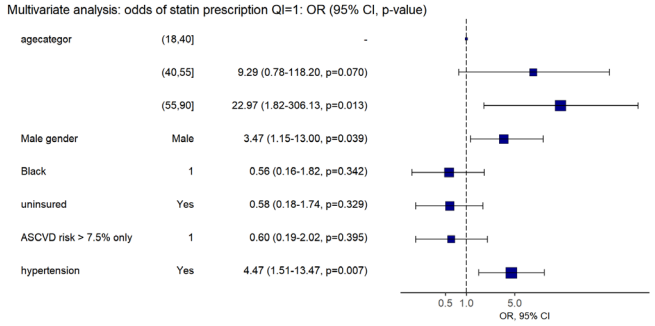

Figure 3 In a multivariate analysis, there was no statistically significant improvement in statin prescription among black patients or those that met statin indication via only a 10-year ASCVD risk of >7.5%. ASCVD, atherosclerotic cardiovascular disease; QI, quality improvement.

statin prescription rate in patients who met the indication via a 10-year ASCVD risk score of ≥7.5% also tended to have higher healthcare insurance rates than those in the pre-intervention group. The more favourable socioeconomic status may be a confounder. Another limitation is the logistical barriers and administrative approvals needed that make implementation of each intervention (ie, display of guidelines in clinic rooms, embedding the reminder phrase in EMR).

Language differences, low health literacy, low socioeconomic status and low adherence rates are all barriers that may limit overall health outcomes. Finally, our study does not measure health outcomes (ie, improvement in LDL-C, reduction in future ASCVD events, etc). Additionally, we did not measure education on lifestyle changes (ie, diet, exercise) to reduce risk of ASCVD although it is heavily encouraged by the guidelines and was taught to the resident physicians during the education sessions part of the intervention. In our QI study, we did not measure counselling that may have taken place at each encounter. However, future directions should consider measuring counselling as an outcome measure. We also recognise that the COVID-19 pandemic had an impact on the state of the affairs of the world and healthcare. This probably had some impact in our study; however, out of 622 encounters, only 30 were telehealth as a result of the influence of COVID-19 in outpatient medical practice, thus the influence into our results should be minimal.

CONCLUSION

The 2018 guidelines emphasise prescription of the appropriate intensity of statin, escalation of therapy, the addition of adjunct agents (ie, ezetimibe) and lifestyle modifications. The aim of our QI project was to improve the rate of statin prescriptions and monitor treatment efficacy. Our data suggest that we accomplished our aim although we cannot draw causal effects given the small sample size. Hopefully, this translates into reduced outcomes of ASCVD events. It is also important to recognise that lipid-lowering therapies are only one factor in primary and secondary ASCVD risk reduction, thus patients should also be counselled on lifestyle modifications and reduction of other risk factors (ie, obesity). The only measurable cost for the project was the cost of the StatinCalc website publication, which has been around US$200 (£153) and is funded by the authors. The project is sustainable as the resources (ie, website, guidelines summary) are easily accessible and do not require maintenance. However, it does require active physician engagement. Given our project was conducted over a 4-month period and data were collected immediately afterwards, the adherence rates of the cholesterol guidelines may decline over time if there is no reinforcement of the interventions. Thus, further directions of the project should include recollecting data at the later time interval (ie, 1 year after intervention implementation) to see whether physicians need a reintervention. Additionally, this could include streamlining of the patient intake process with nursing staff calculating the 10-year ASCVD risk score to improve office visit efficiency and adherence to guidelines.

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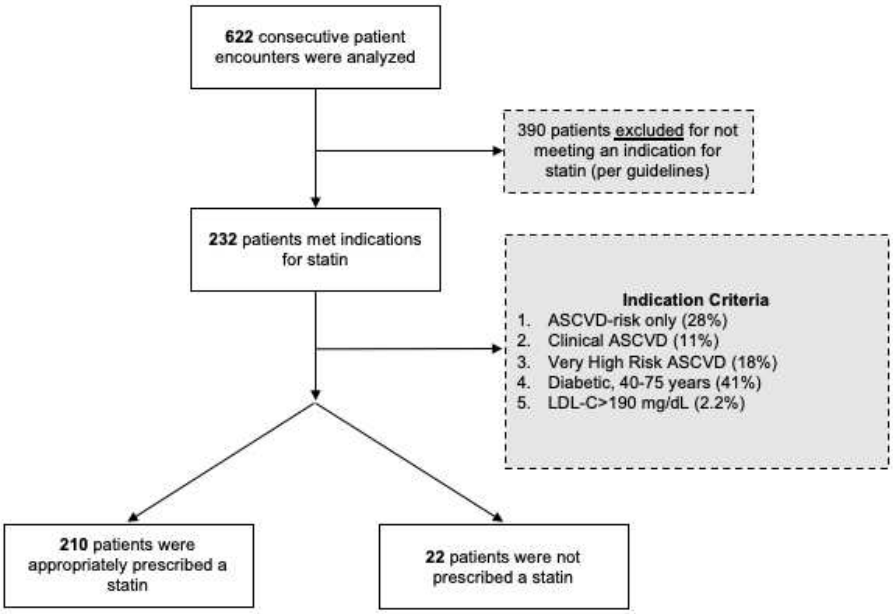
Appendix A: Flow chart of the post-intervention patient groups that met statin indication based on indication.



Appendix B: Characteristics of patients in the pre- and post-intervention group.

Characteristic	**Overall (n = 695)**	**Pre-intervention (n = 463)**	**Post-intervention (n = 232)**	***p***
Demographics				
Age, years	61 ± 10.4	61 ± 10.4	61 ± 10.1	0.4
Males, *n* (%)	326 (47)	214 (46)	112 (48)	0.6
Uninsured, *n* (%)	356 (51)	253 (55)	103 (44)	**0.013**
BMI, kg/m^2	29 [26-33]	29 [26-33]	29 [26-32]	0.5
Race/Ethnicity, *n* (%)				0.6
Black or African Americans	323 (46)	222 (48)	101 (44)	
Hispanic or Latino	304 (44)	211 (46)	93 (42)	
White	41 (6.0)	26 (5.6)	15 (6.5)	
Asian	16 (2.3)	9 (1.9)	7 (3.0)	
Native Hawaiian/Pacific Islander	1 (0.1)	1 (0.2)	0 (0.0)	
Patient Primary Language, *n* (%)				0.7
English	414 (60)	284 (61)	130 (56)	
Spanish	201 (29)	129 (28)	72 (31)	
Portuguese	48 (6.9)	31 (6.7)	17 (7.3)	
Other	24 (3.5)	15 (3.2)	9 (3.9)	
French Creole	7 (1.0)	4 (0.9)	3 (1.3)	
Interpreter Services Utilized	219 (32)	126 (27)	93 (40)	**<0.001**
Comorbidities, *n* (%)				
Hypertension	564 (81)	375 (81)	189 (81)	0.8
Diabetes Mellitus	335 (48)	208 (45)	127 (55)	**0.015**
Hemoglobin A1c	7.30 [6.50-9.30]	7.20 [6.50-8.95]	7.45 [6.57-9.62]	0.3
Chronic Kidney Disease	110 (16)	71 (15)	39 (17)	0.6
Coronary Artery Disease	114 (16)	67 (14)	47 (20)	**0.043**
History of MI	51 (7.3)	32 (6.9)	19 (8.2)	0.5
History of PCI	57 (8.2)	30 (6.5)	27 (12)	**0.019**

History of CABG	25 (3.6)	15 (3.2)	10 (4.3)	0.5
Cerebrovascular Disease	100 (14)	68 (15)	32 (14)	0.8
Peripheral Artery Disease	22 (3.2)	13 (2.8)	9 (3.9)	0.4
Chronic Lung Disease	33 (4.8)	20 (4.3)	13 (5.6)	0.4
Current Smoker (or quit < 1 year ago)	108 (16)	83 (18)	25 (11)	**0.006**
Congestive Heart Failure	87 (13)	60 (13)	27 (12)	0.6
Lipid Profile, mg/dL				
LDL-C	85 [62-120]	87 [64-120]	81 [57-116]	0.14
HDL-C	49 [41-59]	50 [41-59]	48 [41-57]	0.4
Triglycerides	106 [80-153]	103 [78-149]	112 [81-170]	0.061
Statin Indications, *n* (%)				**0.029**
Very high risk ASCVD	118 (17)	76 (16)	42 (18)	
Clinical ASCVD	73 (27)	48 (27)	25 (29)	
10-year ASCVD risk >7.5%	250 (36)	185 (40)	65 (28)	
Diabetes, age 40-75	239 (34)	144 (31)	95 (41)	
LDL-C $\geq$190 mg/dL	15 (2.2)	10 (2.2)	5 (2.2)	

Values represent mean standard deviation, median [IQR 25th–75th percentiles] or number (%). Bold values indicate statistical significance ($p < 0.05$). CABG = coronary artery bypass grafting; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol; MI = myocardial infarction; PCI = percutaneous coronary intervention.