American Heart Journal Plus: Cardiology Research and Practice 13 (2022) 100082

Contents lists available at ScienceDirect

American Heart Journal Plus: Cardiology Research and Practice

journal homepage: www.sciencedirect.com/journal/american-heart-journal-plus-cardiology-research-and-practice

Application of the very high risk criterion and evaluation of cholesterol guideline adherence in acute myocardial infarction patients at an urban academic medical center

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ARTICLE INFO

Keywords:
Cholesterol
Low-density lipoprotein lowering
Cardiovascular risk
Guidelines
Acute myocardial infarction

ABSTRACT

Objective: The 2018 AHA/ACC cholesterol guidelines recommend considering non-statin agents among very high-risk (VHR) patients with LDL-C ≥ 70 mg/dL after maximizing statin therapy. We aimed to evaluate the prevalence of VHR status in acute myocardial infarction (AMI) patients at hospital discharge and the adherence to guideline-directed cholesterol therapy (GDCT) within one-year follow-up post-AMI.

Methods: We performed a retrospective analysis of patients who suffered a type 1 AMI between October 2015 and March 2019, and then were followed at our institution for 1 year after hospital discharge. We calculated the percentage of patients at VHR and among those with follow up lipid panels, we determined the proportion able to achieve GDCT.

Results: The mean age of the 331 AMI patients was 61.0 (SD 11.9) years and 33.6% were women. Overall, 268 (81.0%) patients were categorized as having VHR at discharge. Among patients at VHR, a lipid panel was rechecked in 153 individuals (57.1%) within 1 year of discharge, with the median time to lipid recheck being 22.4 weeks (interquartile range: 10.9–40.7 weeks). Among those with a lipid panel re-check, 100 (65.4%) of patients achieved GDCT.

Conclusions: Approximately 4 out of 5 AMI patients were considered VHR per the 2018 AHA/ACC guidelines, only about half had follow up lipid panels in the year following AMI, and about two-thirds of those with follow up lipid panels achieved GDCT.

1. Introduction

The 2018 American Heart Association/American College of Cardiology (AHA/ACC) cholesterol guidelines recommended reducing low-density lipoprotein-cholesterol (LDL-C) by ≥50% with statin therapy in patients with clinical atherosclerotic cardiovascular disease (ASCVD), repeating a lipid measurement 4–12 weeks after initiation of statin therapy or dose adjustment, and considering non-statin agents among patients with LDL-C ≥ 70 mg/dL after maximizing statin therapy in addition to lifestyle changes [1]. To guide use of non-statin therapies, the guidelines introduced the concept of very high risk (VHR), defined as a history of multiple major ASCVD events or one major ASCVD event plus multiple high-risk conditions. In VHR patients, the adjunctive use of non-statin therapies, in particular ezetimibe and proprotein convertase subtilisin kexin type 9 (PCSK9) inhibitors, further reduces risk of subsequent ASCVD events in the secondary prevention setting [2,3].

Despite the strong evidence for LDL-C lowering in ASCVD management [1,4], recent research has demonstrated that rates of prescribing statins and intensifying lipid-lowering therapy are low among secondary prevention patients. In a multi-center analysis of more than 4000

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https://doi.org/10.1016/j.ahjo.2021.100082
Received 19 December 2021; Accepted 23 December 2021
Available online 5 January 2022

patients hospitalized between 2005 and 2008 for an acute myocardial infarction (AMI), only 23% were discharged on high-intensity statin therapy [5]. In another analysis of greater than 11,000 patients hospitalized for an AMI between 2007 and 2009, only 21% of patients were discharged on a high-intensity statin and only 14% were taking high-intensity statins at one year [6]. Even among patients with an AMI and familial hypercholesterolemia, a recent study examining this population at a large academic medical center from 2000 to 2016 found that only 63% were discharged on high-intensity statins and 82% had an LDL-C level $\geq$ 70 mg/dL at one year [7].

Given the release of the new AHA/ACC guidelines, we sought to: 1) assess the prevalence of VHR status in AMI patients and 2) evaluate adherence to guideline-directed cholesterol therapy (GDCT) after hospital discharge within one-year post-AMI.

2. Methods

2.1. Study population

The present study was an ancillary study of type 1 AMI patients in the Myocardial infarction, COmbined-device, Recovery Enhancement (MiCORE) study, a multi-center nonrandomized controlled trial evaluating the effect of a digital health intervention (DHI) on all-cause unplanned 30-day readmissions after AMI between two groups [8,9]. The DHI group included 200 patients who were admitted to four US hospitals between October 1, 2016 and March 29, 2019, while the historical control group included 864 patients admitted to these hospitals between October 1, 2015 and September 30, 2016. Type I AMI hospitalizations were identified based on International Classification of Diseases-Tenth Revision CM codes, which included I21.01, I21.02, I21.09, I21.11, I21.19, I21.21, I21.29, I21.3, and I21. Type I AMI was defined using the Fourth Universal Definition of Myocardial infarction [10]. This ancillary study consisted of 908 MiCORE participants (DHI: 174; Control: 734) who were enrolled at two hospital sites: Johns Hopkins Hospital (JHH) and Johns Hopkins Bayview Medical Center (JHBMC), with the aim of assessing adherence to GDCT. The final sample for this study was limited to participants who were followed by a primary care professional or cardiologist within 1-year post-discharge at JHH or JHBMC ($N = 331$, or 31.1% of the original MiCORE sample, see Fig. 1). Participants excluded from the analysis were older, more likely to be women, and had a higher prevalence of having six or more comorbid conditions. The study was approved by the Institutional Review Board at the Johns Hopkins University School of Medicine (IRB00099938).

2.2. Outcome measures

A detailed review of electronic medical records was performed to evaluate for socio-demographic and clinical characteristics including comorbidities at the time of index admission. Data were extracted independently by two reviewers (AJB & RD) and directly via the administrative database. Patients were identified as VHR according to the 2018 AHA/ACC guideline criteria [1]. Specifically, VHR for future ASCVD events was considered present if a patient had a history of multiple ($\geq$2) major ASCVD events (Acute coronary syndrome [ACS]) within 12 months, myocardial infarction other than any recent ACS within 12 months, ischemic stroke, or peripheral arterial disease (defined as claudication with ankle-brachial index [ABI] <0.85, or previous revascularization or amputation), or had 1 major ASCVD event plus multiple ($\geq$2) high-risk conditions. High-risk conditions included age $\geq$ 65 years, heterozygous familial hypercholesterolemia (HeFH), prior coronary revascularization outside of the major ASCVD events, diabetes (DM), hypertension (HTN), congestive heart failure (CHF), chronic kidney disease (CKD) with estimated glomerular filtration rate of 15–59 mL/min/1.72 cm^2, current smoker, obesity (body mass index $\geq$ 30 kg/m^2) and LDL-C $\geq$ 100 mg/dL despite maximally tolerated statin therapy and ezetimibe.

As noted above, in the original MiCORE study, the DHI focused on 30-day readmission rates and was not specifically designed or used to facilitate GDCT over 1 year follow up. A patient's adherence to GDCT was determined in the year after discharge for those who had follow up lipid panels after their index hospitalization. We defined GDCT only for VHR patients, as our analysis focused on this population. In line with the 2018 AHA/ACC guidelines, GDCT for VHR patients was defined as either (1) a recorded LDL-C value < 70 mg/dL on maximally tolerated statin therapy during follow up or (2) documented consideration of a non-statin agent (ezetimibe or PCSK9i) if a patient's LDL-C was $\geq$70 mg/dL on maximally tolerated statin therapy during the year after discharge from AMI. The Hopkins clinical laboratory utilizes the Martin/Hopkins

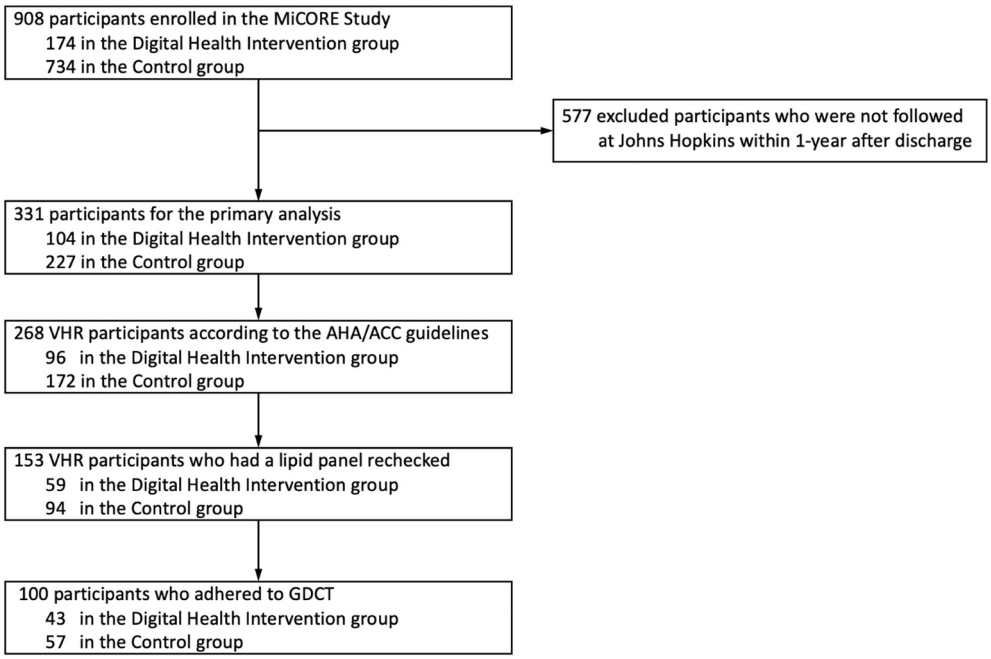

Fig. 1. Flow chart depicting the study population.

method for determination of LDL-C values, a more accurate measure of LDL-C than the traditional Friedewald equation [11,12].

2.3. Covariates

Demographic characteristics included age, sex, race/ethnicity (White, Black, or Hispanic/Asian/other), marital status, and primary insurance type (private/preferred provider organization [PPO]/health maintenance organization [HMO], Medicare, Medicaid, or other). Hospitalization-related characteristics included length of stay, discharge destination, and revascularization during admission (percutaneous coronary intervention [PCI]/coronary artery bypass grafting surgery [CABG], or neither). Clinical characteristics included body mass index (BMI, weight [kg]/height^2 [m]), diabetes, hypertension, myocardial infarction, stroke, peripheral artery disease, congestive heart failure, renal failure, and comorbidity burden (defined by the Agency for Healthcare Research and Quality Elixhauser Comorbidity Index [13] using ICD-10 diagnosis codes). LDL-C levels during admission were obtained from chart review. Use of statin therapy (any, high-intensity, or none) was obtained from chart review as well as an automated medication download from the electronic medical records. High-intensity statin therapy was defined as 40 mg or 80 mg per day of atorvastatin or 20 mg or 40 mg per day of rosuvastatin, while all other statin doses were considered non-high intensity.

2.4. Statistical analysis

Baseline characteristics were summarized by intervention group (DHI vs. Control) as mean (standard deviation, SD) or median [interquartile range, IQR] for continuous variables and as frequencies (%) for categorical variables. We calculated the percentage of patients at VHR and among those with follow up lipid panels, we determined the proportion able to achieve GDCT using logistic regression in two models: crude and adjusting for age, sex, and intervention group status. We also examined the percentage of patients who had follow up lipid panels, the timeline in which these were collected, and risk factors of failing to achieve GDCT in patients at VHR who had repeat lipid testing after discharge. All analyses were performed using Stata, version 15.1 (StataCorp, College Station, TX), and a P-value < 0.05 was considered statistically significant.

3. Results

3.1. Baseline characteristics

The mean age of the 331 patients who experienced a type I AMI was 61.0 (SD 11.9) years and 33.6% were women. There were 104 patients in the DHI group and 227 in the Control group. Patients in the DHI group were more likely to be younger, insured by private companies/PPO/HMO, have revascularization procedures (PCI or CABG), and higher LDL-C levels during the hospital admission, compared to those in the Control group (Table 1). In addition, 138 (41.7% [36.5% in DHI, 44.1% in Control]) were on statin therapy on admission, with 80 (24.2% [23.1% in DHI, 24.7% in Control]) on a high-intensity statin. The mean LDL-C was 103 (SD 46 [111 in DHI with SD of 50 and 99 in Control with SD of 44]) mg/dL on admission. Among both groups, the baseline rates of current smoking, diabetes mellitus, hypertension, and chronic kidney disease were 30.2%, 42.0%, 78.9%, and 18.1%, respectively. Supplementary Table 1 compares baseline characteristics of patients who had follow up lipid panels with those who did not.

3.2. VHR status and adherence to GDCT

Overall, 268 (81.0%) patients were categorized as VHR per the 2018 AHA/ACC guidelines. There was a significantly higher prevalence of VHR status among the DHI group as compared to the Control group in both the crude and age-sex adjusted analysis (92.3% vs. 75.8% and 95.7% vs. 77.8%, respectively, Ps < 0.001) (Table 2). Among patients at VHR who had repeat lipid testing after discharge ($n = 153$), the proportion achieving GDCT adherence did not significantly differ between the DHI group and Control group in crude [72.9% (60.1–82.7%) vs. 60.6% (50.4–70.0%)] or age-sex adjusted [72.6% (60.9–84.2%) vs.

Table 1
Baseline characteristics of patients by intervention group ($N = 331$).

Characteristics	DHI group ($n = 104$)	Control group ($n = 227$)	P value
Age, years	57.8 (10.9)	62.4 (12.1)	0.001
Female	29 (27.9%)	82 (36.1%)	0.14
Race			
White	75 (72.1%)	150 (66.1%)	0.47
Black	21 (20.2%)	60 (26.4%)	
Hispanic/Asian/other	8 (7.7%)	17 (7.5%)	
Insurance type			
Private/PPO/HMO	62 (59.6%)	98 (43.2%)	0.001
Medicare	27 (26.0%)	95 (41.9%)	
Medicaid	14 (13.5%)	19 (8.4%)	
Other[a]	1 (1.0%)	15 (6.6%)	
Length of hospital stay, days	5.0 [3.0, 9.0]	4.3 [2.8, 8.5]	0.15
Married	62 (59.6%)	113 (49.8%)	0.096
Body mass index, kg/m^2	30.4 (6.0)	30.8 (10.7)	0.76
Smoking status			
Never	41 (39.4%)	111 (48.9%)	0.21
Former	30 (28.8%)	49 (21.6%)	
Current	33 (31.7%)	67 (29.5%)	
Medical history			
Diabetes mellitus	44 (42.3%)	95 (41.9%)	0.94
Hypertension	79 (76.0%)	182 (80.2%)	0.39
Myocardial infarction	17 (16.3%)	52 (22.9%)	0.17
Stroke	14 (13.5%)	21 (9.3%)	0.25
Peripheral artery disease	5 (4.8%)	36 (15.9%)	0.005
Congestive heart failure	37 (35.6%)	72 (31.7%)	0.49
Renal failure	14 (13.5%)	46 (20.3%)	0.14
PCI or CABG during admission	98 (94.2%)	172 (75.8%)	<0.001
Comorbidity burden index[b]			
0–3	47 (47.0%)	109 (48.9%)	0.37
4–5	37 (37.0%)	67 (30.0%)	
≥6	16 (16.0%)	47 (21.1%)	
Statin therapy on admission			
Any	38 (36.5%)	100 (44.1%)	0.20
High intensity	24 (23.1%)	56 (24.7%)	0.75
LDL-C on admission, mg/dL	111.1 (50.3)	99.4 (43.1)	0.036
Lipid rechecked within 1 year	62 (59.6%)	125 (55.1%)	0.44
Lipid recheck time from discharge, weeks	20.9 (17.3)	28.6 (15.1)	0.002

Continuous variables are given as mean (SD) or median [IQR]; categorical variables are given as counts (%). Abbreviations: CABG, coronary artery bypass surgery; HMO, health maintenance organization; IQR, interquartile range; LDL-C, low-density lipoprotein cholesterol; PCI, percutaneous coronary intervention; PPO, preferred provider organization; SD, standard deviation.

[a] Other insurance type included self-pay, work compensation, or unknown.

[b] Comorbidity index was defined by the Agency for Healthcare Research and Quality Elixhauser Comorbidity Index using ICD-10 diagnosis codes.

Table 2
Crude and adjusted VHR prevalence by intervention group.

VHR prevalence, % (95% CI)	All participants ($N = 331$)	DHI group ($n = 104$)	Control group ($n = 227$)	P-value[a]
Crude	81.0 (76.4–84.9)	92.3 (85.3–96.1)	75.8 (69.8–80.9)	<0.001
Adjusted	86.3 (81.3–90.1)[b]	95.7 (90.9–98.1)[c]	77.8 (71.3–83.2)[c]	<0.001

Abbreviation: CI, confidence interval; VHR, very high risk.

[a] P-value was calculated using the F-test.

[b] The logistic regression adjusted for age, sex, and group status of digital health intervention or control.

[c] The logistic regression adjusted for age and sex.

60.9% (50.9–70.8%)] analyses (Table 3). We found that obesity [OR = 2.56 (1.10–5.94)] and LDL-C ≥ 70 mg/dL on admission [OR = 3.64 (1.10–12.2)] were significantly associated with failure to achieve GDCT (Fig. 2).

3.3. Lipid management and lipid-lowering therapy at discharge and during follow up

Among all patients, 187 (56.5%) had a lipid panel rechecked within 1 year of discharge from the index hospitalization. Among the 268 patients at VHR, a lipid panel was rechecked in 153 (57.1%). The median time to lipid recheck was 22.4 weeks (interquartile range: 10.9–40.7 weeks) for VHR patients ($n = 153$) and 27.4 weeks (interquartile range: 16.6–40.0 weeks) for non-VHR patients ($n = 34$). Among patients who underwent repeat lipid testing, 28.1% of those at VHR and 20.6% of non-VHR patients had lipid rechecks within 12 weeks of discharge. The mean LDL-C on recheck was 76 mg/dL among non-VHR patients and 62 mg/dL among VHR patients, which corresponds to a 39.1% decrease in LDL-C from admission for all VHR who underwent repeat lipid testing.

Out of a total of 331 patients, 324 (98%) were prescribed statin therapy on discharge (298/324 [92%] on a high-intensity statin and 26/324 [8%] on a moderate-intensity statin) and 7 (2%) were discharged off statin therapy. In addition, 21 (6.3%) of all patients were prescribed ezetimibe on discharge, while no patients were prescribed a PCSK9 inhibitor on discharge. Among the 33 patients who were not prescribed a high-intensity statin at the time of discharge (26 discharged on moderate-intensity statin and 7 discharged off statin therapy), there was a reason documented in the medical chart for 18 patients as follows: 8 had a reported prior intolerance of statin therapy, 6 had elevated liver enzymes, 1 had an LDL-C < 50 mg/dL on a moderate-intensity statin on admission, 2 declined, and 1 had an apparent cost barrier described in the discharge summary for the patient's admission. Among the 7 patients discharged off statin therapy, during the course of 1 year follow up, one was prescribed a moderate intensity statin, one was prescribed a high intensity statin, one was started on ezetimibe and a PCSK9i, and one declined statin therapy. Additionally, during the course of 1 year follow up, among the 26 discharged on moderate intensity statin therapy, 8 were prescribed a high intensity statin, 2 underwent intensification of their moderate intensity statin, 1 was transitioned to a different moderate intensity statin, and 1 was prescribed ezetimibe given concern for statin intolerance. During the 1-year follow-up after discharge, among patients with LDL-C ≥ 70 mg/dL on maximally tolerated statin therapy ($n = 70$), 14 patients (20%) had an intensification of their lipid-lowering therapy; 8 (11.4%) were prescribed ezetimibe, and 5 (7.1%) were prescribed a PCSK9 inhibitor.

Table 3
Crude and adjusted proportion of adherence to GDCT by intervention group.

Proportion, % (95% CI)	VHR participants who had lipid rechecked ($n = 153$)	DHI group ($n = 59$)	Control group ($n = 94$)	P-value[a]
Crude	65.4 (57.4–72.5)	72.9 (60.1–82.7)	60.6 (50.4–70.0)	0.12
Adjusted	65.0 (57.0–72.3)[b]	72.6 (60.9–84.2)[c]	60.9 (50.9–70.8)[c]	0.16

Adherence to GDCT in VHR participants who had at least one lipid panel was defined as either (1) a recorded LDL-C value < 70 mg/dL on maximally tolerated statin therapy during follow up or (2) documented consideration of a non-statin agent (ezetimibe or PCSK9i) if a patient's LDL-C was >70 mg/dL on maximally tolerated statin therapy during the year after discharge. Abbreviation: CI, confidence interval; LDL-C, low-density lipoprotein cholesterol; GDCT, guideline-directed cholesterol therapy; VHR, very high risk.

[a] *P*-value was calculated using the F-test.

[b] The logistic regression adjusted for age, sex, and intervention group status of digital health intervention or control.

[c] The logistic regression adjusted for age and sex.

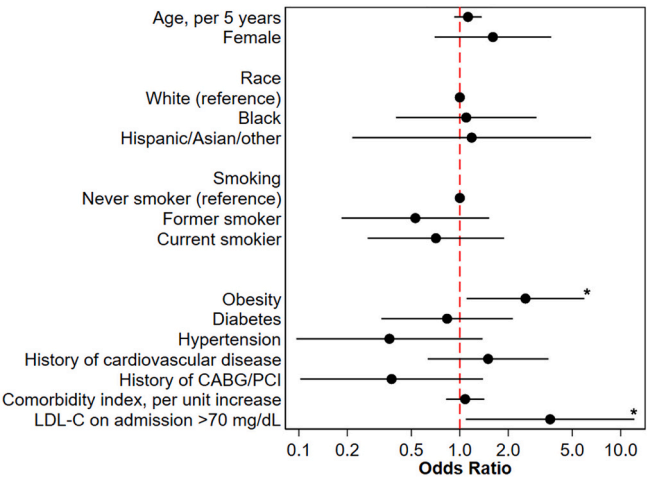

Fig. 2. Multivariable odds ratio of failure to adhere to GDCT among VHR individuals who had lipid panels rechecked within one year from AMI discharge ($n = 153$).
* Statistical significance was demonstrated ($p < 0.05$).
Cardiovascular disease included myocardial infarction, stroke, heart failure, and peripheral artery disease. Abbreviations: AMI, acute myocardial infarction; CABG, coronary artery bypass surgery; LDL-C, low-density lipoprotein cholesterol; GDCT, guideline-directed cholesterol therapy; PCI, percutaneous coronary intervention.

Since release of the AHA/ACC cholesterol guidelines in November of 2018, 34 patients were followed at our institution and all were deemed VHR. Among this subset of patients, 20 (59%) did not have repeat lipid panels after discharge, and among the 14 patients who did, 12 (86%) achieved GDCT).

4. Discussion

In this study of patients who suffered an AMI between October 2015 and March 2019 and were then followed at our institution for 1 year after hospital discharge, approximately 4 out of 5 patients were considered VHR per the 2018 AHA/ACC guidelines. Among those at VHR, 57% had follow up lipid panels after discharge with only 28% of these being collected within 12 weeks of discharge. While guidelines recommend reducing LDL-C by ≥50% with statin therapy in patients with ASCVD [1], we observed only a 39.1% average decline in LDL-C levels within 1 year of discharge among VHR patients. Among those with repeat lipid panels, about two-thirds achieved GDCT as defined by either (1) a recorded LDL-C value < 70 mg/dL on maximally tolerated statin therapy during follow up or (2) documented consideration of an established non-statin agent (ezetimibe or PCSK9i) if a patient's LDL-C was ≥70 mg/dL on maximally tolerated statin therapy during the year after discharge from AMI. The vast majority of patients in this study (298/331; 90%) were discharged on a high intensity statin. Only 6.3% (21/331) of all patients were discharged on ezetimibe and only 13 patients were prescribed ezetimibe and/or a PCSK9i within a year of discharge.

The proportion of patients discharged on high-intensity statin therapy in this study (90%) is substantially higher than earlier published data (8–60% [3–5,9–13]). This reflects an increasing trend toward ensuring patients at high and very-high risk are on maximal statin therapy after AMI. Only two of these prior studies included data on patients after release of the 2013 ACC/AHA Cholesterol guidelines and none included data on patients since release of the 2018 AHA/ACC guidelines.

Additionally, this study found that approximately 80% of patients were VHR per the AHA/ACC guidelines, as compared to almost 2/3 of patients in the ODYSSEY OUTCOMES trial [14], which may reflect the

higher risk status of patients cared for at our urban academic medical center and specifically relate to higher rates of co-morbidities, such as current smoking (30% vs. 24%) and CHF (33% vs. 15%). Our study, along with the ODYSSEY OUTCOMES trial, demonstrates that many patients hospitalized for AMI meet VHR criteria and would thus have an indication for non-statin therapy if LDL-C remains ≥70 mg/dL on maximally tolerated statin therapy. Cannon et al. demonstrated via a simulation study that an additional 18% of patients could optimize LDL-C levels with the addition of ezetimibe to statin therapy [15], yet in our study, only 8 (11%) patients out of 70 with LDL-C ≥ 70 mg/dL on maximally tolerated statin therapy were prescribed ezetimibe during follow up. Our data are consistent with the recently published GOULD study, which demonstrated low rates of intensification of lipid lowering therapy (~17%) over a 2 year follow up period among patients with ASCVD [16].

A fundamental issue in the delivery of care revealed in our study is the failure to recheck lipid panels after discharge for patients with AMI. The 2018 ACC/AHA guidelines recommend rechecking a lipid panel within 4–12 weeks of statin initiation or dose adjustment [1], yet only 57% of patients in our study underwent lipid testing within 1 year of discharge, and among those who did, only 28% did so within 4–12 weeks of discharge. As expected, given the longer duration of follow up, this is marginally higher than the finding by Wang et al. that 44% of Medicare patients after an MI underwent lipid testing within 90 days [6]. Our findings are also consistent with a recently published trial evaluating lipid testing and LDL-C levels after PCI in Canada, in which only half of the study population had lipid panels measured within 6 months of discharge and among those that did, 57% had LDL-C values < 70 mg/dL [17]. Our findings may be partially explained by the fact that 28% of VHR patients were already on a high-intensity statin upon admission and thus may not have undergone repeat lipid testing if there was no change in statin therapy. However, even among patients most at risk for recurrent events (i.e. those at VHR), only 57% underwent lipid panel testing within 1 year of discharge. This represents a crucial missed opportunity to decrease the risk for further events in this population, as LDL-C monitoring is intricately linked with treatment intensification [18–20]. In particular, Jia et al. found that in a population of patients with ASCVD, there was a direct association between the number of lipid panels checked and higher rates of treatment intensification [18].

In patients with follow up lipid panels, failure to achieve GDCT in approximately 30–40% of our population who were deemed VHR is likely multifactorial, related to patient and clinician factors, systems-level issues, and social determinants of health. Regardless, this study suggests that there may be a substantial missed opportunity to decrease the risk for recurrent events among these patients. While the DHI in MiCORE was focused on reducing 30 day readmissions, not on 1 year adherence to GDCT among post-AMI patients, MiCORE participants had high levels of patient activation [9] and yet the rates of adherence to GDCT were not significantly different than among the Control population. These observations highlight the need for new strategies to improve the cardiovascular health of this high-risk population, including innovative platforms to increase patient engagement with specific customization for cholesterol management, clinician decision support tools, multidisciplinary approaches to care, and increasing patient access to care. While we did identify that obesity was associated with failure to achieve GDCT among VHR with repeat lipid testing, this requires further study. One prior study identified that increasing BMI was associated with a higher likelihood of post discharge lipid testing [6].

There are several limitations of the current study. Firstly, this is a single center study. Secondly, not all patients admitted with AMI between October 1, 2016 and March 29, 2019 were enrolled in the MiCORE study due to specific inclusion/exclusion criteria. Therefore, the results presented here do not reflect the outcomes of all patients who presented with AMI during this time period who were then followed longitudinally at our institution. Nevertheless, the gaps in achieving GDCT outside of our patient population would likely be worse given the use of a DHI to enhance patient engagement in a subset of our population. Thirdly, we did not specifically examine patient medication adherence or thoroughly investigate the reasons for lack of titration of lipid-lowering therapy. Lastly, a set of eligibility criteria was applied to enroll patients into the MiCORE study (such as exclusion of patients with cognitive, visual or hearing impairment), which was not applied to patients in the historical control group, who were admitted prior to the start of MiCORE.

Our study's strength includes its examination of granular data among this high risk diverse population, who presented with AMI in a real world setting. We were able to analyze LDL-C levels, prescription patterns of lipid-lowering therapy, and detailed clinical documentation regarding lipid management at a tertiary medical center. Although our study included patients admitted to a single tertiary referral center, patients analyzed in this study are likely reflective of those admitted to tertiary academic medical centers across the country, which treat complex patients with multiple comorbidities. Additionally, the inclusion of a DHI in our study is a novel feature, and further investigation into the efficacy of such technological platforms in improving adherence to GDCT is warranted.

In conclusion, our observational study of 331 patients with AMI demonstrated that the vast majority (~80%) were considered VHR per 2018 ACC/AHA guidelines, yet only 60–70% of these patients with repeat lipid panels achieved GDCT within 1 year of follow up. These data indicate the need for new strategies to improve adherence to GDCT in this high-risk population.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ahjo.2021.100082.

CRediT authorship contribution statement

Adam J. Brownstein: Conceptualization, Methodology, Data Collection, Writing – Original draft preparation, Reviewing and Editing

Robert Derenbecker: Conceptualization, Methodology, Data Collection, Reviewing and Editing

Yumin Gao: Conceptualization, Methodology, Statistical Analysis, Reviewing and Editing

Jie Ding: Conceptualization, Methodology, Statistical Analysis, Reviewing and Editing

Bibin Varghese: Reviewing and Editing

Nino Isakadze: Reviewing and Editing

Erin M. Spaulding: Reviewing and Editing

Francoise A. Marvel: Reviewing and Editing

Seth S. Martin: Conceptualization, Methodology, Reviewing and Editing, Supervision, Resources/Funding

Sources of funding

This work was funded by Amgen. In addition, outside of this work, Dr. Isakadze and Dr. Martin have received research support from the American Heart Association (20SFRN35380046 and COVID19-811000) and from Sandra and Larry Small. Dr. Martin also reports research support from PCORI (ME-2019C1-15328), National Institutes of Health (P01 HL108800), the David and June Trone Family Foundation, the Pollin Digital Innovation Fund, PJ Schafer Cardiovascular Research Fund, CASCADE FH, Apple, Google, and iHealth.

Author disclosures

Dr. Martin is a co-inventor on a pending patent filed by Johns Hopkins University for a novel system of low-density lipoprotein cholesterol estimation. In addition, under a license agreement between Corrie Health and the Johns Hopkins University, the University owns equity in Corrie Health and the University, Dr. Marvel, and Dr. Martin are entitled to royalty distributions related to the technology described

in the study discussed in this publication. In addition, Dr. Marvel and Dr. Martin are founders of and hold equity in Corrie Health. This arrangement has been reviewed and approved by the Johns Hopkins University in accordance with its conflict of interest policies. Dr. Martin has served as a scientific consultant to Amgen, AstraZeneca, DalCor, Esperion, iHealth, Kaneka, Novartis, Novo Nordisk, Sanofi, and 89bio. The other authors report no conflicts.

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