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ORIGINAL RESEARCH

Management of Persistent Angina After Myocardial Infarction Treated With Percutaneous Coronary Intervention: Insights From the TRANSLATE-ACS Study

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Background—Angina has important implications for patients' quality of life and healthcare utilization. Angina management after acute myocardial infarction (MI) treated with percutaneous coronary intervention (PCI) is unknown.

Methods and Results—TRANSLATE-ACS (Treatment With Adenosine Diphosphate Receptor Inhibitors: Longitudinal Assessment of Treatment Patterns and Events After Acute Coronary Syndrome) was a longitudinal study of MI patients treated with percutaneous coronary intervention at 233 US hospitals from 2010 to 2012. Among patients with self-reported angina at 6 weeks post-MI, we described patterns of angina and antianginal medication use through 1 year postdischarge. Of 10 870 percutaneous coronary intervention–treated MI patients, 3190 (29.3%) reported angina symptoms at 6 weeks post-MI; of these, 658 (20.6%) had daily/weekly angina while 2532 (79.4%) had monthly angina. Among patients with 6-week angina, 2936 (92.0%) received β-blockers during the 1 year post-MI, yet only 743 (23.3%) were treated with other antianginal medications. At 1 year, 1056 patients (33.1%) with 6-week angina reported persistent angina symptoms. Of these, only 31.2% had been prescribed non–β-blocker antianginal medications at any time in the past year. Among patients undergoing revascularization during follow-up, only 25.9% were on ≥1 non–β-blocker anti-anginal medication at the time of the procedure.

Conclusions—Angina is present in one third of percutaneous coronary intervention–treated MI patients as early as 6 weeks after discharge, and many of these patients have persistent angina at 1 year. Non–β-blocker antianginal medications are infrequently used in these patients, even among those with persistent angina and those undergoing revascularization. **(*J Am Heart Assoc.* 2017;6:e007007. DOI: 10.1161/JAHA.117.007007.)**

Key Words: angina pectoris • guideline adherence • myocardial infarction • patient reported outcome • percutaneous coronary intervention

More than 1.5 million Americans have myocardial infarctions (MI) each year, and many of these patients continue to have angina symptoms with important implications for patient quality of life and healthcare utilization.[1,2] Patients with angina are more likely to report limited physical function and depression, and are more likely to be rehospitalized within 1 year of their index MI.[3–6]

The principal treatment goal for these patients is control of angina symptoms, and 4 classes of medications are approved for the treatment of angina in the United States—β-blockers, calcium channel blockers, nitrates, and ranolazine.[7] Percutaneous coronary intervention (PCI) is also indicated for management of angina symptoms that cannot be controlled with optimal medical therapy.[8,9] β-Blockers reduce mortality in patients with acute MI, and are thus recommended as first-line therapy for patients with angina. For patients with angina despite β-blocker treatment, guidelines recommend adding additional non–β-blocker antianginal medications in a

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Accompanying Data S1, Tables S1 through S3, and Figure S1 are available at http://jaha.ahajournals.org/content/6/10/e007007/DC1/embed/inline-supplementary-material-1.pdf

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Clinical Perspective

What Is New?

- Nearly 30% of patients undergoing percutaneous coronary intervention for myocardial infarction reported angina 6 weeks later, and one third of these patients continued to have angina at 12-month follow-up.
- Fewer than 25% of patients with angina 6 weeks after percutaneous coronary intervention for myocardial infarction were treated with a non–β-blocker anti-anginal medication at any time over 12-month follow-up.
- Treatment with non–β-blocker anti-anginal medications was infrequent even in patients with persistent or severe angina, and those undergoing revascularization.

What Are the Clinical Implications?

- Strategies to increase provider awareness of angina burden coupled with symptom-driven management, including prescription of anti-anginal medications, should be explored.

stepwise manner before proceeding to PCI for refractory angina.[9] The prevalence of non–β-blocker antianginal medication use among patients with post-MI angina has not been well described, and it is unclear whether providers adhere to these guidelines.

In TRANSLATE-ACS (Treatment With Adenosine Diphosphate Receptor Inhibitors: Longitudinal Assessment of Treatment Patterns and Events After Acute Coronary Syndrome), investigators collected longitudinal information on patient-reported angina and antianginal medication use for patients initially hospitalized with an acute MI that was treated with PCI. This offered a unique opportunity to describe the prevalence and longitudinal patterns of post-MI angina as well as antianginal medication(s) used in its treatment.

Methods

Data Source and Patient Population

The design of TRANSLATE-ACS has been previously reported.[10] TRANSLATE-ACS was a multicenter observational study that examined longitudinal antiplatelet use, effectiveness, and safety among MI patients treated with PCI. Patients were enrolled from April 2010 through October 2012. Eligible patients were ≥18 years old, diagnosed with ST-segment elevation MI (STEMI) or non-ST-segment elevation MI, treated with PCI, discharged on a $P2Y_{12}$ inhibitor (clopidogrel, prasugrel, ticlopidine, or ticagrelor), and able to provide consent for long-term follow-up.

TRANSLATE-ACS enrolled 12 365 patients. Since our study focused on patterns of postdischarge angina and antianginal treatment, we excluded patients (n=14) who died in the hospital and those missing data on angina frequency at 6 weeks (n=1481), yielding a final study population of 10 870 patients (Figure 1). Descriptive characteristics of patients with missing data on 6-week angina frequency are presented in Table S1. Analyses of anti-angina medication use were performed on the 3190 (29%) patients who reported angina symptoms within 6 weeks after MI diagnosis.

All patients enrolled in TRANSLATE-ACS provided written informed consent, and the study protocol was approved by the ethics committee or institutional review board of each participating site. The Duke University Medical Center

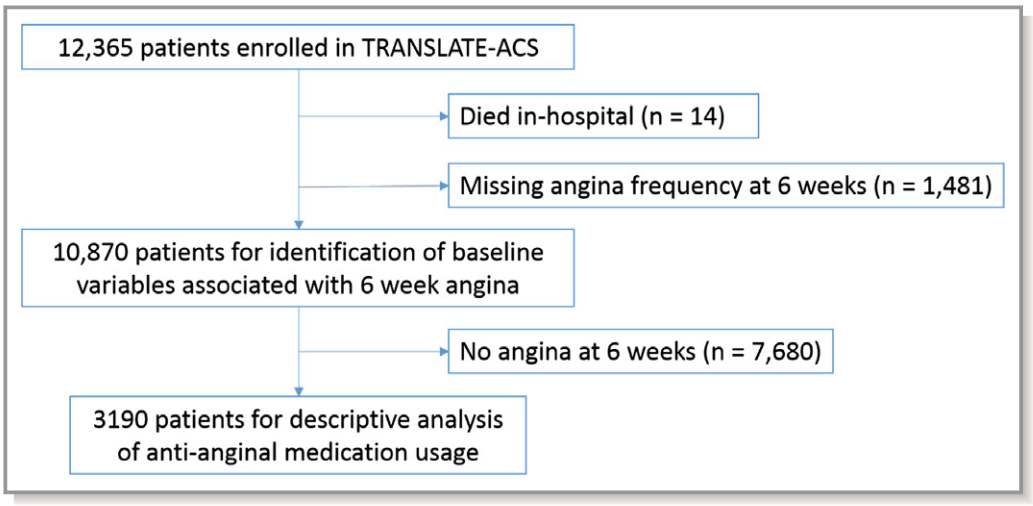

Figure 1. CONSORT diagram. CONSORT indicates Consolidated Standards of Reporting Trials; TRANSLATE-ACS, Treatment With Adenosine Diphosphate Receptor Inhibitors: Longitudinal Assessment of Treatment Patterns and Events After Acute Coronary Syndrome.

Institutional Review Board approved use of TRANSLATE-ACS data for this analysis.

Data Collection and Definitions

During each patient's index MI admission, hospitals collected information on baseline demographic and clinical characteristics, processes of care, discharge medications, and in-hospital outcomes according to the standardized set of data elements and definitions used by the National Cardiovascular Data Registry CathPCI Registry. Patients with multivessel coronary artery disease (≥50% stenosis in >1 epicardial coronary artery) who did not undergo multivessel PCI were defined as having incomplete revascularization. Patients were contacted by telephone at 6 weeks, 6 months, 12 months, and 15 months postdischarge, at which time they were asked about current medications and angina symptoms using the Seattle Angina Questionnaire (SAQ) angina frequency questions (related to angina frequency and nitroglycerin use; see Data S1). Responses were summed to derive the SAQ angina frequency score.[11] Scores were then classified into the following categories: no angina (100 points), monthly angina (70–90 points), weekly angina (40–60 points), or daily angina (0–30 points).[12] Patients were also asked about rehospitalizations or coronary revascularization procedures. Rehospitalizations were verified by the collection of medical bills and/or medical records; unplanned revascularizations were independently validated by study physicians based on review of medical records for PCI or coronary artery bypass graft surgery (CABG) procedures and excluded electively staged revascularization procedures.[13] During the 6-week follow-up phone call, patients also completed the EuroQOL 5 dimensions quality of life questionnaire, which asks about mobility, self-care, ability to do usual activities, pain, and anxiety/depression symptoms, and includes an overall quality of life visual analogue scale.

Statistical Analysis

Patients were grouped according to presence of angina 6 weeks following PCI for MI. Descriptive statistics are reported as median (25th, 75th percentiles) for continuous variables and frequency (percent) for categorical variables. For continuous variables, differences between groups were compared using the Wilcoxon rank-sum test. For categorical variables, differences between groups were assessed using the χ^2 or Fisher exact test.

We performed multivariable logistic regression to identify factors associated with 6-week angina. Variables entered into the model included sociodemographic factors (age, sex, race, insurance [private, government, versus none], marital status, education level [college and above, high school, versus less than high school], and employment status), clinical history (prior MI, prior PCI, prior CABG, extracardiac vascular disease [peripheral arterial or cerebrovascular disease], diabetes mellitus, hypertension, and current/recent smoker), presentation features (MI type [STEMI versus non-ST-segment elevation MI], body mass index, glomerular filtration rate, left ventricular ejection fraction, and heart failure signs/symptoms), angiographic/procedural characteristics (number of diseased coronary arteries, PCI of a previously stented culprit lesion, drug-eluting stent use, and completeness of revascularization [incomplete defined as multivessel coronary artery disease without multivessel PCI]), and number of discharge antianginal medications. After forward selection of variables, we refit the logistic regression model using generalized estimating equations to account for within-hospital clustering, and calculated a c-statistic. Among patients with 6-week angina, we repeated this process to identify factors associated with persistent angina at 12 months.

We reported the proportion of patients taking antianginal medications at 6-week, 6-month, and 12-month follow-up. Preprocedural rates of antianginal medication use were described for patients who underwent unplanned coronary revascularization. Among patients with 6-week angina who continued to have angina through 12 months, we performed multivariable logistic regression to identify factors associated with prescription of non–β-blocker antianginal medications at any time. Variables entered into the model were the same as those used to predict 6-week angina, with the addition of 6-week and 6-month SAQ angina frequency scores.

Results

Baseline Characteristics Associated With 6-Week Angina

In the final study population of 10 870 PCI-treated MI patients, 3190 (29.3%) reported angina within the first 6 weeks after discharge. Of patients with angina, 85 (2.7%) had daily angina, 573 (18.0%) had weekly angina, and 2532 (79.3%) had angina less than once a week but at least once a month. Compared with patients without 6-week angina, patients with angina were younger, more often black, and uninsured with lower education levels (Table). They more often had prior MI or prior coronary revascularization; they were more likely to be smoking at the time of their index MI but did not have a higher prevalence of diabetes mellitus or hypertension. Patients with angina at 6 weeks had no significant differences in MI type (STEMI versus non-ST-segment elevation MI), the location of their culprit lesion, left ventricular ejection fraction, or the prevalence of multivessel disease compared with patients without angina. The extent of PCI was similar between groups; patients who reported angina at 6 weeks were not significantly more likely to have incomplete revascularization than patients without

Table. Baseline Characteristics by Presence of Angina at 6 Weeks

	Overall (n=10 870)	No Angina at 6 Wks (n=7680, 70.7%)	Angina at 6 Wks (n=3190, 29.3%)	*P* Value
Demographics				
Age	60 (52, 68)	61 (54, 69)	57 (50, 65)	<0.0001
Female sex	3015 (27.7%)	1998 (26.0%)	1017 (31.9%)	<0.0001
Race				
White	9617 (88.5%)	6876 (89.5%)	2741 (85.9%)	<0.0001
Black	926 (8.5%)	569 (7.4%)	357 (11.2%)	<0.0001
Other nonwhite	218 (2.0%)	157 (2.0%)	61 (1.9%)	. . .
Health insurance				
Private	6958 (64.0%)	5105 (66.5%)	1853 (58.1%)	<0.0001
Government	4442 (40.9%)	3199 (41.7%)	1243 (39.0%)	0.007
No insurance	1508 (13.9%)	933 (12.2%)	575 (18.0%)	<0.0001
Married	7000 (64.4%)	5065 (66.0%)	1935 (60.7%)	<0.0001
Education				<0.0001
College	5806 (53.4%)	4185 (54.5%)	1621 (50.8%)	. . .
High school graduate	3695 (34.0%)	2609 (34.0%)	1086 (34.0%)	
Less than high school	1225 (11.3%)	792 (10.3%)	433 (13.6%)	<0.0001
Employed	5419 (49.9%)	3858 (50.2%)	1561 (48.9%)	0.23
BMI	29 (26, 33)	29 (26, 33)	30 (26, 34)	0.005
Past medical history				
Prior MI	2084 (19.2%)	1420 (18.5%)	664 (20.8%)	0.006
Prior PCI	2334 (21.5%)	1598 (20.8%)	736 (23.1%)	0.01
Prior CABG	1019 (9.4%)	676 (8.8%)	343 (10.8%)	0.002
Cerebrovascular disease	779 (7.2%)	532 (6.9%)	247 (7.7%)	0.14
Peripheral vascular disease	690 (6.4%)	487 (6.3%)	203 (6.4%)	0.98
Prior heart failure	630 (5.8%)	437 (5.7%)	193 (6.1%)	0.47
Prior atrial fibrillation	514 (4.7%)	383 (5.0%)	131 (4.1%)	0.05
Diabetes mellitus	2818 (25.9%)	1963 (25.6%)	855 (26.8%)	0.19
Hypertension	7276 (66.9%)	5141 (66.9%)	2135 (66.9%)	0.92
Hyperlipidemia	7145 (65.7%)	5071 (66.0%)	2074 (65.0%)	0.28
Current/recent smoker	3999 (36.8%)	2637 (34.3%)	1362 (42.7%)	<0.0001
Chronic lung disease	1046 (9.6%)	654 (8.5%)	392 (12.3%)	<0.0001
Index MI/PCI characteristics				
STEMI	5656 (52.0%)	4008 (52.2%)	1648 (51.7%)	0.62
Culprit lesion location				0.47
Left main	92 (0.9%)	63 (0.8%)	29 (0.9%)	. . .
LAD	4043 (37.2%)	2846 (37.1%)	1197 (37.5%)	···
LCx	2385 (21.9%)	1667 (21.7%)	718 (22.5%)	···
RCA	4255 (39.1%)	3043 (39.6%)	1212 (38.0%)	···
Culprit lesion in graft	492 (4.5%)	330 (4.2%)	162 (5.1%)	0.29
Culprit lesion previously treated	792 (7.3%)	530 (6.9%)	262 (8.2%)	0.01
Culprit lesion is bifurcation	1216 (11.2%)	862 (11.2%)	354 (11.1%)	0.89

Continued

Table. Continued

	Overall (n=10 870)	No Angina at 6 Wks (n=7680, 70.7%)	Angina at 6 Wks (n=3190, 29.3%)	*P* Value
Multivessel disease	5367 (49.4%)	3810 (49.6%)	1557 (48.8%)	0.29
Multivessel PCI	1176 (10.8%)	859 (11.2%)	317 (9.9%)	0.06
Incomplete revascularization	4321 (39.8%)	3055 (39.8%)	1266 (39.7%)	0.93
Drug-eluting stent	7760 (71.4%)	5544 (72.2%)	2216 (69.5%)	0.006
Discharge LVEF <40%	2008 (20.6%)	1416 (20.6%)	592 (20.9%)	0.75
Discharge medications				
$P2Y_{12}$ inhibitor	10 821 (99.6%)	7648 (99.6%)	3173 (99.5%)	0.26
Prasugrel/ticagrelor	3419 (31.5%)	2391 (31.1%)	1028 (32.2%)	0.27
Statin	10 343 (95.5%)	7313 (95.6%)	3030 (95.3%)	0.54
Aspirin	10 685 (98.7%)	7554 (98.6%)	3131 (98.7%)	0.69
ACEI/ARB	8025 (74.5%)	5702 (74.9%)	2323 (73.5%)	0.13
β-Blocker	10 054 (93.4%)	7097 (93.4%)	2957 (93.6%)	0.77
Calcium channel blocker	721 (6.6%)	523 (6.8%)	198 (6.2%)	0.25
Long-acting nitrate	537 (4.9%)	341 (4.4%)	196 (6.1%)	0.0002
Ranolazine	66 (0.6%)	33 (0.4%)	33 (1.0%)	0.0002

Continuous variables presented as median (25th, 75th percentiles); categorical variables presented as number (%). ACEI indicates angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker. $P2Y_{12}$ inhibitors include clopidogrel, ticlopidine, ticagrelor, and prasugrel; BMI, body mass index; CABG, coronary artery bypass grafting; LAD, left anterior descending coronary artery; LCx, left circumflex coronary artery; LVEF, left ventricular ejection fraction; MI, myocardial infarction; PCI, percutaneous coronary intervention; RCA, right coronary artery; STEMI, ST-segment elevation myocardial infarction.

angina. Rates of guideline-directed secondary prevention medication use at discharge were similar between groups. Calcium channel blockers, long-acting nitrates, and ranolazine were infrequently prescribed at discharge: 6.6%, 4.9%, and 0.6%, respectively.

On multivariable modeling, independent factors associated with angina at 6 weeks following PCI for MI included younger age, female sex, black race, history of revascularization (PCI or CABG) before the index PCI, lower education level, unemployment, and lack of health insurance (Figure 2).

Compared with patients without angina, patients with angina at 6 weeks were more likely to report problems with mobility (26.5% versus 19.8%), washing and dressing (10.2% versus 7.1%), performing usual activities (30.9% versus 23.4%), moderate or extreme pain (42.1% versus 30.1%), and moderate or extreme anxiety/depression (34.8% versus 23.9%; $P<0.001$ for all comparisons) at their 6-week interview. Median EuroQOL 5 dimensions visual analogue scale score was lower (indicating worse overall quality of life) in patients with 6-week angina than in those without (70 versus 75, $P<0.001$).

Temporal Patterns of Angina Over Follow-Up

Of the 3190 patients reporting angina within 6 weeks following PCI for MI, 2891 answered SAQ questions at 6 months. Of these 2891 patients, 1287 (44.5%) had angina at 6 months; of these patients, 57 (4.4%) had daily angina, 268 (20.8%) had weekly angina, and 962 (74.7%) had monthly angina. At 12 months, data on angina frequency were available for 2715 patients with 6-week angina; 1056 (38.9%) of these patients continued to have angina at 12 months; 47 (4.5%) had daily angina, 232 (22.0%) had weekly angina, and 777 (73.6%) had monthly angina. Characteristics of patients with missing angina frequency at 6 and 12 months are included in Tables S2 and S3, respectively.

The strongest predictors of persistent angina at 12 months among patients with angina at 6 weeks included younger age (odds ratio 1.19, 95% confidence interval, 1.14–1.25 per 5-year decrease) and daily or weekly angina at 6 weeks (odds ratio 2.19, 95% confidence interval, 1.74–2.74). The full list of covariates associated with persistent angina on multivariable modeling is in Figure S1.

Among patients without 6-week angina (N = 7680), 994 (12.9%) had angina at 6 months; of these patients, 146 (14.7%) had daily/weekly angina, and 848 (85.3%) had monthly angina. Eight hundred forty-five (11.0%) patients without angina at 6 weeks had angina at 12 months—125 (14.8%) daily/weekly and 720 (85.2%) monthly.

Temporal Patterns of Anti-Anginal Medication Use Over Follow-Up

Of patients with 6-week angina, 92.0% reported taking β-blockers at any time in the year following their MI—89.7%

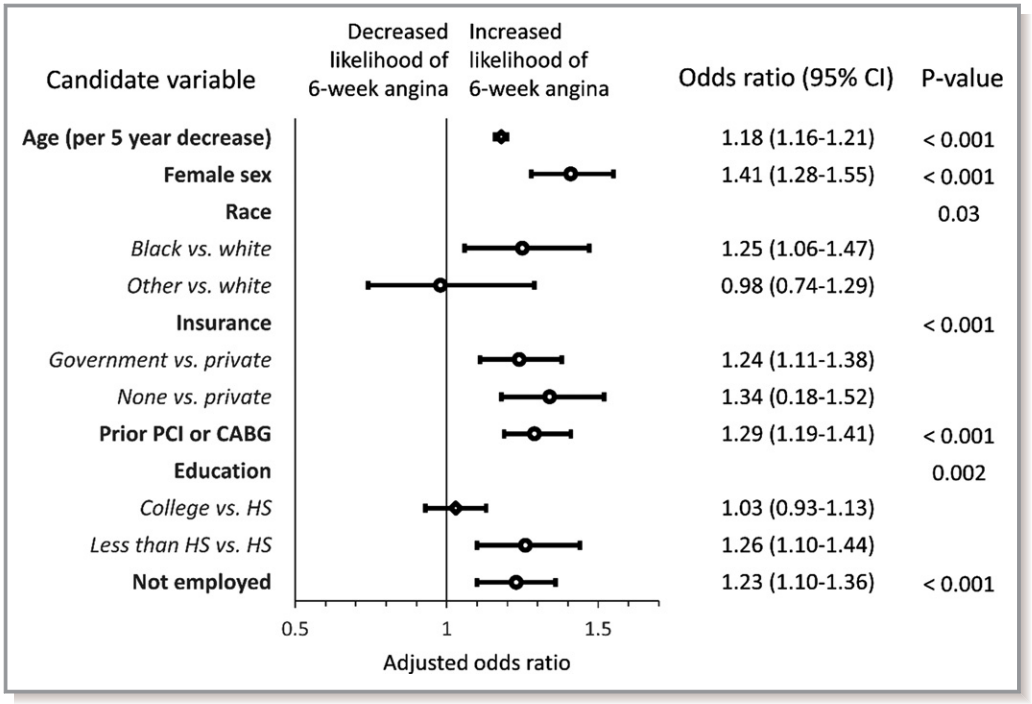

Figure 2. Factors associated with angina at 6 weeks. C-index for the multivariate model=0.62. CABG indicates coronary artery bypass graft surgery; CI, confidence interval; HS, high school; PCI, percutaneous coronary intervention.

at 6 weeks, 85.8% at 6 months, and 82.3% at 12 months. In contrast, only 743 (23.3%) were prescribed any non–β-blocker antianginal medication at any time over 12-month follow-up; rates of non–β-blocker antianginal medication use were 17.3%, 19.4%, and 20.6% at 6 weeks, 6 months, and 12 months, respectively (Figure 3). The proportion of patients with post-MI angina who were prescribed calcium channel blockers, long-acting nitrates, and ranolazine as part of their antianginal regimens remained stable over the 1-year follow-up; ≈10% of patients were prescribed calcium channel

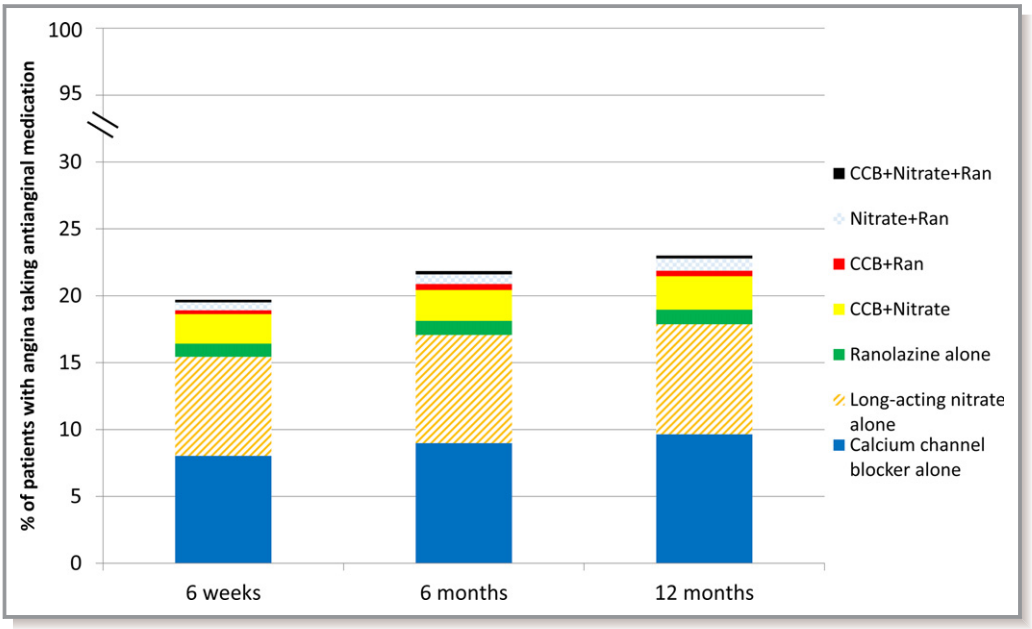

Figure 3. Temporal patterns of antianginal medication use. CCB indicates calcium channel blocker; Ran, ranolazine.

blockers, 10% were prescribed long-acting nitrates, and 2% were prescribed ranolazine at 6 weeks, 6 months, and 12 months.

When stratified by angina frequency, only 15.6% of patients who reported monthly angina at 6 weeks were treated with non–β-blocker antianginal medications; 2.1% of these patients were on 2 or more non–β-blocker antianginal medications. Among patients with daily or weekly angina, 24.0% were treated with non–β-blocker antianginal medications and 5.0% were taking 2 or more medications. Over the course of follow-up, the proportion of patients taking 1, 2, or 3 non–β-blocker antianginal medications increased modestly both for patients with monthly and daily/weekly angina (Figure 4, top panel). When stratified by sublingual nitroglycerin use, 104 of 303 patients (34.4%) who reported using sublingual nitroglycerin ≥1 time per week at 6 weeks were treated with at least 1 non–β-blocker antianginal medication, compared with 449 of 2873 patients (15.6%) who used <1 time per week (Figure 4, bottom panel). Over the course of follow-up, the proportion of patients taking 1, 2, or 3 non–β-blocker antianginal medications increased modestly for patients who used sublingual nitroglycerin <1 and ≥1 time per week.

In the 1056 patients who had persistent angina through 1 year, 727 (68.8%) were never prescribed any non–β-blocker antianginal medications post-MI. Even among patients who reported daily/weekly angina at the 12-month interview, 61.3% were never prescribed non–β-blocker antianginal medications. On multivariable analysis, among patients with

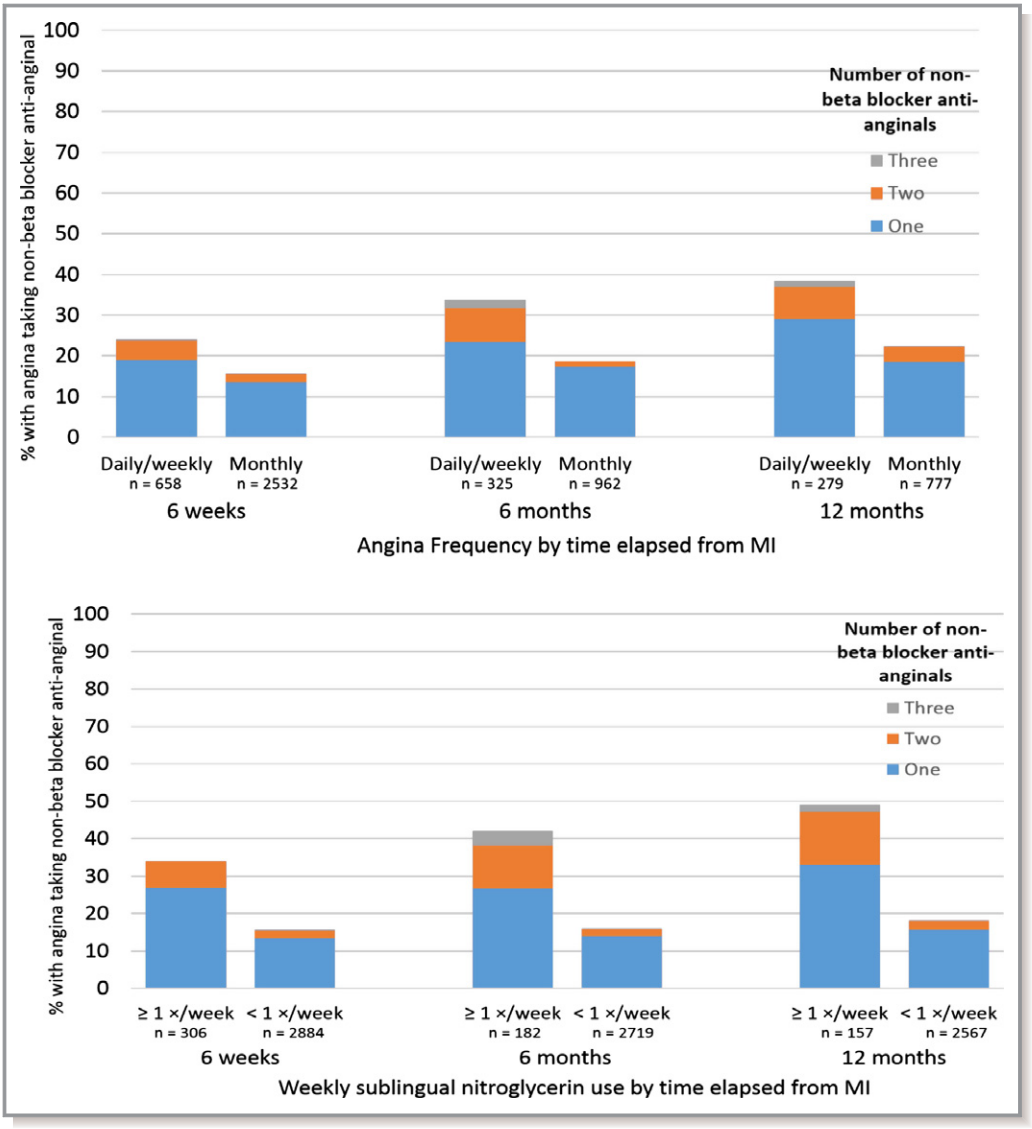

Figure 4. Temporal patterns of antianginal medication use by angina frequency and sublingual nitroglycerin use. Angina frequency and sublingual nitroglycerin use reflect patient-reported symptoms at each time point (6 weeks, 6 months, and 12 months). MI indicates myocardial infarction.

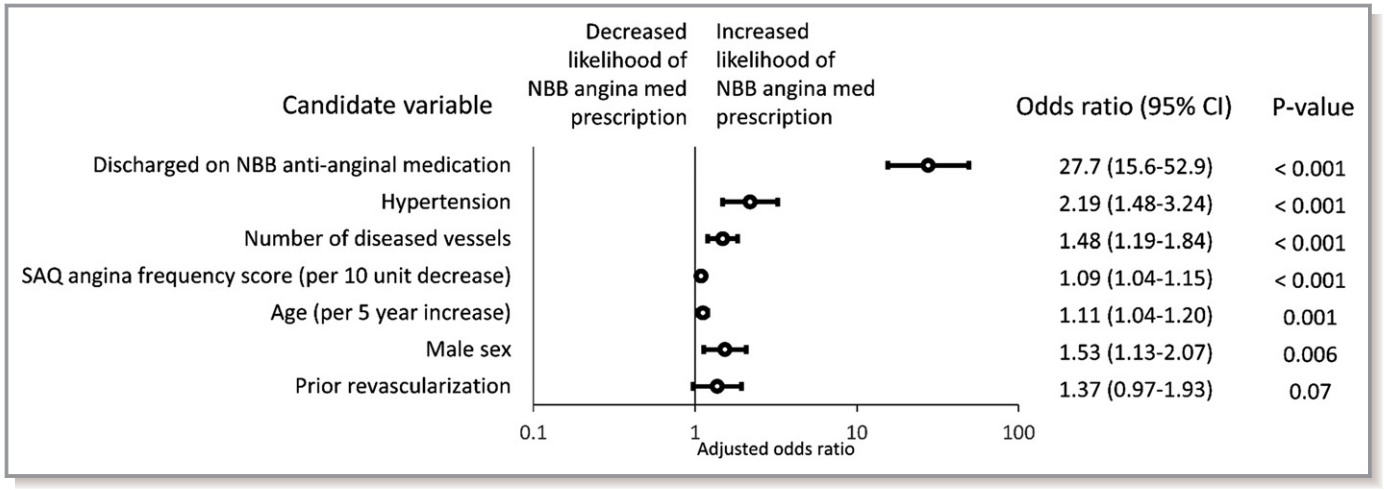

Figure 5. Factors associated with non–β-blocker antianginal medication among patients with continued angina over the entirety of follow-up. C-index for the multivariable model=0.81. CI indicates confidence interval; NBB, non–β-blocker; SAQ, Seattle Angina Questionnaire.

continued angina over the entirety of follow-up, the factor most strongly associated with use of non–β-blocker antianginal medication at any time during 1-year follow-up was prescription of a non–β-blocker antianginal medication at the time of discharge after the index event (odds ratio 29.7, 95% confidence interval, 16.7–52.9). Only 15% of patients were prescribed non–β-blocker antianginal medications at the time of discharge, but these patients comprised 45% of patients prescribed these medications at any time over the course of follow-up. Other factors associated with use of non–β-blocker antianginal medications included hypertension, number of diseased vessels, advanced age, more severe angina, female sex, and prior revascularization (Figure 5, C-index=0.83).

Antianginal Medications and Coronary Revascularization

Overall, 381 of 3190 patients (11.9%) with 6-week angina underwent symptom-driven, unplanned PCI or CABG in the 12 months following their index MIs. Median time to revascularization was 156 (25th, 75th percentiles: 85–284) days. At the time of revascularization, 330 (86.6%) of these patients were taking β-blockers, but only 99 patients (25.9%) were prescribed a non–β-blocker antianginal medication; 73 (19.2%), 23 (6.0%), and 3 (0.8%) were taking 1, 2, and 3 non–β-blocker antianginal medications, respectively.

Discussion

In this national study of MI patients treated with PCI, we observed a high incidence of post-PCI angina at 6 weeks, with a substantial proportion persisting through 1 year. While most post-MI patients were treated with β-blockers, non–β-blocker antianginal medications were used infrequently; 24.0% of patients with daily or weekly angina at 6 weeks and 31.2% of patients with persistent angina through 1 year after the index MI reported taking non–β-blocker antianginal medications. Notably, less than one third of patients who returned for symptom-driven unplanned coronary revascularization were treated with a non–β-blocker antianginal medication before their procedure.

The incidence of patient-reported post-MI angina in our study is lower than prior reports. In the PREMIER (Prospective Registry Evaluating Outcomes After Myocardial Infarction: Events and Recovery) and TRIUMPH (Translational Research Investigating Underlying Disparities in Acute Myocardial Infarction Patients' Health Status) registries, ≈20% of patients reported angina 12 months following MI, compared with ≈10% in TRANSLATE-ACS.[1,5] The lower prevalence of angina at 12 months in TRANSLATE-ACS may be because of all patients in TRANSLATE-ACS undergoing PCI for MI; rates of PCI were 70.3% and 67.8% in PREMIER and TRIUMPH, respectively. In PREMIER and TRIUMPH, younger, nonwhite patients were more likely to have angina than older, white patients; and calcium channel blockers and nitrates (including sublingual nitroglycerin) were prescribed to 12% and 51% of patients with angina, respectively.[1] In our study, younger age, female sex, nonwhite race, and lack of private health insurance were the strongest predictors of 6-week angina, and were also strong predictors of persistent angina at 12 months among patients with 6-week angina. Revascularization before the index PCI was the only baseline clinical factor associated with angina following the index PCI; this finding is consistent with the importance of the extent and severity of coronary artery disease in determining angina burden. Patients with more severe angina at 6 weeks were also more likely to have persistent angina at 12 months.

Incomplete revascularization following PCI was not associated with 6-week angina; though this finding is somewhat surprising, it is consistent with the low prevalence of angina following PCI with incomplete revascularization in the RIVER-PCI (Ranolazine in patients with incomplete revascularization after percutaneous coronary intervention) clinical trial.[14] Among patients with 6-week angina, prescription of non–β-blocker antianginal medications at the time of index discharge was associated with persistent angina at 12 months; this finding is likely because of confounding by indication, as patients with more severe and chronic angina are likely to be prescribed non–β-blocker anti-anginal medications.

Though our study showed a lower prevalence of angina than the PREMIER and TRIUMPH registries, the prevalence of angina was higher early post-PCI, and a considerable proportion of these patients continued to have angina and/or underwent symptom-driven unplanned coronary revascularization through the first year, especially among patients with more severe angina at 6 weeks. The fact that use of non–β-blocker antianginal medications was low at 6 months, 12 months, and at the time of unplanned revascularization in the cohort of patients that had persistent angina since their PCI demonstrates low provider adherence to guideline recommendations recommending stepwise escalation of medical antianginal therapy. Low use of non–β-blocker antianginal medications in these patients with angina likely contributes to the persistence of angina symptoms. Though most angina patients in our study had infrequent symptoms, and these patients may prefer to treat their infrequent symptoms with short-acting nitroglycerin as needed, <40% of patients with daily or weekly angina that persisted for 12 months following index PCI for MI were treated with non–β-blocker antianginal medications.

Underutilization of non–β-blocker antianginal medications in our population may be related to several factors. Effective angina treatment requires that clinicians recognize angina symptoms in their patients; yet multiple studies have demonstrated gaps in symptom recognition.[3,15,16] In 1 study of patients with long-term stable angina, 46% of patients with monthly angina and 26% of patients with daily or weekly angina were noted to have no angina by their physicians, and there was considerable variability between physicians in their recognition of patients' angina, with rates of under-recognition ranging from 0% to >90%.[16] In the same cohort of patients, just over half of patients reporting daily or weekly angina were treated with ≥2 antianginal medications, but the range of patients receiving more than 1 antianginal medication ranged from 0% to 100% across practice sites.[17] In an internet study of patients with chronic angina, >10% of patients with daily or weekly angina and 25% of patients with monthly angina did not discuss their symptoms with their physician.[18] A gap between patient-reported symptoms and physician-guided treatment of those symptoms is common in chronic diseases, in which treatment decisions critically depend on adequate communication between patients and healthcare providers.[19–21]

In addition, physicians may fail to recognize the importance of treating angina or the effectiveness of existing antianginal medications, as evidenced by consistent lack of treatment, even in the face of very frequent or persistent symptoms. Despite guidelines recommending use of at least 2 classes of antianginal medications (a β-blocker plus 1 additional agent) for patients with chronic angina,[9] there is no evidence that non–β-blocker antianginal medications reduce cardiovascular mortality or clinical events in the post-MI setting. However, all 3 classes of non–β-blocker antianginal medications increase exercise duration and time to electrocardiographic ischemia in patients with stable angina.[22–25] We found that patients with angina have worse quality of life across multiple domains than those without angina, and antianginal medications may help patients increase activity level and exercise capacity, and, in turn, improve quality of life.[1,26,27] Angina is also the factor most strongly associated with hospitalization within the 12 months following an index MI.[2,6,28] Furthermore, there may be cost or logistical barriers to the prescription of ranolazine, which is not yet available in generic form; however, low rates of prescription of nitrates and calcium channel blockers argue against cost being a major driver of this finding. Lastly, treatment inertia may be playing a role: Among patients with angina over the entirety of the study period, those who were treated with a non–β-blocker antianginal medication at the time of their index MI discharge were 30-fold more likely to take antianginal medications at any point than those who were not treated with a non–β-blocker antianginal medication at the time of index MI discharge.

Variability in practice between clinicians suggests room for improvement in angina management, perhaps by addressing the communication gap between patients and providers. In 1 single-center study, treating patients with angina in a dedicated "angina clinic" with monthly visits and scripted questions regarding angina severity and activity level resulted in clinically meaningful improvements in angina frequency and quality of life compared with usual care.[29] Provider education strategies to enhance patient–physician communication and improve angina management are needed, perhaps especially for younger and female patients, who are more likely to report angina at 6 weeks and persistent angina at 12 months, and are less likely to receive medical anti-anginal therapy.

Limitations

This analysis is limited to patient-reported angina, and it is unknown whether these patients have objective myocardial ischemia that would benefit from use of medical antianginal

therapy. Participants were only asked the SAQ's 2 questions about angina frequency; answers to questions from the SAQ's other domains—physical limitation (though this was collected as part of the EuroQOL 5 dimensions), angina stability, treatment satisfaction, and disease perception—were not collected. Participants were not asked about dyspnea, which is not well captured by the SAQ and may be an anginal equivalent; this study may thus underestimate the true prevalence of residual angina in the TRANSLATE-ACS population. Moreover, we excluded patients with missing angina status at 6 weeks; compared with patients with known angina status, these patients were younger, more frequently women, and more frequently had government insurance—all variables associated with angina among patients with known angina status. If patients with missing angina were more likely to have angina than those with known angina status, as might be predicted from patient characteristics, our study would underestimate the prevalence of residual angina in the post-PCI population. In addition, hypertension was associated with prescription of non–β-blocker anti-anginal therapy at 12 months among patients with 6-week angina; since calcium channel blockers and long-acting nitrates are also used as antihypertensive agents, this suggests that clinicians may not have recognized angina even in some patients who were treated with non–β-blocker anti-anginal medications. Though such patients would be treated with non–β-blocker anti-anginal medications, they may not have their anti-anginal medications titrated as aggressively as patients purposefully treated for angina. Further, exercise frequency and tolerance were not captured in TRANSLATE-ACS, and it is possible that patients reporting angina in our study were actually more physically active than patients without angina, and that their physical activity unmasked angina; however, the higher frequency of difficulty with mobility, self-care, usual activities, pain, and anxiety/depression among patients with angina argues against this possibility. Regardless, angina has effects on quality of life beyond limiting physical activity, and it remains important to treat patients' symptoms. Lastly, we do not report on outcomes related to use or escalation of non–β-blocker antianginal medications; any outcomes analysis would be limited by substantial confounding by indication. Without knowing about care processes contributing to underuse of antianginals, outcomes comparisons between treatment strategies may be flawed.

Conclusion

Angina is present in ≈30% of PCI-treated MI patients as early as 6 weeks after discharge, and persists at 1 year in many of these patients. Despite national guidelines, non–β-blocker antianginal medications are infrequently used in these patients in contemporary practice. Strategies to increase awareness of angina burden coupled with symptom-driven management to permit patient-centric improvement in outcomes should be explored.

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SUPPLEMENTAL MATERIAL

Data S1. Seattle Angina Questionnaire Angina Frequency Questions*

Angina frequency scores were determined based on two questions, one regarding angina frequency and one regarding nitroglycerin use. Points for each question were added and multiplied by a factor of 10 to derive the Seattle Angina Questionnaire Angina Frequency score. Scores were then classified into the following categories: no angina (100 points), monthly angina (70–90 points), or daily/weekly angina (0–60 points).

1. Angina frequency: In the last month, on average, how often did you experience chest discomfort or angina (symptoms similar to your heart attack)?

- ❑ More than once daily (0)
- ❑ Once daily (1)
- ❑ Several times a week but not every day (2)
- ❑ Once a week (3)
- ❑ Less than once a week (4)
- ❑ None in the past month (5)

2. Nitroglycerin use: In the last month, on average, how many times have you had to use nitros (nitroglycerin tablets) for your chest discomfort or angina?

- ❑ More than once daily (0)
- ❑ Once daily (1)
- ❑ Several times a week but not every day (2)
- ❑ Once a week (3)
- ❑ Less than once a week (4)
- ❑ None in the past month (5)

*Adapted from the Seattle Angina Questionnaire

Table S1. Baseline characteristics among patients with angina, no angina, and missing angina status at 6 weeks

	Overall (n = 12,351)	No angina at 6 weeks (n = 7680)	Angina at 6 weeks (n = 3190)	Missing angina status at 6 weeks (n = 1,481)	p-value
Demographics					
Age	60 (52,68)	61 (54, 69)	57 (50, 65)	56 (49, 65)	< 0.0001
Female sex	3470 (28.1%)	1998 (26.0%)	1017 (31.9%)	1026 (69.3%)	< 0.0001
Race					< 0.0001
White	10,862 (71.9%)	6876 (89.5%)	2741 (85.9%)	1245 (84.1%)	
Black/African American	1097 (8.9%)	569 (7.4%)	357 (11.2%)	171 (11.2%)	
Other non-white	236 (1.9%)	157 (2.0%)	61 (1.9%)	18 (1.2%)	
Health Insurance					< 0.0001
Private	7735 (62.6%)	5105 (66.5%)	1853 (58.1%)	777 (52.5%)	
Government	5006 (40.5%)	3199 (41.7%)	1243 (39.0%)	892 (60.2%)	
No insurance	1815 (14.7%)	933 (12.2%)	575 (18.0%)	307 (20.7%)	
Married	7723 (62.5%)	5065 (66.0%)	1935 (60.7%)	723 (48.8%)	< 0.0001
Education					< 0.0001
College	6465 (52.3%)	4185 (54.5%)	1621 (50.8%)	659 (44.5%)	
High school graduate	4272 (34.6%)	2609 (34.0%)	1086 (34.0%)	577 (38.7%)	
Less than high school	1437 (11.6%)	792 (10.3%)	433 (13.6%)	212 (14.3%)	
Employed	6176 (50.0%)	3858 (50.2%)	1561 (48.9%)	757 (51.1%)	0.32
BMI	29 (26, 33)	29 (26, 33)	30 (26, 34)	29 (26, 33)	0.02
Past Medical History					
Prior MI	2418 (19.6%)	1420 (18.5%)	664 (20.8%)	334 (22.6%)	0.0001
Prior PCI	2680 (21.7%)	1598 (20.8%)	736 (23.1%)	346 (23.4%)	0.008
Prior CABG	1143 (9.3%)	676 (8.8%)	343 (10.8%)	124 (8.4%)	0.003
Cerebrovascular disease	889 (7.2%)	532 (6.9%)	247 (7.7%)	110 (7.4%)	0.31
Peripheral artery disease	785 (6.4%)	487 (6.3%)	203 (6.4%)	95 (6.4%)	0.99
Prior heart failure	730 (5.9%)	437 (5.7%)	193 (6.1%)	100 (6.8%)	0.25
Prior atrial fibrillation	576 (4.7%)	383 (5.0%)	131 (4.1%)	62 (4.2%)	0.10
Diabetes	3267 (26.5%)	1963 (25.6%)	855 (26.8%)	449 (30.3%)	0.0004
Hypertension	8264 (66.9%)	5141 (66.9%)	2135 (66.9%)	988 (66.7%)	0.99
Hyperlipidemia	8084 (65.5%)	5071 (66.0%)	2074 (65.0%)	939 (63.4%)	0.17
Current/recent smoker	4725 (38.3%)	2637 (34.3%)	1362 (42.7%)	726 (49.0%)	< 0.0001
Chronic lung disease	1208 (9.8%)	654 (8.5%)	392 (12.3%)	162 (10.9%)	< 0.0001
Index MI/PCI characteristics					
STEMI	6509 (51.9%)	4008 (52.2%)	1648 (51.7%)	753 (50.9%)	0.61
Culprit lesion location					0.08
Left main	105 (0.9%)	63 (0.8%)	29 (0.9%)	13 (0.9%)	

	Overall (n = 12,351)	No angina at 6 weeks (n = 7680)	Angina at 6 weeks (n = 3190)	Missing angina status at 6 weeks (n = 1,481)	p-value
LAD	4572 (37.0%)	2846 (37.1%)	1197 (37.5%)	529 (35.7%)	
LCx	2758 (22.3%)	1667 (21.7%)	718 (22.5%)	373 (25.2%)	
RCA	4799 (38.9%)	3043 (39.6%)	1212 (38.0%)	544 (36.7%)	
Culprit lesion in graft	511 (4.1%)	330 (4.2%)	162 (5.1%)	45 (3.0%)	0.002
Culprit lesion previously treated	912 (7.4%)	530 (6.9%)	262 (8.2%)	120 (8.1%)	0.03
Culprit lesion is bifurcation	1376 (11.1%)	862 (11.2%)	354 (11.1%)	160 (10.8%)	0.95
Multi-vessel disease	6064 (49.1%)	3810 (49.6%)	1557 (48.8%)	697 (47.1%)	0.16
Multi-vessel PCI	1352 (11.0%)	859 (11.2%)	317 (9.9%)	176 (11.9%)	0.08
Drug eluting stent	8738 (70.8%)	5544 (72.2%)	2216 (69.5%)	978 (66.1%)	< 0.0001
Discharge LVEF ≤ 40%	2280 (20.6%)	1416 (20.6%)	592 (20.9%)	272 (20.6%)	0.95
Discharge medications					
$P2Y_{12}$ inhibitor	12,285 (99.5%)	7648 (99.6%)	3173 (99.5%)	1464 (98.9%)	0.0007
Prasugrel/ticagrelor	3915 (31.7%)	2391 (31.1%)	1028 (32.2%)	496 (33.5%)	0.16
Statin	11,745 (95.4%)	7313 (95.6%)	3030 (95.3%)	1402 (94.9%)	0.50
Aspirin	12,132 (98.7%)	7554 (98.6%)	3131 (98.7%)	1447 (98.6%)	0.88
ACEI/ARB	9100 (74.3%)	5702 (74.9%)	2323 (73.5%)	1075 (73.3%)	0.21
Beta blocker	11,419 (93.5%)	7097 (93.4%)	2957 (93.6%)	1365 (93.5%)	0.96
Calcium channel blocker	826 (6.7%)	523 (6.8%)	198 (6.2%)	105 (7.1%)	0.42
Long-acting nitrate	632 (5.1%)	341 (4.4%)	196 (6.1%)	95 (6.4%)	< 0.0001
Ranolazine	76 (0.6%)	33 (0.4%)	33 (1.0%)	10 (0.7%)	0.001

Continuous variables presented as median (25^{th}, 75^{th} percentiles); categorical variables presented as number (%). BMI, body mass index; MI, myocardial infarction; PCI, percutaneous coronary intervention; CABG, coronary artery bypass grafting; STEMI, ST segment elevation myocardial infarction; LAD, left anterior descending coronary artery; LCx, left circumflex coronary artery; RCA, right coronary artery; LVEF, left ventricular ejection fraction; ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin II receptor blocker. $P2Y_{12}$ inhibitors include clopidogrel, ticlopidine, ticagrelor, and prasugrel; generation 2 $P2Y_{12}$ inhibitors are ticagrelor and prasugrel.

Table S2. Baseline characteristics among patients with angina, no angina, and missing angina status at 6 months, among patients with angina at 6 weeks

	Overall (n = 3190)	**No angina at 6 months (n = 1,604)**	**Angina at 6 months (n = 1,287)**	**Missing angina status at 6 months (n = 299)**	**p-value**
Demographics					
Age	57 (60, 65)	59 (52, 67)	56 (50, 64)	54 (47, 62)	< 0.0001
Female sex	1017 (31.9)	468 (29.2)	442 (34.4)	106 (35.5)	0.004
Race					< 0.0001
White	2741 (85.9)	1415 (88.2)	1092 (84.9)	234 (78.3)	
Black/African American	357 (11.2)	149 (9.3)	157 (12.2)	51 (17.1)	
Other non-white	61 (1.9)	29 (1.8)	25 (1.9)	7 (2.3)	
Health Insurance					< 0.0001
Private	1853 (58.1)	1028 (64.1)	694 (53.9)	131 (43.8)	
Government	1243 (39.0)	609 (38.0)	510 (39.6)	124 (41.5)	
No insurance	575 (18.0)	244 (15.2)	250 (19.4)	81 (27.1)	
Married	1935 (60.7)	1069 (66.7)	725 (56.3)	141 (47.2)	< 0.0001
Education					
College	598 (18.8)	350 (21.8)	212 (16.5)	36 (12.0)	< 0.0001
High school graduate	2109 (66.1)	1045 (65.1)	860 (66.8)	204 (68.2)	
Less than high school	433 (13.6)	182 (11.4)	194 (15.1)	57 (19.1)	
Employed	1561 (48.9)	850 (53.0)	591 (45.9)	120 (40.1)	< 0.0001
BMI	30 (26, 39)	29 (26, 33)	30 (26, 34)	30 (26, 35)	0.58
Past Medical History					
Prior MI	664 (20.8)	295 (18.4)	296 (23.0)	73 (24.4)	0.003
Prior PCI	736 (23.1)	332 (20.7)	329 (25.6)	75 (25.1)	0.005
Prior CABG	343 (10.8)	148 (9.2)	165 (12.8)	30 (10.0)	0.007
Cerebrovascular disease	247 (7.7)	110 (6.9)	107 (8.3)	30 (10.0)	0.10
Peripheral artery disease	203 (6.4)	92 (5.7)	87 (6.8)	24 (8.0)	0.24
Prior heart failure	193 (6.1)	70 (4.4)	92 (7.2)	31 (10.4)	< 0.0001
Prior atrial fibrillation	131 (4.1)	63 (3.9)	52 (4.0)	16 (5.4)	0.51
Diabetes	855 (26.8)	407 (25.4)	358 (27.8)	90 (30.1)	0.13
Hypertension	2135 (66.9)	1055 (65.8)	877 (68.1)	203 (67.9)	0.32
Hyperlipidemia	2074 (65.0)	1060 (66.1)	828 (64.3)	186 (62.2)	0.39
Current/recent smoker	1362 (42.7)	617 (38.5)	570 (44.3)	175 (58.5)	< 0.0001
Chronic lung disease	392 (12.3)	165 (10.3)	170 (13.2)	57 (19.1)	< 0.0001
Index MI/PCI characteristics					
STEMI	1648 (51.7)	857 (53.4)	630 (49.0)	161 (53.9)	0.04
Culprit lesion location					0.65
Left main	29 (0.9)	13 (0.8)	11 (0.9)	5 (1.7)	

	Overall (n = 3190)	No angina at 6 months (n = 1,604)	Angina at 6 months (n = 1,287)	Missing angina status at 6 months (n = 299)	p-value
LAD	1197 (37.5)	620 (38.7)	467 (36.3)	110 (36.8)	
LCx	718 (22.5)	354 (22.1)	300 (23.3)	64 (21.4)	
RCA	1212 (38.0)	602 (37.5)	492 (38.2)	118 (39.5)	
Culprit lesion in graft	162 (5.1)	71 (4.4)	73 (5.7)	18 (6.0)	0.56
Culprit lesion previously treated	262 (8.2)	10.8 (6.7)	116 (9.0)	38 (12.7)	0.001
Culprit lesion is bifurcation	354 (11.1)	190 (11.9)	132 (10.3)	32 (10.7)	0.40
Multi-vessel disease	1557 (48.8)	791 (49.3)	630 (49.0)	136 (45.5)	0.36
Multi-vessel PCI	317 (9.9)	160 (10.0)	124 (9.6)	33 (11.0)	0.78
Drug eluting stent	2216 (69.5)	1138 (71.0)	891 (69.2)	187 (62.5)	0.01
Discharge LVEF ≤ 40%	592 (20.9)	288 (20.1)	231 (20.2)	73 (27.9)	0.02
Discharge medications					
$P2Y_{12}$ inhibitor	3173 (99.5)	1596 (99.5)	1280 (99.5)	297 (99.3)	0.93
Prasugrel/ticagrelor	1028 (32.2)	518 (32.3)	427 (33.2)	83 (27.8)	0.20
Statin	3030 (95.3)	1515 (94.9)	1235 (96.3)	280 (93.7)	0.08
Aspirin	3131 (98.7)	1576 (98.6)	1261 (98.8)	294 (99.0)	0.82
ACEI/ARB	2323 (73.5)	1175 (73.8)	928 (73.0)	220 (73.8)	0.87
Beta blocker	2957 (93.6)	1480 (93.3)	1198 (93.7)	279 (94.3)	0.76
Calcium channel blocker	198 (6.2)	104 (6.5)	76 (6.9)	18 (6.0)	0.81
Long-acting nitrate	196 (6.1)	82 (5.1)	91 (7.1)	23 (7.7)	0.05
Ranolazine	33 (1.0)	12 (0.8)	19 (1.5)	2 (0.7)	0.13

Continuous variables presented as median (25^{th}, 75^{th} percentiles); categorical variables presented as number (%). BMI, body mass index; MI, myocardial infarction; PCI, percutaneous coronary intervention; CABG, coronary artery bypass grafting; STEMI, ST segment elevation myocardial infarction; LAD, left anterior descending coronary artery; LCx, left circumflex coronary artery; RCA, right coronary artery; LVEF, left ventricular ejection fraction; ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin II receptor blocker.

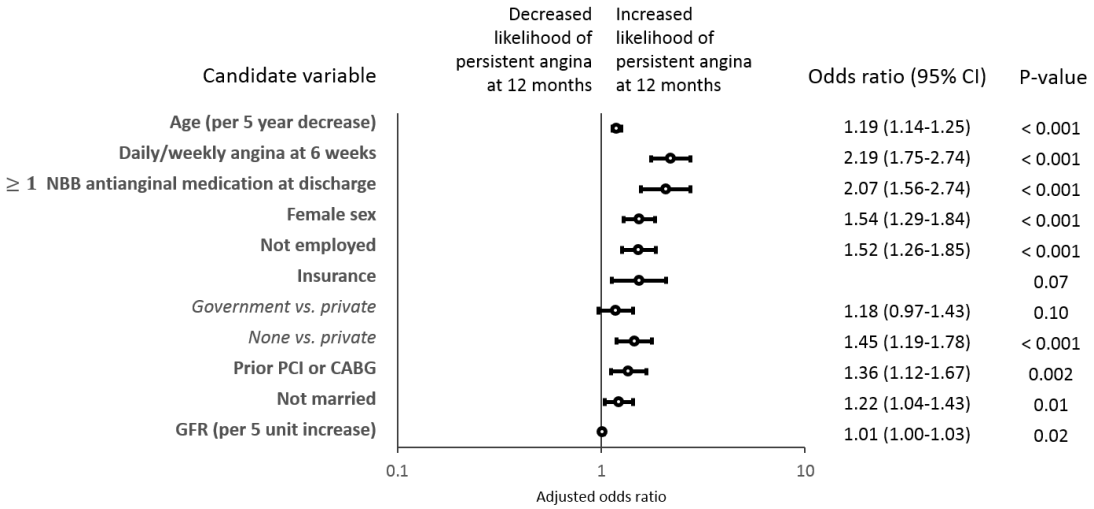
Table S3. Baseline characteristics among patients with angina, no angina, and missing angina status at 12 months, among patients with angina at 6 weeks

	Overall (n = 3190)	No angina at 12 months (n = 1,659)	Angina at 12 months (n = 1,056)	Missing angina status at 12 months (n = 475)	p-value
Demographics					
Age	57 (50, 65)	59 (52, 67)	56 (49, 63)	55 (48, 62)	< 0.0001
Female sex	1017 (31.9)	455 (27.4)	381 (36.1)	181 (38.1)	< 0.0001
Race					< 0.0001
White	2741 (85.9)	1468 (88.5)	886 (83.9)	387 (81.5)	
Black/African American	357 (11.2)	144 (8.7)	139 (13.2)	74 (15.6)	
Other non-white	61 (1.9)	32 (1.9)	21 (2.0)	8 (1.7)	
Health Insurance					< 0.0001
Private	1853 (58.1)	1080 (65.1)	566 (53.6)	207 (43.6)	
Government	1243 (39.0)	634 (38.2)	402 (38.1)	207 (43.6)	
No insurance	575 (18.0)	230 (13.9)	220 (20.8)	125 (26.3)	
Married	1935 (60.7)	1110 (66.9)	600 (56.8)	225 (47.4)	< 0.0001
Education					< 0.0001
College	598 (18.8)	373 (22.5)	175 (16.6)	50 (10.5)	
High school graduate	2109 (66.1)	1077 (64.9)	713 (	319 (	
Less than high school	433 (13.6)	182 (11.0)	151 (14.3)	100 (21.1)	
Employed	1561 (48.9)	897 (54.1)	471 (44.6)	193 (40.6)	< 0.0001
BMI	30 (26, 34)	29 (26, 34)	30 (26, 34)	30 (26, 35)	0.72
Past Medical History					
Prior MI	664 (20.8)	297 (17.9)	242 (22.9)	125 (26.3)	< 0.0001
Prior PCI	736 (23.1)	328 (19.8)	271 (25.7)	137 (28.8)	< 0.0001
Prior CABG	343 (10.8)	150 (9.0)	138 (13.1)	55 (11.6)	0.003
Cerebrovascular disease	247 (7.7)	113 (6.8)	81 (7.7)	53 (11.2)	0.007
Peripheral artery disease	203 (6.4)	85 (5.1)	77 (7.3)	41 (8.6)	0.007
Prior heart failure	193 (6.1)	66 (4.0)	69 (6.5)	58 (12.2)	< 0.0001
Prior atrial fibrillation	131 (4.1)	64 (3.9)	50 (4.7)	17 (3.6)	0.45
Diabetes	855 (26.8)	406 (24.5)	288 (27.3)	161 (33.9)	0.0002
Hypertension	2135 (66.9)	1094 (65.9)	699 (66.2)	342 (72.0)	0.03
Hyperlipidemia	2074 (65.0)	1077 (64.9)	683 (64.7)	314 (66.1)	0.85
Current/recent smoker	1362 (42.7)	625 (37.7)	472 (44.7)	265 (55.8)	< 0.0001
Chronic lung disease	392 (12.3)	158 (9.5)	146 (13.8)	88 (18.5)	< 0.0001
Index MI/PCI characteristics					
STEMI	1648 (51.7)	888 (53.5)	521 (49.3)	239 (50.3)	0.08
Culprit lesion location					0.04
Left main	29 (0.9)	10 (0.6)	12 (1.1)	7 (1.5)	

	Overall (n = 3190)	No angina at 12 months (n = 1,659)	Angina at 12 months (n = 1,056)	Missing angina status at 12 months (n = 475)	p-value
LAD	1197 (37.5)	634 (38.2)	404 (38.3)	159 (33.5)	
LCx	718 (22.5)	349 (21.0)	257 (24.3)	112 (23.6)	
RCA	1212 (38.0)	650 (39.2)	371 (35.1)	191 (40.2)	
Culprit lesion in graft	162 (5.1)	72 (4.3)	65 (6.2)	25 (5.3)	0.14
Culprit lesion previously treated	262 (8.2)	110 (6.6)	100 (9.5)	52 (11.0)	0.002
Culprit lesion is bifurcation	354 (11.1)	194 (11.7)	121 (11.5)	39 (8.2)	0.09
Multi-vessel disease	1557 (48.8)	835 (50.3)	493 (46.7)	229 (48.2)	0.15
Multi-vessel PCI	317 (9.9)	156 (9.4)	108 (10.2)	53 (11.2)	0.50
Drug eluting stent	2216 (69.5)	1175 (70.8)	741 (70.2)	300 (63.2)	0.004
Discharge LVEF ≤ 40%	592 (20.9)	311 (20.7)	186 (19.8)	95 (24.0)	0.21
Discharge medications					
$P2Y_{12}$ inhibitor	3173 (99.5)	1647 (99.3)	1054 (99.8)	472 (99.4)	0.17
Prasugrel/ticagrelor	1028 (32.2)	529 (31.9)	362 (34.3)	137 (28.8)	0.10
Statin	3030 (95.3)	1581 (95.6)	1007 (95.6)	442 (93.5)	0.11
Aspirin	3131 (98.7)	1633 (98.9)	1033 (98.5)	465 (98.9)	0.64
ACEI/ARB	2323 (73.5)	1224 (74.5)	758 (72.5)	341 (72.3)	0.42
Beta blocker	2957 (93.6)	1541 (93.9)	983 (93.5)	433 (92.3)	0.47
Calcium channel blocker	198 (6.2)	78 (4.7)	88 (8.3)	32 (6.7)	0.0006
Long-acting nitrate	196 (6.1)	73 (4.4)	91 (8.6)	32 (6.7)	< 0.0001
Ranolazine	33 (1.0)	7 (0.4)	20 (1.9)	6 (1.3)	0.0009

Continuous variables presented as median (25^{th}, 75^{th} percentiles); categorical variables presented as number (%). BMI, body mass index; MI, myocardial infarction; PCI, percutaneous coronary intervention; CABG, coronary artery bypass grafting; STEMI, ST segment elevation myocardial infarction; LAD, left anterior descending coronary artery; LCx, left circumflex coronary artery; RCA, right coronary artery; LVEF, left ventricular ejection fraction; ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin II receptor blocker.

Figure S1. Factors associated with persistent angina at 12 months among patients with 6-week angina



NBB, non-beta blocker; GFR, glomerular filtration rate