Published in final edited form as:

Am J Cardiol. 2011 September 15; 108(6): 822–827. doi:10.1016/j.amjcard.2011.04.034.

Predictors of Low Clopidogrel Adherence Following Percutaneous Coronary Intervention

Paul Muntner, PhD^a, Devin M Mann, MD^b, Mark Woodward, PhD^c, James W Choi, MD^d, Robert C Stoler, MD^d, Daichi Shimbo, MD^e, Michael E. Farkouh, MD^{f,g}, and Michael C Kim, MD^f

^aDepartment of Epidemiology and Medicine (PM), University of Alabama at Birmingham, Birmingham, AL

^bSection of Preventive Medicine and Epidemiology (DMM), Boston University, Boston, MA

^cThe George Institute (MW), University of Sydney, Australia

^dBaylor Heart and Vascular Hospital (JWC, RCS) at Baylor University Medical Center, Dallas, TX

^eDepartment of Medicine, Columbia University, New York, NY

^fThe Zena and Michael A. Wiener Cardiovascular Institute and Marie-Josée and Henry R. Kravis Center for Cardiovascular Health (MEF, MCK), Mount Sinai School of Medicine, New York, New York

^gThe Peter Munk Cardiac Centre and Li Ka Shing Knowledge Institute, University of Toronto, Toronto, Canada (MEF)

Abstract

Few data are available on factors associated with low adherence or early clopidogrel discontinuation following percutaneous coronary intervention (PCI). Patients (n=284) were evaluated prior to hospital discharge following PCI to identify factors associated with low adherence to clopidogrel 30 days later. Pre-PCI adherence to daily medications was assessed using the 8-item Morisky Medication Adherence Scale (MMAS-8) and categorized as low, medium, or high (scores <6, 6 to <8 and 8, respectively). Low adherence to clopidogrel was defined as a MMAS-8 score < 6 (n=21) or having discontinued clopidogrel (n=11), both ascertained during a 30-day post-PCI interview. At 30 days post-PCI, 11% of patients had low adherence to clopidogrel. The odds ratios (95% confidence interval) for low adherence to clopidogrel was 3.78 (1.09 – 13.1), 3.06 (1.36 – 6.87), 2.46 (0.97 – 6.27) and 3.36 (0.99 – 11.4) for patients who reported, prior to PCI, taking smaller doses of medication due to cost, had difficulty filling prescriptions, had difficulty reaching their primary physician and were not comfortable asking their doctor for instructions, respectively. The odds ratios (95% CI) for low clopidogrel adherence following PCI among patients with medium and low, versus high adherence, to daily medications prior to PCI was 6.13 (1.34 – 28.2) and 10.9 (2.46 – 48.7), respectively. The c-statistic associated with pre-PCI MMAS-8 scores for discriminating low clopidogrel adherence at 30 days post-PCI

© 2011 Excerpta Medica, Inc. All rights reserved.

Address correspondence and reprint requests to: Paul Muntner, Department of Epidemiology, University of Alabama at Birmingham, 1665 University Boulevard, Suite 230J, Birmingham, AL 35294, (205) 975-8077 – phone, (205) 934-8665 - fax, pmuntner@uab.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

was 0.733 (95% CI: 0.650 – 0.852). Pre-PCI adherence to daily medications may be a useful indicator for identifying patients who will have low clopidogrel adherence following PCI.

Keywords

Clopidogrel; medication adherence; percutaneous coronary intervention

Dual anti-platelet therapy with aspirin and clopidogrel is standard of care for patients following percutaneous coronary interventions (PCI)¹. Despite the importance of persistence to clopidogrel following PCI, little is known about the factors associated with low adherence and early discontinuation of clopidogrel. Therefore, we conducted an analysis of data from the Ambulatory Closure Device (ABCD-PCI) trial to assess factors, collected prior to hospital discharge following PCI, associated with early clopidogrel discontinuation or low adherence to clopidogrel at 30 days following PCI.

METHODS

The ABCD-PCI trial included patients undergoing elective PCI and was designed to confirm the safety of same day hospital discharge following PCI. Additionally, patients' preference for same day hospital discharge versus longer stays was evaluated. Patients were recruited from Mount Sinai Hospital in New York, New York and Baylor Heart and Vascular Hospital at Baylor University Medical Center in Dallas, Texas. Major inclusion criteria were age < 75 years, having type A or B lesions, and the use of a closure device. Patients with evidence of a recent acute coronary syndrome or who received three or more stents were not enrolled. Overall, 298 patients were enrolled and completed the baseline and follow-up ABCD-PCI study visits. Patients who did not complete the medication adherence screening tool (n=14), described below, at both administrations were excluded. This study was approved by the Institutional Review Boards of Mount Sinai School of Medicine and Baylor University Medical Center. Patient consent for was obtained prior to enrollment.

Of relevance to the current analysis, data were collected following PCI, but prior to hospital discharge, via a self-administered questionnaire and at 30 days following PCI using an interview administered questionnaire. The pre-hospital discharge survey instrument included domains assessing sociodemographics, cigarette smoking, health insurance status, barriers to filling medications, patient-physician communication, beliefs about medication and adherence to daily medications. Potential barriers to filling medications included skipping or taking smaller medication doses due to cost and lack of health insurance coverage for prescription medications. Medication beliefs were assessed using the 16-item Beliefs about Medicines Questionnaire (BMQ)^{2–5}. Adherence to daily medications prior to PCI was assessed using the 8-item Morisky Medication Adherence Scale (MMAS-8)⁶. Items on this scale reflect reasons for non-adherent behavior (e.g., forgetfulness, health beliefs, and side-effects) and thus may be useful in identifying the underlying causes of non-adherence. The MMAS-8 contains 7 “Yes” or “No” responses and one item scored on a five point Likert-type scale. Scores on the MMAS-8 can range from zero to eight; with scores of <6, 6 to <8, and 8 reflecting low, medium and high adherence, respectively⁶. The MMAS-8 has been determined to be reliable and associated with blood pressure control and pharmacy fill rates in individuals with hypertension^{6–8}. For administration prior to hospital discharge, the MMAS-8 was tailored to assess adherence to all medications taken on a daily basis.

At 30 days following PCI, a separate questionnaire was administered via telephone by a trained research staff member. The 30 day follow-up questionnaire included an item about discontinuing clopidogrel. Among patients who reported they did not discontinue

clopidogrel, the MMAS-8 was administered. For administration during the 30 day follow-up interview, the MMAS-8 was tailored to apply to clopidogrel adherence. For example, the question “Do you sometimes forget to take your medications” was changed to “Do you sometimes forget to take your Plavix?” The outcome for the current analysis was discontinuation of clopidogrel and low adherence to clopidogrel 30 days following PCI. Due to the moderate sample size of the current study, discontinuation of clopidogrel and low adherence to clopidogrel at 30 days following PCI were used as a pooled outcome, referred to as low adherence through the rest of the manuscript. Discontinuation at 30 days following PCI was assessed via self-report and low adherence was defined as scores < 6 on the MMAS-8.

Characteristics of patients were calculated overall and by pre-PCI level of medication adherence (low, medium, and high). The prevalence and odds ratios of low adherence to clopidogrel at 30 days following PCI were calculated for each item on the pre-hospital discharge MMAS-8 administration. The distribution of adherence to clopidogrel (low, medium, and high) at 30 days post-PCI was calculated by level of pre-PCI adherence to daily medications. Odds ratios for low adherence at 30 days following PCI were calculated for patient sociodemographics, medication taking behaviors, beliefs about medications, and overall MMAS-8 scale scores assessed prior to hospital discharge following PCI. To assess how well factors assessed prior to hospital discharge following PCI discriminate between those who subsequently had versus did not have low clopidogrel adherence, c-statistics were calculated for variables associated ($p < 0.10$) with low clopidogrel adherence in univariable analysis. Additionally, c-statistics were calculated for each item, as well as overall scores, on the pre-hospital discharge administration of the MMAS-8. Since patients who receive drug eluting stents (DES) are recommended long term clopidogrel therapy, for a sensitivity analysis, odds ratios and c-statistics for low adherence to clopidogrel at 30 days post PCI were calculated restricted to patients who received a DES. All analyses were conducted using SAS 9.2 (SAS Institute, Cary NC).

RESULTS

The mean age of patients included in this analysis was 55.8 years, 26% were women, and 33%, 15%, 26%, and 21% were non-Hispanic white, non-Hispanic black, Hispanic, and Asian, respectively (Table 1). Overall, prior to hospital discharge following PCI, 32%, 35%, and 32% of patients reported low, medium and high adherence to daily medications, respectively. Also, 73.9%, 81.0% and 84.6% of participants with low, medium and high adherence to daily medications prior to PCI received DES ($p = 0.102$).

Overall, 32 (11%), 68 (24%), and 184 (65%) patients had low, medium, and high adherence to clopidogrel at 30 days post-PCI. Of those with low adherence, 11 (34%) had discontinued clopidogrel and 21 (66%) had a low MMAS-8 scale score. Among those with low adherence to daily medications prior to PCI, 20% had low adherence to clopidogrel in the month after PCI (Figure 1). In contrast, 12% and 2% of those with medium and high adherence to daily medications prior to PCI had low adherence to clopidogrel at 30 days post-PCI ($p < 0.001$). Also, 49%, 65%, and 80% of patients with low, medium, and high adherence to daily medications prior to PCI had high adherence to clopidogrel following PCI ($p < 0.001$).

Four of the 8 items that comprise the MMAS-8 (sometimes forgetting to take medications, missed taking medication in the past two weeks, sometimes forgetting to bring medications when leaving home, and having difficulty remembering to take all medications), assessed for daily medication use prior to PCI, were associated with higher odds ratios for low adherence to clopidogrel at 30 days post-PCI (Table 2). The odds ratios for low adherence to clopidogrel at 30 days following PCI were 6.13 (95% CI 1.34 – 28.2) and 10.9 (95% CI:

2.46 – 48.7) among patients with medium and low adherence to daily medications prior to PCI, respectively.

The odds ratios for low adherence to clopidogrel following PCI associated with patient characteristics and behaviors are provided in Table 3. Of note, the odds ratios for low adherence to clopidogrel were 3.78 (95% CI: 1.09 – 13.1) for patients who, prior to PCI, reported sometimes or often taking smaller doses due to cost, 3.06 (95% CI 1.36 – 6.87) for patients who reported sometimes or often having difficulty filling prescriptions, 2.46 (95% CI: 0.97 – 6.27) for patients who have difficulty reaching their doctor and 3.36 (95% CI: 0.99 – 11.4) for patients who were not comfortable asking their doctor for instructions.

C-statistics for discriminating low adherence to clopidogrel 30 days following PCI associated with items assessed prior to hospital discharge following PCI are presented in Table 4. C-statistics were greater than 0.65 for three items on the pre-discharge MMAS-8 administration (sometimes forgetting to take medications, missing taking medicine in the past two weeks, and having difficulty remembering to take all medication) but none of the other variables evaluated. The c-statistic for the MMAS-8 administered prior to PCI was 0.733 (95% CI: 0.650 – 0.815).

Twenty four of the 226 patients (10.6%) receiving DES had low adherence to clopidogrel 30 days following PCI. Among patients who received DES, the odds ratios for low clopidogrel adherence were 2.47 (95% CI: 0.46 – 13.1) and 13.2 (95% CI: 2.77 – 56.5) for patients with medium and low adherence, versus high adherence, to daily medications prior to PCI. The c-statistic for discriminating low adherence to clopidogrel at 30 days post-PCI associated with MMAS-8 scale scores assessing adherence pre-PCI adherence was 0.771 (95% CI: 0.663 – 0.879).

DISCUSSION

In the current study, several patient, provider and health system factors were associated with adherence to clopidogrel following PCI. Of note, a strong graded association was present between level of adherence to daily medications prior to PCI with post-PCI adherence to clopidogrel. The overall MMAS-8 score, assessed prior to hospital discharge for PCI, had a c-statistic >0.7 for discriminating between individuals who subsequently had versus did not have low adherence to clopidogrel following PCI. Other factors related to low adherence to clopidogrel included cost issues, physician and pharmacy access, and patient-provider communication.

Early discontinuation of clopidogrel following PCI is common. Over 9 months of follow-up of PCI-CURE trial participants, 9.7% discontinued clopidogrel⁹. In the PREMIER registry, 16% of patients were not taking clopidogrel 30 days following their PCI procedure¹⁰. Early clopidogrel discontinuation has been associated with stent thrombosis after DES implantation^{11;12}. Also, all-cause mortality rates at one year following PCI were 7.5% and 0.7% for patients who had discontinued and were still taking clopidogrel therapy, respectively, at 30 days following PCI in the PREMIER registry (hazard ratio =9.02, 95% CI:1.3 – 60.6)¹⁰.

A few prior studies, primarily secondary data analyses, have examined factors associated with early clopidogrel discontinuation. Patients in the PREMIER registry who had stopped taking clopidogrel were older, less likely to be married and have completed high school, more likely to have avoided healthcare because of cost, and have a history of cardiovascular disease and anemia¹⁰. Also, patients who did not receive discharge instructions for medication use were also less likely to be taking clopidogrel. In a multivariable adjusted model, having less than a high school education was the only factor significantly associated

with clopidogrel discontinuation (odds ratio=1.79; 95% CI: 1.01 – 3.10). Identifying the key determinants of low adherence and early discontinuation to clopidogrel may aid in the development of interventions to increase adherence following PCI.

Several factors related to low clopidogrel adherence in the current study have not been previously reported. These include low adherence to daily medications prior to PCI, cost issues, pharmacy access, and patient-physician communication. In the context of the physician-patient relationship, poor communication has been shown to limit adherence to medication¹³. The current study identified patient-level factors (e.g., forgetfulness), the connection of patients with their healthcare providers (e.g., not feeling comfortable asking their doctors' questions) and health systems factors (e.g., difficulty filling prescriptions, cost issues) with low clopidogrel adherence.

Identifying patients who are likely to discontinue clopidogrel early or have low adherence can impact clinical decision making prior to PCI. Specifically, cardiologists may choose to use BMS or balloon angioplasty for patients they identify as likely to discontinue or have low adherence to clopidogrel following PCI. Prior studies have documented the inability of clinicians to intuitively assess patients' adherence to medication^{14;15}. The current study suggests that it may be possible to use a few items to identify who is likely to discontinue clopidogrel following PCI. Future studies with larger sample sizes and a longer follow-up period are needed to develop a screening tool for clopidogrel adherence following PCI using a standard psychometric approach. In turn, a short (e.g., <10 items) screening tool can be easily administered, scored and interpreted prior to PCI and may be useful for guiding clinical decisions.

The current analysis has several potential limitations. It was conducted using low-risk patients enrolled in a randomized controlled trial. The consistency of our findings in high risk patients (e.g., those with acute coronary syndromes) needs to be evaluated. Follow up for clopidogrel adherence was limited to 30 days following PCI and the collection of outcomes data (e.g., stent thrombosis) was beyond the scope of this study. Additionally, we only assessed the relation between one adherence tool (i.e., the MMAS-8) and low adherence to clopidogrel following PCI. Future studies are needed to determine if other published adherence scales predict low clopidogrel better than the MMAS-8^{16;17}. Finally, the small sample size in this study required us to pool together discontinuation and low adherence to clopidogrel. The current study has several strengths including a high follow-up rate (96%), data collection using structured questionnaires and a validated medication adherence scale, and inclusion of an ethnically diverse population. In the current study, we document a strong association between several patient factors and clopidogrel adherence following PCI. Studies are needed to confirm these findings and identify the optimal combination of questions for predicting low clopidogrel adherence following PCI.

Acknowledgments

Use of the ©MMAS is protected by US copyright laws. Permission for use is required. A license agreement is available from: Donald E. Morisky, ScD, ScM, MSPH, Professor, Department of Community Health Sciences, UCLA School of Public Health, 650 Charles E. Young Drive South, Los Angeles, CA 90095-1772.

References

1. King SB III, Smith SC Jr, Hirshfeld JW Jr, Jacobs AK, Morrison DA, Williams DO, Feldman TE, Kern MJ, O'Neill WW, Schaff HV, Whitlow PL, Adams CD, Anderson JL, Buller CE, Creager MA, Ettinger SM, Halperin JL, Hunt SA, Krumholz HM, Kushner FG, Lytle BW, Nishimura R, Page RL, Riegel B, Tarkington LG, Yancy CW. 2007 Focused Update of the ACC/AHA/SCAI 2005 Guideline Update for Percutaneous Coronary Intervention: a report of the American College

of Cardiology/American Heart Association Task Force on Practice Guidelines: 2007 Writing Group to Review New Evidence and Update the ACC/AHA/SCAI 2005 Guideline Update for Percutaneous Coronary Intervention, Writing on Behalf of the 2005 Writing Committee. *Circulation*. 2008; 117:261–295. [PubMed: 18079354]

2. Horne R, Weinman J. Patients' beliefs about prescribed medicines and their role in adherence to treatment in chronic physical illness. *J Psychosom Res*. 1999; 47:555–567. [PubMed: 10661603]
3. Horne R, Weinman J, Hankins M. The beliefs about medicines questionnaire: The development and evaluation of a new method for assessing the cognitive representation of medication. *Psychology and Health*. 1999; 14:1–24.
4. Byrne M, Walsh J, Murphy AW. Secondary prevention of coronary heart disease: patient beliefs and health-related behaviour. *J Psychosom Res*. 2005; 58:403–415. [PubMed: 16026655]
5. Sud A, Kline-Rogers EM, Eagle KA, Fang J, Armstrong DF, Rangarajan K, Otten RF, Stafkey-Mailey DR, Taylor SD, Erickson SR. Adherence to medications by patients after acute coronary syndromes. *Ann Pharmacother*. 2005; 39:1792–1797. [PubMed: 16204391]
6. Morisky DE, Ang A, Krousel-Wood M, Ward HJ. Predictive Validity of a Medication Adherence Measure in an Outpatient Setting. *J Clin Hypertens (Greenwich)*. 2008; 10:348–354. [PubMed: 18453793]
7. Krousel-Wood M, Islam T, Webber LS, Re RN, Morisky DE, Muntner P. New medication adherence scale versus pharmacy fill rates in seniors with hypertension. *Am J Manag Care*. 2009; 15:59–66. [PubMed: 19146365]
8. Krousel-Wood MA, Muntner P, Islam T, Morisky DE, Webber LS. Barriers to and determinants of medication adherence in hypertension management: perspective of the cohort study of medication adherence among older adults. *Med Clin North Am*. 2009; 93:753–769. [PubMed: 19427503]
9. Mehta SR, Yusuf S, Peters RJ, Bertrand ME, Lewis BS, Natarajan MK, Malmberg K, Rupprecht H, Zhao F, Chrolavicius S, Copland I, Fox KA. Effects of pretreatment with clopidogrel and aspirin followed by long-term therapy in patients undergoing percutaneous coronary intervention: the PCI-CURE study. *Lancet*. 2001; 358:527–533. [PubMed: 11520521]
10. Spertus JA, Kettelkamp R, Vance C, Decker C, Jones PG, Rumsfeld JS, Messenger JC, Khanal S, Peterson ED, Bach RG, Krumholz HM, Cohen DJ. Prevalence, predictors, and outcomes of premature discontinuation of thienopyridine therapy after drug-eluting stent placement: results from the PREMIER registry. *Circulation*. 2006; 113:2803–2809. [PubMed: 16769908]
11. Jeremias A, Sylvia B, Bridges J, Kirtane AJ, Bigelow B, Pinto DS, Ho KK, Cohen DJ, Garcia LA, Cutlip DE, Carrozza JP Jr. Stent thrombosis after successful sirolimus-eluting stent implantation. *Circulation*. 2004; 109:1930–1932. [PubMed: 15078797]
12. Iakovou I, Schmidt T, Bonizzi E, Ge L, Sangiorgi GM, Stankovic G, Airolidi F, Chieffo A, Montorfano M, Carlino M, Michev I, Corvaja N, Briguori C, Gerckens U, Grube E, Colombo A. Incidence, predictors, and outcome of thrombosis after successful implantation of drug-eluting stents. *JAMA*. 2005; 293:2126–2130. [PubMed: 15870416]
13. Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med*. 2005; 353:487–497. [PubMed: 16079372]
14. Stephenson BJ, Rowe BH, Haynes RB, Macharia WM, Leon G. The rational clinical examination. Is this patient taking the treatment as prescribed? *JAMA*. 1993; 269:2779–2781. [PubMed: 8492406]
15. Mushlin AI, Appel FA. Diagnosing potential noncompliance. Physicians' ability in a behavioral dimension of medical care. *Arch Intern Med*. 1977; 137:318–321. [PubMed: 843149]
16. Kim MT, Hill MN, Bone LR, Levine DM. Development and testing of the Hill-Bone Compliance to High Blood Pressure Therapy Scale. *Prog Cardiovasc Nurs*. 2000; 15:90–96. [PubMed: 10951950]
17. McHorney CA. The Adherence Estimator: a brief, proximal screener for patient propensity to adhere to prescription medications for chronic disease. *Curr Med Res Opin*. 2009; 25:215–238. [PubMed: 19210154]

Figure 1.

Distribution of clopidogrel adherence at 30 days following percutaneous coronary intervention among patients with low, medium, and high adherence to daily medications prior to percutaneous coronary intervention.

Table 1

Characteristics of the study population by medication adherence prior to percutaneous coronary intervention.

Variable	Overall (N = 284)	Adherence – Prior to PCI [*]			P-trend
		Low (n=92)	Medium (n=100)	High (n=92)	
Age, mean (sd) (Years)	55.8 (7.9)	54.9 (7.8)	56.2 (8.1)	56.5 (7.6)	0.34
Female	26.2%	28.3%	26.0%	24.2%	0.53
Non-Hispanic White	33.0%	30.4%	29.6%	39.1%	0.15
Non-Hispanic Black	14.9%	15.2%	16.3%	13.0%	
Hispanic	25.5%	22.8%	28.6%	25.0%	
Asian	21.3%	23.9%	21.4%	18.5%	
Other	5.3%	7.6%	4.1%	4.4%	
Education, did not graduate high school,	26.9%	30.3%	28.6%	21.7%	0.19
Married	68.7%	65.2%	69.0%	71.7%	0.34
Income <\$20,000	34.8%	37.2%	37.4%	29.6%	0.31
Self-rated health, fair to poor	37.1%	44.6%	40.4%	26.1%	0.01
Current smoker	15.0%	18.7%	15.3%	11.0%	0.15
Skipped doses due to cost, sometimes or often	7.9%	14.6%	8.1%	1.1%	<0.001
Smaller doses due to cost, sometimes or often	4.7%	11.2%	3.0%	0.0%	<0.001
Prescriptions covered by any health insurance	97.8%	97.8%	96.9%	98.9%	0.60
Difficulty filling prescriptions, sometimes or often	16.9%	28.1%	17.2%	5.6%	<0.001
Difficult to reach primary doctor	11.6%	15.7%	12.2%	6.7%	0.06
Comfortable asking doctor for instructions	95.0%	92.1%	96.0%	96.6%	0.17
Feeling that medicine is a necessity [†]	47.2%	53.3%	47.0%	41.3%	0.10
Feeling that medicine is a concern [†]	48.9%	59.8%	55.0%	31.5%	0.001
Received drug eluting stent	79.9%	73.9%	81.0%	84.6%	0.102

PCI – percutaneous coronary intervention; SD – standard deviation

^{*} Determined prior to hospital discharge following percutaneous coronary intervention using the 8-item Morisky Medication Adherence Scale.

[†] Feelings of necessity and concern were determined using the Beliefs about Medication Questionnaire (Ref: 8).

Table 2

Odds ratios for having low adherence to clopidogrel at 30 days post-percutaneous coronary intervention associated with pre-percutaneous coronary intervention adherence to daily medications.

Baseline Medication Adherence Scale Item	Low Adherence at 30-Days post-PCI* (N=32)	Odds Ratio (95% CI) for Low Adherence at 30-Days post-PCI	p-value
Sometimes forget to take medicine			
No	7.1%	1 (ref)	
Yes	18.8%	3.03 (1.43, 6.43)	0.004
Missed taking medicine in past 2 weeks [†]			
No	7.7%	1 (ref)	
Yes	28.0%	4.67 (2.13, 10.2)	<0.001
Ever cut back or stopped taking medication because felt worse [‡]			
No	10.4%	1 (ref)	
Yes	15.9%	1.63 (0.66, 4.03)	0.239
Sometimes forget to bring medication when leaving home			
No	9.4%	1 (ref)	
Yes	20.0%	2.41 (1.06, 5.47)	0.036
Took all of medicines day before [†]			
No	13.0%	1 (ref)	
Yes	10.9%	0.82 (0.33, 2.01)	0.662
Sometimes stop taking medication because feel problems under control			
No	10.0%	1 (ref)	
Yes	20.0%	2.24 (0.89, 5.65)	0.088
Ever feel hassled about sticking to treatment plan, %			
No	9.0	1 (ref)	
Yes	16.7	2.02 (0.95, 4.29)	0.066
Have difficulty remembering to take all medications			
Rarely/Never	6.1%	1 (ref)	
Once in a while	18.6%	3.59 (1.49, 8.63)	0.004
Sometimes	36.0%	8.81 (3.23, 24.0)	<0.001
Usually	0.0%	n/a	n/a
Always	0.0%	n/a	n/a
Baseline Medication Adherence Scale Category[§]			
High	2.2%	1 (ref)	
Medium	12.0%	6.13 (1.34, 28.20)	0.002
Low	19.6%	10.9 (2.46, 48.7)	0.02

CI – Confidence interval; PCI – Percutaneous coronary intervention

* Low adherence was defined as scores less than 6 on the 8-item Morisky Medication Adherence Scale or having discontinued clopidogrel.

[†] With the exception of medicines doctor indicated patient not take due to PCI.

[‡] without telling their doctor.

[§] Determined prior to hospital discharge following percutaneous coronary intervention using the 8-item Morisky Medication Adherence Scale.

Table 3

Odds ratios for having low adherence to clopidogrel at 30 days post-percutaneous coronary intervention associated with sociodemographic and medication-related characteristics assessed prior to hospital discharge for percutaneous coronary intervention.

Characteristic *	Odds Ratios (95% CI)	P-value
Age (Years)		
< 50	1 (ref)	
50–54	0.72 (0.24, 2.16)	0.56
55–59	0.78 (0.27, 2.24)	0.64
60	0.67 (0.26, 1.76)	0.42
Female versus male	1.33 (0.60, 2.96)	0.49
Race †		
Non-Hispanic White	1 (ref)	
Non-Hispanic Black	1.76 (0.63, 4.91)	0.28
Hispanic	1.10 (0.42, 2.89)	0.84
Asian	0.98 (0.34, 2.80)	0.97
Education, Did not versus did graduate high school	1.07 (0.47, 2.44)	0.87
Married versus not married	0.73 (0.34, 1.58)	0.43
Income <\$20,000 versus \$20,000	1.61 (0.74, 3.53)	0.23
Overall health, Fair or poor versus excellent, very good or good	1.82 (0.87, 3.81)	0.11
Current versus never/past cigarette smoker	0.79 (0.26, 2.38)	0.67
Skipped doses due to cost, Sometimes or often versus rarely, once or never	1.82 (0.57, 5.75)	0.31
Took smaller doses due to cost, Sometimes or often versus rarely, once or never	3.78 (1.09, 13.07)	0.04
Prescriptions covered by any health insurance, Yes versus no	0.62 (0.07, 5.49)	0.67
Have difficulty filling prescriptions, Sometimes or often versus rarely, once or never	3.06 (1.36, 6.87)	0.007
Difficult to reach primary doctor, Yes versus no	2.46 (0.97, 6.27)	0.06
Not comfortable versus comfortable asking doctor to explain instructions	3.06 (0.99, 11.4)	0.05
Side effects from clopidogrel, yes versus no	1.07 (0.23, 4.96)	0.93
Feeling that medicine is a necessity ‡	1.14 (0.54, 2.37)	0.74
Feeling that medicine is a concern ‡	1.86 (0.87, 3.97)	0.11

* Characteristics were assessed at baseline (prior to hospital discharge following percutaneous coronary intervention).

† Patients with an 'Other' race were excluded from the odds ratio analysis on race due to small sample size.

‡ Feelings of necessity and concern were determined from a series of questions designed to gauge the patient's feelings about their medicines. Each question was scored then dichotomized into high and low feelings of necessity or concern, depending on the question.

Table 4

C-statistics for discriminating low adherence to clopidogrel at 30-day following percutaneous coronary intervention for items assessed prior to hospital discharge.

Variable	C-statistic (95% CI)
Items associated (p<0.10) with low clopidogrel adherence at 30-days post-PCI (see Table 3)	
Smaller doses taken	0.611 (0.500, 0.722)
Difficulty filling prescriptions	0.627 (0.515, 0.739)
Difficulty reaching primary doctor	0.608 (0.497, 0.719)
Comfortable asking doctor	0.617 (0.506, 0.729)
MMAS-8 items assessed at baseline	
Sometimes forget to take medicine	0.684 (0.592, 0.776)
Missed taking medicine in past 2 weeks	0.701 (0.601, 0.801)
Ever cut back or stopped taking medication because felt worse	0.564 (0.453, 0.675)
Sometimes forget to bring medication when leaving home	0.639 (0.528, 0.749)
Took all of medicines day before	0.570 (0.454, 0.686)
Sometimes stop taking medication because feel problems under control	0.629 (0.527, 0.732)
Ever feel hassled about sticking to treatment plan	0.627 (0.528, 0.726)
Have difficulty remembering to take all medications	0.749 (0.660, 0.839)
Overall MMAS-8 scale score at baseline	
Baseline MMAS-8 adherence score	0.733 (0.650, 0.815)

CI: confidence interval, MMAS-8: 8-item Morisky Medication Adherence Scale

All variables were assessed at baseline – prior to hospital discharge following percutaneous coronary intervention.