Performance Measures

2016 Clinical Measures for Adults with Atrial Fibrillation or Atrial Flutter

A Report of the American College of Cardiology/American Heart Association Task Force on Performance Measures

Developed in Collaboration with the Heart Rhythm Society

Writing Committee Members

Paul A. Heidenreich, MD, MS, FACC, FAHA, *Chair*

N. A. Mark Estes MD, FACC, FAHA
Gregg C. Fonarow, MD, FACC, FAHA§
Corrine Y. Jurgens PhD, RN, ANP-BC, FAHA
Joseph E. Marine, MD, FACC‡
David D. McManus, MD, MS, FACC, FAHA, FHRS
Robert L. McNamara, MD, MHS, FACC
Penelope Solis, JD

ACC/AHA Task Force on Performance Measures

Paul A. Heidenreich, MD, MS, FACC, FAHA, *Chair*

Nancy M. Albert, PhD, CCNS, CCRN, FAHA†
Paul S. Chan, MD, MSc, FACC*
Lesley H. Curtis, PhD*
T. Bruce Ferguson, Jr., MD, FACC†
Gregg C. Fonarow, MD, FACC, FAHA*§
Michelle Gurvitz, MD, FACC†
P. Michael Ho, MD, PhD, FACC, FAHA*
Sean O'Brien, PhD†
Corrine Y. Jurgens PhD, RN, ANP-BC, FAHA*
Andrea M. Russo, MD, FACC, FHRS*
Randal J. Thomas, MD, FACC, FAHA†
Paul D. Varosy, MD, FACC†

*American Heart Association Representative.
†American College of Cardiology Representative.
‡ Heart Rhythm Society Representative.
§ACC/AHA Task Force on Performance Measures Liaison.

This document underwent a 14-day peer review between ●● ●●●, 2015, and ●● ●●●, 2015 and a 30 day public comment period between ●● ●●●, 2015, and ●● ●●●, 2015.

This document was approved by the American College of Cardiology Board of Trustees on ●● ●●●, 2015 and the Executive Committee on ●● ●●●, 2015; by the American Heart Association Science Advisory and Coordinating Committee on ●● ●●●, 2015 and the Executive Committee ●● ●●●, 2015; and by the Heart Rhythm Society on ●● ●●●, 2015.

The American College of Cardiology requests that this document be cited as follows:

J Am Coll Cardiol. 2016;●●●:●●●●–●●●●.

This article has been co-published in *Circulation.*

Copies: This document is available on the World Wide Web sites of the American College of Cardiology (www.acc.org) and the American Heart Association (http://my.americanheart.org). For copies of this document, please contact Elsevier Inc. Reprint Department via fax (212-633-3820) or email (reprints@elsevier.com).

1 **Table of Contents**

Preamble

The American College of Cardiology (ACC)/American Heart Association (AHA) performance measure sets serve as vehicles to accelerate translation of scientific evidence into clinical practice. Measure sets developed by the ACC/AHA are intended to provide practitioners and institutions that deliver cardiovascular services with tools to measure the quality of care provided and identify opportunities for improvement.

Writing committees are instructed to consider the methodology of performance measure development (1) and to ensure that the measures developed are aligned with ACC/AHA clinical guidelines. The writing committees also are charged with constructing measures that maximally capture important aspects of care quality, including timeliness, safety, effectiveness, efficiency, equity, and patient-centeredness, while minimizing, when possible, the reporting burden imposed on hospitals, practices, and/or practitioners.

Potential challenges from measure implementation may lead to unintended consequences. The manner in which challenges are addressed is dependent on several factors, including the measure design, data collection method, performance attribution, baseline performance rates, reporting methods, and incentives linked to these reports.

The ACC/AHA Task Force on Performance Measures distinguishes quality measures from performance measures. Quality measures are those metrics that *may* be useful for local quality improvement but are not yet appropriate for public reporting or pay for performance programs (uses of performance measures). New measures are initially evaluated for potential inclusion as performance measures. In some cases, a measure is insufficiently supported by the guidelines. In other instances, when the guidelines support a measure, the writing committee may feel it is necessary to have the measure tested to identify the consequences of measure

implementation. Quality measures may then be promoted to the status of performance measures as supporting evidence becomes available.

Paul Heidenreich, MD, FACC, FAHA
Chair, ACC/AHA Task Force on Performance Measures

1. Introduction

In the summer of 2015, the ACC/AHA convened the writing committee to begin the process of revising the existing atrial fibrillation (AF) and atrial flutter measure set that was released in 2008 (2) and for which implementation notes had been issued in 2011 (3). The writing committee also was charged with the task of developing new measures to benchmark and improve the quality of care for atrial fibrillation or atrial flutter patients. Throughout the report the term atrial fibrillation will include atrial flutter unless specifically stated.

All the measures included in the measure set are briefly summarized in Table 1 which provides information on the measure number, measure title, and care setting. The detailed measure specifications (available in Appendix A) provide not only the information included in Table 1 but also provide more detailed information including the measure description, numerator, denominator (including denominator exclusions and exceptions), rationale for the measure, guideline that support the measure, measurement period, source of data, attribution.

This atrial fibrillation measure set is notable for several reasons. First, the writing committee considered whether measures should be developed for the inpatient setting, expanding the scope of the original measure set. Specifically, the writing committee decided to broaden the care setting from solely outpatient to the inpatient setting in order to further improve the

continuity of care for these patients by addressing the multiple settings where patients receive care.

Second, new measures were developed for care domains that were not previously addressed including patient safety, effective clinical care, communication and care coordination. Many measure concepts were considered but were ultimately not included in this set after committee discussion. It is the hope of this writing committee that this measure set be reassessed as new science is developed and as electronic health record data standards are more broadly implemented across settings.

The writing committee has developed a comprehensive atrial fibrillation measure that includes 26 total measures, including 6 performance measures (3 inpatient measures and 3 outpatient measures), and 20 quality measures (11 inpatient measures and 9 outpatient measures), as reflected in Table 1 and Appendix A. The writing committee believes that implementation of this measure set by providers, physician practices, and hospital systems will help to enhance the quality of care provided to atrial fibrillation patients in both the inpatient and outpatient setting.

Table 1. 2016 ACC/AHA Atrial Fibrillation Measure Set Update

#	MEASURE TITLE	CARE SETTING	Measure Domain
PERFORMANCE MEASURES			
PM-1	CHA_2DS_2–VASc Risk Score Documented Prior to Discharge	Inpatient	Effective Clinical Care
PM-2	Anticoagulation Prescribed Prior to Discharge	Inpatient	Effective Clinical Care
PM-3	Prothrombin time (PT)/ International Normalized Ratio (INR) Planned Follow-Up Documented Prior to Discharge	Inpatient	Effective Clinical Care
PM-4	CHA_2DS_2–VASc Risk Score Documented	Outpatient	Effective Clinical Care
PM-5	Anticoagulation Prescribed	Outpatient	Effective Clinical Care
PM-6	Monthly INR	Outpatient	Effective Clinical Care
QUALITY MEASURES			
QM-1	Beta Blocker Prescribed Prior to Discharge	Inpatient	Effective Clinical Care
QM-2	ACE inhibitor (ACEI) or Angiotensin-Receptor Blocker (ARB) Prescribed Prior to Discharge	Inpatient	Effective Clinical Care
QM-3	Inappropriate Prescription of Antiarrhythmic Drugs Prior to Discharge to Patients with Permanent Atrial Fibrillation for Rhythm Control	Inpatient	Patient Safety
QM-4	Inappropriate Prescription of a Specific Type of Antiarrhythmic Drugs Prior to Discharge in Atrial Fibrillation Patients With Coronary Artery Disease and/or Heart Failure	Inpatient	Patient Safety
QM-5	Inappropriate Prescription of Dofetilide or Sotalol Prior to Discharge in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease (CKD) or on Dialysis Prior to Discharge	Inpatient	Patient Safety
QM-6	Inappropriate Prescription of a Direct Thrombin or Factor Xa Inhibitor Prior to Discharge in Atrial Fibrillation Patients with a Mechanical Heart Valve	Inpatient	Patient Safety

#	MEASURE TITLE	CARE SETTING	Measure Domain
QM-7	Inappropriate Prescription of a Direct Thrombin and Factor Xa Inhibitor Rivaroxaban or Edoxaban Prior to Discharge in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease or on Dialysis	Inpatient	Patient Safety
QM-8	Inappropriate Prescription of Aspirin and Oral Anticoagulation Therapy Prior to Discharge for Patients Who Do Not have Coronary Artery Disease and/or Vascular Disease	Inpatient	Patient Safety
QM-9	Inappropriate Prescription of Nondihydropyridine Calcium Channel Antagonist Prior to Discharge in Patients with Reduced Ejection Fraction or Decompensated Heart Failure	Inpatient	Patient Safety
QM-10	Patients Who Underwent Atrial Fibrillation Catheter Ablation Who Were Not Treated with Anticoagulation Therapy During or After a Procedure	Inpatient	Patient Safety
QM-11	Shared Decision Making Between Physician and Patient in Anticoagulation Prescription Prior to Discharge	Inpatient	Communication and Care Coordination
QM-12	Beta Blocker Prescribed	Outpatient	Effective Clinical Care
QM-13	Inappropriate Prescription of Antiarrhythmic Drugs to Patients with Permanent Atrial Fibrillation for Rhythm Control	Outpatient	Patient Safety
QM-14	Inappropriate Prescription of a Specific Type of Antiarrhythmic Drugs in Atrial Fibrillation Patients With Coronary Artery Disease and/or Heart Failure	Outpatient	Patient Safety
QM-15	Inappropriate Prescription of Dofetilide or Sotalol in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease or on Dialysis	Outpatient	Patient Safety
QM-16	Inappropriate Prescription of a Direct Thrombin or Factor Xa Inhibitor in Atrial Fibrillation Patients With Mechanical Heart Valve	Outpatient	Patient Safety
QM-17	Inappropriate Prescription of a Direct Thrombin and Factor Xa Inhibitor (Rivaroxaban or Edoxaban) in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease or on Dialysis	Outpatient	Patient Safety
QM-18	Inappropriate Prescription of Aspirin and Oral Anticoagulation Therapy for Patients Who Do Not Have Coronary Artery Disease and/or Vascular Disease	Outpatient	Patient Safety

#	MEASURE TITLE	CARE SETTING	Measure Domain
QM-19	Inappropriate Prescription of Nondihydropyridine Calcium Channel Antagonist in Patients with Reduce Ejection Fraction or Decompensated Heart Failure	Outpatient	Patient Safety
QM-20	Shared Decision Making Between Physician and Patient in Anticoagulation Prescription	Outpatient	Communication and Care Coordination

1.1. Scope of the Problem

Atrial fibrillation is recognized as the most common cardiac arrhythmia in the United States and is associated with increased mortality for individuals who have other cardiovascular conditions and procedures, such as heart failure (4-6), myocardial infarction (7,8), coronary artery bypass graft (9,10) and stroke (11). Furthermore, atrial fibrillation is associated with a four to five-fold increased risk for stroke (12).

It is estimated that atrial fibrillation impacts between 2.7 million and 6.1 million American adults and this number is expected to double by 2050 (13,14). Among Medicare patients who are 65 years and older that were diagnosed from 1993 to 2007, the prevalence of atrial fibrillation increased 5% per year, from approximately 41.1 per 1000 beneficiaries to 85.5 per 1000 beneficiaries (15).

Hospitalizations with atrial fibrillation listed as the primary diagnosis increased by 34% from 1996 to 2001 (16). Just of over half of patients admitted for atrial fibrillation were men (50.8%) (17). The costs of care for patients with atrial fibrillation are substantial; with estimates ranging from $6 to $26 billion a year, of which $6 billion was attributed directly to atrial fibrillation, $9.9 billion to other cardiovascular expenses, and $10.1 billion to non-cardiovascular expenses (18). Based on this information, identifying performance and quality measures that can be implemented by provider or healthcare systems may aid not only in improving patient care, but also in reducing costs by reducing adverse outcomes of atrial fibrillation (e.g., fewer strokes).

Accordingly, updating the existing atrial fibrillation measure set was a priority for the ACC and AHA. Particular attention was given to those assessment, therapies, and interventions that could improve the quality of life for atrial fibrillation patients. This document serves to

reflect those measures that were developed by the writing committee after comprehensive internal discussion, peer review, and public comment.

1.2. Disclosure of Relationships With Industry and Other Entities

The ACC/AHA Task Force on Performance Measures makes every effort to avoid actual, potential, or perceived conflicts of interest that could arise as a result of relationships with industry or other entities (RWI). Detailed information on the ACC/AHA policy on RWI can be found at http://www.acc.org/guidelines/about-guidelines-and-clinical-documents/relationships-with-industry-policy. All members of the writing committee, as well as those selected to serve as peer reviewers of this document, were required to disclose all current relationships and those existing within the 12 months before the initiation of this writing effort. ACC/AHA policy also requires that the writing committee co-chairs and at least 50% of the writing committee have no relevant RWI.

Any writing committee member who develops new RWI during his or her tenure on the writing committee is required to notify staff in writing. These statements are reviewed periodically by the Task Force and by members of the writing committee. Author and peer reviewer RWI which are relevant to the document are included in the appendices: Please see Appendix B for relevant writing committee RWI and Appendix C for relevant peer reviewer RWI. Additionally, to ensure complete transparency, the writing committee members' comprehensive disclosure information, including RWI not relevant to the present document, is available online at [insert link to Comprehensive RWI here once paper finalized] Disclosure information for the Task Force is also available online at http://www.acc.org/guidelines/about-guidelines-and-clinical-documents/guidelines-and-documents-task-forces.

The work of the writing committee was supported exclusively by the ACC and the AHA without commercial support. Members of the writing committee volunteered their time for this effort. Meetings of the writing committee were confidential and attended only by writing committee members and staff from the ACC, AHA, and the Heart Rhythm Society (HRS) who served as a collaborator on this project.

2. Methodology

2.1. Literature Review

In developing the updated atrial fibrillation measure set, the writing committee reviewed evidence based guidelines and statements that would potentially impact the construct of the measures. The practice guidelines and statements that provided the basis for these measures can be seen in Table 2.

Table 2 Associated Guidelines and Other Clinical Guidance Documents

GUIDELINES	
1.	2014 AHA/ACC/HRS Guidelines for the Management of Patients with Atrial Fibrillation (19)
2.	2013 ACCF/AHA Guideline for Management of Heart Failure (20)
STATEMENTS	
1.	2013 Treatment of Atrial Fibrillation (21,22)
2.	2012 AHA/ASA Oral Antithrombotic Agents for Prevention of Stroke in Non-Valvular Atrial Fibrillation: A Scientific Advisory for Healthcare Professionals (23)
3.	2012 HRS/EHRA/ECAS Expert Consensus Statement on Catheter and Surgical Ablation of Atrial Fibrillation Recommended for Patient Selection, Procedural Techniques, Patient Management and Follow-Up, Definitions, Endpoints, and Research Trial Design (24)

ACC indicates American College of Cardiology; ACCF, American College of Cardiology Foundation; AHA, American Heart Association; ASA, American Stroke Association; EHRA European Heart Rhythm Association; ECAS, the European Cardiac Arrhythmia Society; HRS, Heart Rhythm Society.

2.2. Definition and Selection of Measures

The writing committee reviewed both recent guidelines and other clinical guidance documents referenced in Table 2. The writing committee also examined available information on gaps in

care to address which new measures might be appropriate as performance measures or quality measures for this measure set update.

All measures were designed to assess quality of care experienced by individuals who have atrial fibrillation or atrial flutter in the inpatient and outpatient setting. The measures also were designed to limit performance measurement to patients without a valid reason for exclusion from the measure. Measure exclusions are those reasons that remove a patient automatically from the denominator. For example, all measures excluded patients who were under 18 years of age or on comfort care. In contrast to exclusions, denominator exceptions are those conditions that remove a patient from the denominator only if the numerator criteria are not met. Denominator exceptions are used in select cases to allow for a fairer measurement of quality for those providers with higher risk populations. Exceptions are also used to defer to the clinical judgement of the provider. Several of the measures include exceptions.

During the course of developing the measure set, the writing committee evaluated the potential measures against the ACC/AHA attributes of performance measures (Table 3) to reach consensus on which measures should be advanced for inclusion in the final measure set. After the peer review and public comment period, the writing committee reviewed and discussed the comments received, and further refined the measure set.

Table 3. ACC/AHA Task Force on Performance Measures: Attributes for Performance Measures

1. Evidence Based	
High-impact area that is useful in improving patient outcomes	a) For structural measures, the structure should be closely linked to a meaningful process of care that in turn is linked to a meaningful patient outcome. b) For process measures, the scientific basis for the measure should be well established, and the process should be closely linked to a meaningful patient outcome. c) For outcome measures, the outcome should be clinically meaningful. If appropriate, performance measures based on outcomes should adjust for relevant clinical characteristics through the use of appropriate methodology and high-quality data sources.
2. Measure Selection	
Measure definition	a) The patient group to whom the measure applies (denominator) and the patient group for whom conformance is achieved (numerator) are clearly defined and clinically meaningful.
Measure exceptions and exclusions	b) Exceptions and exclusions are supported by evidence.
Reliability	c) The measure is reproducible across organizations and delivery settings.
Face validity	d) The measure appears to assess what it is intended to.
Content validity	e) The measure captures most meaningful aspects of care.
Construct validity	f) The measure correlates well with other measures of the same aspect of care.
3. Measure Feasibility	
Reasonable effort and cost*	a) The data required for the measure can be obtained with reasonable effort and cost.
Reasonable time period	b) The data required for the measure can be obtained within the period allowed for data collection.
4. Accountability	
Actionable*	a) Those held accountable can affect the care process or outcome.
Unintended consequences avoided	b) The likelihood of negative unintended consequences with the measure is low.

ACC indicates American College of Cardiology; AHA, American Heart Association.

Adapted from: Normand SL, McNeil BJ, Peterson LE, et al. Eliciting expert opinion using the Delphi technique: identifying performance indicators for cardiovascular disease. Int J Qual Health Care. 1998;10:247-60.

3. ACC/AHA Atrial Fibrillation/Atrial Flutter Measure Set Performance Measures

3.1 Discussion of 2016 Atrial Fibrillation/Atrial Flutter Measure Set

After reviewing the existing guidelines, and the 2008 measure set (2) and 2011 implementation notes (3), the writing committee discussed which measures needed to be revised in order to reflect the updated science, and worked to identify which guideline recommendations could serve as the basis for new performance or quality measures. The writing committee also reviewed existing measure sets that were publicly available.

The following subsections serve as a synopsis of the revisions that were made to previous measures, and a description of why the new measures were created for both the inpatient and outpatient setting.

3.1.1. Retired Measures

The writing committee decided not to retire any of the three measures that were previously included in the 2008 measure set. Although the writing committee did note that the data needed for the monthly INR measure have proved difficult to collect for some institutions, it was noted that that some healthcare systems such the Veteran Affairs may be able to collect this information. The writing committee hopes that by maintaining this as a performance measure, health systems will be encouraged sites to improve data collection. The writing committee also anticipates that increased interoperability of health care data in general, and across inpatient and outpatient records in particular, will facilitate the ability to report this measure.

3.1.2. Revised Measures

The writing committee did make a number of changes to the three measures which are summarized in the Table 4. The majority of the changes were made to reflect the updated

guideline recommendations, while other changes were made to strengthen the measure construct. Table 4 provides information including the measure care setting, title, and a brief rationale as to the revisions made to the measure.

Table 4: Revised Atrial Fibrillation Measures

#	Care Setting	Measure Title	Rationale for Revisions
PM-4	Outpatient	CHA_2DS_2–VASc Risk Score Documented	This measure was revised to reflect the update in the 2014 guidelines that recommends the use of the CHA_2DS_2–VASc score instead of the CHA_2DS_2. Additionally, this measure was revised to allow for a patient reason exception that reflects those instances where a patient may choose to have an atrial appendage device placed or to clearly account for those medical instances in which a patient already has such a device is already in place.
PM-5	Outpatient	Anticoagulation Prescribed	This measure had the same changes made as noted in the CHA_2DS_2–VASc Risk Score Documented "Rationale for Revisions." This measure was also revised to require the healthcare provider document if the patient has a CHA_2DS_2–VASc Risk Score of 2 or greater as a reason for why anticoagulation was prescribed. This was accomplished by modifying the denominator to include in this measure all patients with nonvalvular atrial fibrillation or atrial flutter who do not have a score of 0 or 1 documented in the medical record.
PM-6	Outpatient	Monthly International Normalized Ration (INR)	This measure was maintained as previously specified in the 2008 measure set. However, the attribution was changed to facility or provider level instead of being limited to physician level. The writing committee acknowledged that this measure has been difficult to implement in registries, however, the sentiment was that this measure does lead to improved patient care and can be implemented in certain instances such as the Veteran Affairs or integrated healthcare systems. It is the hope of the writing committee that with increased interoperability and common data standards, this measure may be more readily adopted in the future by more systems.

3.1.3. New Measures

The writing committee has worked to create a comprehensive list of measures that can be utilized for atrial fibrillation patients. This set included 23 new measures, of which 3 are inpatient performance measures, and 20 are quality measures (11 inpatient, 9 outpatient). Table 5 includes a list of the measures with information on the care setting, and a brief rationale.

Six of the quality measures are structured in a typical format in which the goal is seek a higher performance score nearing 100%. However, a number of these new measures of patient harm (safety measures, 14 in total) where the optimal score is 0%.

For more detailed information on the measure construct, please refer to the detailed measure specifications for each measure in Appendix A.

Table 5: New Atrial Fibrillation Measures

#	Care Setting	Measure Title	Rationale for Creating New Measure	Rationale for Designating as a Quality Measure as Opposed to a Performance Measure (If Applicable)
PM-1	Inpatient	CHA_2DS_2–VASc Risk Score Documented Prior to Discharge	The writing committee determined that it should create inpatient measures. This measure seeks to implement a Class I Level of Evidence A recommendation that patients have a CHA_2DS_2–VASc risk score assessment performed prior to discharge which will aid in the treatment eligible patients in the outpatient setting with anticoagulation medications.	Not Applicable.
PM-2	Inpatient	Anticoagulation Prescribed Prior to Discharge	The writing committee developed this measure because members felt that prior to discharge the provider should ensure that the patient was prescribed anticoagulation medication in accordance with the guideline recommendations. As in the outpatient measure the CHA_2DS_2–VASc risk score must be documented to receive credit for this measure.	Not Applicable.

PM-3	Inpatient	PT/INR Planned Follow-Up Documented Prior to Discharge	The writing committee did discuss whether or not to expand this measure from just documentation of scheduled follow-up to be a measure that examined did the patient have a follow up performed. However, the writing committee felt that the burden of documentation of a referral was sufficiently burdensome for the inpatient setting. Furthermore, because most systems are not integrated and there are limits in terms of electronic data sharing between the inpatient and the outpatient setting extending this measure to require documentation of actual PT/INR completed post discharge would provide to be a significant burden on hospitals and physicians.	Not Applicable.
QM-1	Inpatient	Beta Blocker Prescribed Prior to Discharge	Patients with atrial fibrillation and atrial flutter can benefit from having beta blockers prescribed in the inpatient and in the outpatient setting. The guideline recommends that use of beta blockers to control ventricular rate in patients with paroxysmal, persistent, or permanent atrial fibrillation. Given this recommendation the writing committee felt that it would be valuable to measure whether or not beta blockers were prescribed to atrial fibrillation/flutter patients.	While the recommendation support beta blocker use in controlling atrial fibrillation is a Class 1 Level of Evidence B recommendation the writing committee felt that it would be appropriate to designate this as quality measure only.
QM-12	Outpatient	Beta Blocker Prescribed		

QM-2	Inpatient	ACE inhibitor (ACEI) or Angiotensin-Receptor Blocker (ARB) Prescribed Prior to Discharge	Patients with atrial fibrillation can benefit from having ACEI/ARBs prior to discharge who are also diagnosed with having heart failure and a left ventricular ejection fraction (LVEF) ≤40. Given this, the writing committee determined it would be valuable to develop a measure that would evaluate if ACEI/ARBs were prescribed.	There is a strong linkage between patients who have atrial fibrillation and heart failure. Given this, the writing committee felt that there would be some benefit in developing an inpatient and outpatient quality measure that examined whether or not patients were placed on ACEI/ARBs, but did not feel at this time that there was sufficient evidence to validate this becoming a performance measure.
QM-3	Inpatient	Inappropriate Prescription of Antiarrhythmic Drugs to Patients with Permanent Atrial Fibrillation Prior to Discharge for Rhythm Control	The 2014 atrial fibrillation guideline recommends that antiarrhythmic drugs for rhythm control not be continued when atrial fibrillation becomes permanent. In accordance with this recommendation, the writing committee sought to develop measure that would attempt to track how often patients with permanent atrial fibrillation are prescribed an antiarrhythmic drug.	The writing committee felt that there would be value in developing an inpatient and an outpatient quality measure for inappropriate prescription of antiarrhythmic drugs for rhythm control in accordance with the guideline. However, the writing committee did note that it may be possible that some patients may be inappropriately classified as permanent atrial fibrillation. After discussion, it was determined that this measure would be best designated as a quality measure.
QM-13	Outpatient	Inappropriate Prescription of Antiarrhythmic Drugs to Patients with Permanent Atrial Fibrillation for Rhythm Control		

QM-4	Inpatient	Inappropriate Prescription of a Specific Type of Antiarrhythmic Drugs Prior to Discharge in Atrial Fibrillation Patients With Coronary Artery Disease and/or Heart Failure	Patients with atrial fibrillation and coronary artery disease should not be prescribed flecainide and propafenone and patients with atrial fibrillation and heart failure should not be prescribed flecainide, propafenone, sotalol, and dronedarone. Therefore, the writing committee felt that there would be some value in generating a measure that examined whether patients received any of these inappropriate prescriptions based on the patient also having a diagnosis of coronary artery disease and /or heart failure.	The writing committee felt that this measure may prove to be quite valuable. However, at this time the writing committee felt that additional data was needed before this measure could be promoted to a performance measure.
QM-14	Outpatient	Inappropriate Prescription of A Specific Type of Antiarrhythmic Drugs in Atrial Fibrillation Patients With Coronary Artery Disease and/or Heart Failure		
QM-5	Inpatient	Inappropriate Prescription of Dofetilide or Sotalol Prior to Discharge in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease or on Dialysis	Patients with atrial fibrillation and chronic kidney disease or on dialysis should not have sotalol and dofetilide prescribed. The writing committee did discuss whether patients with chronic kidney disease and dialysis should be included in QM-4 or QM-14 but decided that it would be more appropriate to create a separate measure.	At this time the writing committee felt that additional data was needed before this measure could be promoted to a performance measure.
QM-15	Outpatient	Inappropriate Prescription of Dofetilide or Sotalol in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease or on Dialysis		
QM-6	Inpatient	Inappropriate Prescription of a Direct Thrombin or Factor Xa Inhibitor Discharge in Atrial Fibrillation Patients with a Mechanical Heart Valve	According to the 2014 atrial fibrillation patients with atrial fibrillation and a mechanical heart valve should not be prescribed direct thrombin inhibitor dabigatran. When creating these measures, the writing committee determined that the science and guidelines justified expanding the measure to include Factor Xa inhibitors.	Additional data is required prior to making this measure a performance measure.
QM-16	Outpatient	Inappropriate Prescription of a Direct Thrombin or Factor Xa Inhibitor in Atrial Fibrillation Patients With Mechanical Heart Valve		

QM-7	Inpatient	Inappropriate Prescription of a Direct Thrombin and Factor Xa inhibitor Rivaroxaban or Edoxaban in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease or on Dialysis	The 2014 atrial fibrillation guidelines recommend that patients with atrial fibrillation and end-stage chronic kidney disease or on dialysis not be prescribed direct thrombin inhibitor dabigatran and the factor Xa inhibitor rivaroxaban because of the lack of evidence from clinical trials regarding the balance of risks and benefits. The writing committee in developing this measure expanded it to include edoxaban since it was approved for use in atrial fibrillation patients after the guidelines had been released.	Additional data is required prior to making this measure a performance measure.
QM-17	Outpatient	Inappropriate Prescription of a Direct Thrombin and Factor Xa inhibitor (Rivaroxaban or Edoxaban) in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease or on Dialysis		
QM-8	Inpatient	Inappropriate Prescription of Aspirin and Oral Anticoagulation Therapy Prior to Discharge for Patients who do not have Coronary Artery Disease and/or Vascular Disease	Combining of oral anticoagulants and antiplatelet therapy is associated with a high annual risk of fatal and nonfatal bleedings.	Additional data is required prior to making this measure a performance measure.
QM-18	Outpatient			
QM-9	Inpatient	Inappropriate Prescription of Nondihydropyridine Calcium Channel Antagonist Prior to Discharge in Patients with Reduced Ejection Fraction or Decompensated Heart Failure	The 2014 guidelines state that nondihydropyridine calcium channel antagonists should not be used in patients with decompensated heart failure (HF) as these may lead to further hemodynamic compromise.	Additional data is required prior to making this measure a performance measure.
QM-19	Outpatient	Inappropriate Prescription of Nondihydropyridine Calcium Channel Antagonist in Patients with Reduce Ejection Fraction or Decompensated Heart Failure		

QM-10	Inpatient	Patients Who Underwent Atrial Fibrillation Catheter Ablation Who Were Not Treated with Anticoagulation Therapy During or After a Procedure	Atrial fibrillation catheter ablation should not be performed in patients who cannot be treated with anticoagulant therapy during and after the procedure. Given this the writing committee felt that it would be important to develop a measure for the occurrence of this "never event."	Additional data is required prior to making this measure a performance measure.
QM-11	Inpatient	Shared Decision Making Between Physician and Patient in Anticoagulation Prescription Prior to Discharge	The writing committee believed that there would be value in developing a measure to capture shared decision making between physicians and the patient on the type of anticoagulation medication prescribed. The writing committee did acknowledged that this measure may create some administrative burden in documentation for hospitals, practices, or practitioners but believed that this measure is critical for patient engagement and empowerment in the medication regimen that they are prescribed.	The writing committee felt that while these measures are important they are associated with a high level of administrative burden. Therefore, it was felt that at this time, without any data, it would be more appropriate to designate these constructs as quality measures.
QM-20	Outpatient	Shared Decision Making Between Physician and Patient in Anticoagulation Prescription		

4. Areas for Further Research

The writing committee felt that documentation of a bleeding score may be beneficial but that more data are needed before recommending that calculation of a bleeding score be advanced to the level of a performance or quality measure. While the 2014 ACC/AHA Atrial Fibrillation guideline does reference the HAS-BLED score, it does not include specific guideline recommendations with regards to bleeding risk assessment. Although other guidelines, like the 2014 National Institute For Health Care And Excellence for Atrial Fibrillation (25), do include recommendations for the use of HAS-BLED score to assess the risk of bleeding, the writing committee felt that additional evidence was needed before creating a performance or quality measure.

The writing committee also discussed whether any outcome measures should be developed specific to atrial fibrillation. The committee felt there is insufficient evidence to support the use of an outcome measure (e.g. stroke rate per capita) as a measure of quality of atrial fibrillation care. It is not clear that patient outcomes will be improved by having patients select providers based on outcome metrics when measures of process of care are equivalent.

Staff

American College of Cardiology
Kim A. Williams, MD, FACC, President
Shalom Jacobovitz, Chief Executive Officer
William J. Oetgen, MD, MBA, FACC, Executive Vice President, Science, Education, Quality and Publications
Lara Slattery, MHS, Senior Director, ACC Scientific Reporting
Jensen S. Chiu, MHA, Team Lead, Quality Measurement
Penelope Solis, JD, Associate, Quality Measurement
Amelia Scholtz, PhD, Publications Manager, Clinical Policy and Pathways

American College of Cardiology/American Heart Association
Sana Gokak, MPH, Associate, Quality Measurement

American Heart Association
Mark A. Creager, MD, FAHA, President
Nancy Brown, Chief Executive Officer
Rose Marie Robertson, MD, FACC, FAHA, Chief Science Officer
Gayle R. Whitman, PhD, RN, FAHA, FAAN, Senior Vice President, Office of Science Operations
Melanie B. Turner, MPH, Science and Medicine Advisor, Office of Science Operations
Jody Hundley, Production Manager, Scientific Publishing, Office of Science Operations

Key Words

ACC/AHA Performance Measures ■ ■ atrial fibrillation■ ■ atrial flutter■ ■ performance measures■ ■ quality measures■ ■ quality indicators ■

Appendix A. Atrial Fibrillation Measure Set

Performance Measure for Use with Inpatient and Outpatient Atrial Fibrillation or Atrial Flutter Patients

Inpatient Measures

Short Title: PM-1: CHA_2DS_2 –VASc Risk Score Documented Prior to Discharge	
PM-1: Atrial Fibrillation/Atrial Flutter: CHA_2DS_2 –VASc Risk Score Documented Prior to Discharge	
Measure Description: Percent of patients, age 18 and older, with nonvalvular atrial fibrillation or atrial flutter for whom a CHA_2DS_2-VASc risk score has been documented in the medical record.	
Numerator	• Patients with nonvalvular atrial fibrillation or atrial flutter for whom a CHA_2DS_2-VASc risk score were documented prior to discharge. For patients with nonvalvular atrial fibrillation or atrial flutter, assessment of thromboembolic risk should include: **CHA_2DS_2-VASc** — **Score** Congestive HF — 1 Hypertension — 1 Age>= 75Y — 2 Diabetes Mellitus — 1 Stroke/Transient Ischemic Attack (TIA)/ Thromboembolism [TE] — 2 Vascular disease (prior myocardial infarction [MI], peripheral artery disease [PAD], or aortic plaque) — 1 Age 64-74 years — 1 Sex category (i.e.; female) — 1
Denominator	• All patients with nonvalvular atrial fibrillation or atrial flutter.
Denominator Exclusions	• Patients less than 18 years of age • Patients with transient or reversible causes of AF (e.g., pneumonia, hyperthyroidism, pregnancy, cardiac surgery) • Patients who leave against medical advice • Patients who die during hospitalization

	• Patients who are on comfort care measures only • Patients who are transferred to another acute care hospital
Denominator Exceptions	• Medical reason(s) documented for not assessing risk factors and documenting the CHA_2DS_2-VASc score, including atrial appendage device in place. • Patient choice of having atrial appendage device placed.
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient

Rationale

AF, whether paroxysmal, persistent, or permanent and whether symptomatic or silent, significantly increases the risk of thromboembolic ischemic stroke. Nonvalvular atrial fibrillation increases the risk of stroke 5 times, and AF in the setting of mitral stenosis increases the risk of stroke 20 times over that of patients in sinus rhythm.

Thromboembolism occurring with AF is associated with a greater risk of recurrent stroke, more severe disability, and mortality (11). Silent AF is also associated with ischemic stroke (26-29). The appropriate use of antithrombotic therapy and the control of other risk factors, including hypertension and hypercholesterolemia, substantially reduce stroke risk.

One meta-analysis has stratified ischemic stroke risk among patients with nonvalvular AF using the following point scoring systems (30): AF Investigators; CHA_2DS_2 (Congestive heart failure, Hypertension, Age ≥75 years, Diabetes mellitus, Prior Stroke or transient ischemic attack or Thromboembolism [doubled]), or CHA_2DS_2-VASc (Congestive heart failure, Hypertension, Age ≥75 years [doubled] (31), Diabetes mellitus, Prior Stroke or TIA or thromboembolism [doubled], Vascular disease, Age 65 to 74 years, Sex category).

When compared with the CHA_2DS_2 score (32), the CHA_2DS_2-VASc score for nonvalvular AF has a broader score range (0 to 9) and includes a larger number of risk factors (female sex, 65 to 74 years of age, and vascular disease) (33,34).

The selection of an antithrombotic agent should be based on shared decision making that takes into account risk factors, cost, tolerability, patient preference, potential for drug interactions, and other clinical characteristics, including time in the INR therapeutic range if the patient has been on warfarin, irrespective of whether the AF pattern is paroxysmal, persistent, or permanent.

Clinical Recommendation(s)

2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19)
1. In patients with AF, antithrombotic therapy should be individualized based on shared decision-making after discussion of the absolute and RRs of stroke and bleeding, and the patient's values and preferences. (Class I, Level of Evidence: C)

2. Selection of antithrombotic therapy should be based on the risk of thromboembolism irrespective of

whether the AF pattern is paroxysmal, persistent, or permanent (35-38). (Class I, Level of Evidence: B)

3. In patients with nonvalvular AF, the CHA_2DS_2-VASc score is recommended for assessment of stroke risk (39-41). (Class I, Level of Evidence: B)

4. For patients with AF who have mechanical heart valves, warfarin is recommended and the target international normalized ratio (INR) intensity (2.0 to 3.0 or 2.5 to 3.5) should be based on the type and location of the prosthesis (42-44). (Class I, Level of Evidence: B)

5. For patients with nonvalvular AF with prior stroke, TIA, or a CHA_2DS_2-VASc score of 2 or greater, oral anticoagulants are recommended. Options include: warfarin (INR 2.0 to 3.0) (35-38) (Class I, Level of Evidence: A), dabigatran (45) (Class I, Level of Evidence: B), rivaroxaban (46) (Class I, Level of Evidence: B), or apixaban (47) (Class I, Level of Evidence: B).

6. Among patients treated with warfarin, the INR should be determined at least weekly during initiation of antithrombotic therapy and at least monthly when anticoagulation (INR in range) is stable (48-50). (Class I, Level of Evidence: A)

7. For patients with nonvalvular AF unable to maintain a therapeutic INR level with warfarin, use of a direct thrombin or factor Xa inhibitor (dabigatran, rivaroxaban, or apixaban) is recommended. (Class I, Level of Evidence: C)

8. Re-evaluation of the need for and choice of antithrombotic therapy at periodic intervals is recommended to reassess stroke and bleeding risks. (Class I, Level of Evidence: C)

9. For patients with atrial flutter, antithrombotic therapy is recommended according to the same risk profile used for AF. (Class I, Level of Evidence: C)

Short Title: PM-2: Anticoagulation Prescribed Prior to Discharge

PM-2: Atrial Fibrillation/Atrial Flutter: Anticoagulation Prescribed Prior to Discharge	
Measure Description: Percent of patients, age 18 and older, with nonvalvular atrial fibrillation or atrial flutter who were discharged on warfarin or another Food and Drug Administration (FDA) approved anticoagulant drug for the prevention of thromboembolism.	
Numerator	• Patients with nonvalvular atrial fibrillation or atrial flutter for whom warfarin or another FDA approved anticoagulant was prescribed* prior to discharge. *Prescribed-Also satisfied by documentation in current medication list.
Denominator	• All patients with nonvalvular atrial fibrillation or atrial flutter who do not have a CHA_2DS_2-VASc risk score of 0 or 1

	documented.
Denominator Exclusions	• Patients less than 18 years of age • Patients with transient or reversible causes of AF (e.g., pneumonia, hyperthyroidism, pregnancy, cardiac surgery) • Patients who leave against medical advice • Patients who die during hospitalization • Patients who are on comfort care measures only • Patients who are transferred to another acute care hospital
Denominator Exceptions	• Documentation of a medical reason for not prescribing warfarin or another FDA approved anticoagulant to a patient with a CHA_2DS_2-VASc score of 2 or greater, including atrial appendage device in place. • Documentation of a patient reason for not prescribing warfarin or another oral anticoagulant drug that is FDA approved for the prevention of thromboembolism, including patient choice of having atrial appendage device placed. • Patient currently enrolled in a clinical trial related to atrial fibrillation/atrial flutter.
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient
Rationale	
AF, whether paroxysmal, persistent, or permanent and whether symptomatic or silent, significantly increases the risk of thromboembolic ischemic stroke. Nonvalvular atrial fibrillation increases the risk of stroke 5 times, and AF in the setting of mitral stenosis increases the risk of stroke 20 times over that of patients in sinus rhythm. Thromboembolism occurring with AF is associated with a greater risk of recurrent stroke, more severe disability, and mortality (11). Silent AF is also associated with ischemic stroke (26-29). The appropriate use of antithrombotic therapy and the control of other risk factors, including hypertension and hypercholesterolemia, substantially reduce stroke risk. One meta-analysis has stratified ischemic stroke risk among patients with nonvalvular AF using the following point scoring systems (30): AF Investigators; CHA_2DS_2 (Congestive heart failure, Hypertension, Age ≥75 years, Diabetes mellitus, Prior Stroke or TIA or Thromboembolism [doubled]), or CHA_2DS_2-VASc (Congestive heart failure, Hypertension, Age ≥75 years [doubled] (31), Diabetes mellitus, Prior Stroke or TIA or thromboembolism [doubled], Vascular disease, Age 65 to 74 years, Sex category). When compared with the CHA_2DS_2 score (32), the CHA_2DS_2-VASc score for nonvalvular AF has a broader score range (0 to 9) and includes a larger number of risk factors (female sex, 65 to 74 years of	

age, and vascular disease) (33,34). The selection of an antithrombotic agent should be based on shared decision making that takes into account risk factors, cost, tolerability, patient preference, potential for drug interactions, and other clinical characteristics, including time in the INR therapeutic range if the patient has been on warfarin, irrespective of whether the AF pattern is paroxysmal, persistent, or permanent.
Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) 1. In patients with AF, antithrombotic therapy should be individualized based on shared decision-making after discussion of the absolute and RRs of stroke and bleeding, and the patient's values and preferences. (Class I, Level of Evidence: C) 2. Selection of antithrombotic therapy should be based on the risk of thromboembolism irrespective of whether the AF pattern is paroxysmal, persistent, or permanent (35-38). (Class I, Level of Evidence: B) 3. In patients with nonvalvular AF, the CHA_2DS_2-VASc score is recommended for assessment of stroke risk (39-41). (Class I, Level of Evidence: B) 4. For patients with AF who have mechanical heart valves, warfarin is recommended and the target international normalized ratio (INR) intensity (2.0 to 3.0 or 2.5 to 3.5) should be based on the type and location of the prosthesis (42-44). (Class I, Level of Evidence: B) 5. For patients with nonvalvular AF with prior stroke, TIA, or a CHA_2DS_2-VASc score of 2 or greater, oral anticoagulants are recommended. Options include: warfarin (INR 2.0 to 3.0) (35-38) (Class I, Level of Evidence: A), dabigatran (45) (Class I, Level of Evidence: B), rivaroxaban (46) (Class I, Level of Evidence: B), or apixaban (47) (Class I, Level of Evidence: B). 6. Among patients treated with warfarin, the INR should be determined at least weekly during initiation of antithrombotic therapy and at least monthly when anticoagulation (INR in range) is stable (48-50). (Class I, Level of Evidence: A) 7. For patients with nonvalvular AF unable to maintain a therapeutic INR level with warfarin, use of a direct thrombin or factor Xa inhibitor (dabigatran, rivaroxaban, or apixaban) is recommended. (Class I, Level of Evidence: C) 8. Re-evaluation of the need for and choice of antithrombotic therapy at periodic intervals is recommended to reassess stroke and bleeding risks. (Class I, Level of Evidence: C) 9. For patients with atrial flutter, antithrombotic therapy is recommended according to the same risk profile used for AF. (Class I, Level of Evidence: C)

Short Title: PM-3: Prothrombin time (PT)/ international normalized ratio (INR) Planned Follow-Up Documented Prior to Discharge

PM-3: Atrial Fibrillation/Atrial Flutter: PT/INR Planned Follow-Up Documented Prior to Discharge	
Percentage of patients, age 18 and older, with nonvalvular atrial fibrillation or atrial flutter who are prescribed warfarin who have a PT/INR follow-up scheduled prior to hospital discharge.	
Numerator	• Patients with nonvalvular atrial fibrillation or atrial flutter for whom warfarin was prescribed prior to discharge and for whom a PT/INR follow-up* is scheduled. *Follow up is scheduled within 2 weeks for those patients who were newly prescribed warfarin, or scheduled within 30 days for those patients that were previously on warfarin. A "yes" or "no" should be documented in the medical record to denote whether follow up PT/INR was scheduled.
Denominator	• Patients with nonvalvular atrial fibrillation or atrial flutter who were prescribed warfarin.
Denominator Exclusions	• Patients less than 18 years of age • Patients with transient or reversible causes of AF (e.g., pneumonia, hyperthyroidism, pregnancy, cardiac surgery) • Patients who leave against medical advice • Patients who die during hospitalization • Patients who are on comfort care measures only • Patients who are transferred to another acute care hospital
Denominator Exceptions	• None
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient
Rationale	
Frequent monitoring of INR level is essential to guiding warfarin dose adjustment to maintain anticoagulation intensity in the desired target range. More frequent monitoring may be required during initiation of warfarin therapy or when other drugs that interact with warfarin are started or stopped.	
Clinical Recommendation(s)	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19)	

1. In patients with AF, antithrombotic therapy should be individualized based on shared decision-making after discussion of the absolute and RRs of stroke and bleeding, and the patient's values and preferences. (Class I, Level of Evidence: C)

2. Selection of antithrombotic therapy should be based on the risk of thromboembolism irrespective of whether the AF pattern is paroxysmal, persistent, or permanent (35-38). (Class I, Level of Evidence: B)

3. In patients with nonvalvular AF, the CHA_2DS_2-VASc score is recommended for assessment of stroke risk (39-41). (Class I, Level of Evidence: B)

4. For patients with AF who have mechanical heart valves, warfarin is recommended and the target international normalized ratio (INR) intensity (2.0 to 3.0 or 2.5 to 3.5) should be based on the type and location of the prosthesis (42-44). (Class I, Level of Evidence: B)

5. For patients with nonvalvular AF with prior stroke, transient ischemic attack (TIA), or a CHA_2DS_2-VASc score of 2 or greater, oral anticoagulants are recommended. Options include: warfarin (INR 2.0 to 3.0) (35-38) (Class I, Level of Evidence: A), dabigatran (45) (Class I, Level of Evidence: B), rivaroxaban (46) (Class I, Level of Evidence: B), or apixaban (47) (Class I, Level of Evidence: B).

6. Among patients treated with warfarin, the INR should be determined at least weekly during initiation of antithrombotic therapy and at least monthly when anticoagulation (INR in range) is stable (48-50). (Class I, Level of Evidence: A)

7. For patients with nonvalvular AF unable to maintain a therapeutic INR level with warfarin, use of a direct thrombin or factor Xa inhibitor (dabigatran, rivaroxaban, or apixaban) is recommended. (Class I, Level of Evidence: C)

8. Re-evaluation of the need for and choice of antithrombotic therapy at periodic intervals is recommended to reassess stroke and bleeding risks. (Class I, Level of Evidence: C)

9. For patients with atrial flutter, antithrombotic therapy is recommended according to the same risk profile used for AF. (Class I, Level of Evidence: C)

Outpatient Measures

Short Title: PM-4: CHA2DS2–VASc Score Risk Score Documented	
PM-4: Atrial Fibrillation/Atrial Flutter: CHA_2DS_2–VASc Score Risk Score Documented	
Measure Description: Percent of patients, age 18 and older, with nonvalvular atrial fibrillation or atrial flutter for whom a CHA_2DS_2-VASc risk score is documented.	
Numerator	• Patients with nonvalvular atrial fibrillation or atrial flutter for whom a CHA_2DS_2-VASc risk score is documented.
Denominator	• All patients with nonvalvular atrial fibrillation or atrial flutter.

Denominator Exclusions	• Patients less than 18 years of age • Patients with transient or reversible causes of AF (e.g., pneumonia, hyperthyroidism, pregnancy, cardiac surgery) • Patients who are on comfort care measures only
Denominator Exceptions	• Documentation of a medical reason for not prescribing warfarin or another FDA approved anticoagulant to a patient with a CHA_2DS_2-VASc score of 2 or greater, including atrial appendage device in place. • Patient choice of having atrial appendage device placed.
Measurement Period	Reporting Year
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient

Rationale

AF, whether paroxysmal, persistent, or permanent and whether symptomatic or silent, significantly increases the risk of thromboembolic ischemic stroke. Nonvalvular atrial fibrillation increases the risk of stroke 5 times, and AF in the setting of mitral stenosis increases the risk of stroke 20 times over that of patients in sinus rhythm.

Thromboembolism occurring with AF is associated with a greater risk of recurrent stroke, more severe disability, and mortality (11). Silent AF is also associated with ischemic stroke (26-29). The appropriate use of antithrombotic therapy and the control of other risk factors, including hypertension and hypercholesterolemia, substantially reduce stroke risk.

One meta-analysis has stratified ischemic stroke risk among patients with nonvalvular AF using the following point scoring systems (30): AF Investigators; CHA_2DS_2 (Congestive heart failure, Hypertension, Age ≥75 years, Diabetes mellitus, Prior Stroke or TIA or Thromboembolism [doubled]), or CHA_2DS_2-VASc (Congestive heart failure, Hypertension, Age ≥75 years [doubled] (31), Diabetes mellitus, Prior Stroke or TIA or thromboembolism [doubled], Vascular disease, Age 65 to 74 years, Sex category).

When compared with the CHA_2DS_2 score (32), the CHA_2DS_2-VASc score for nonvalvular AF has a broader score range (0 to 9) and includes a larger number of risk factors (female sex, 65 to 74 years of age, and vascular disease) (33,34).

The selection of an antithrombotic agent should be based on shared decision making that takes into account risk factors, cost, tolerability, patient preference, potential for drug interactions, and other clinical characteristics, including time in the INR therapeutic range if the patient has been on warfarin, irrespective of whether the AF pattern is paroxysmal, persistent, or permanent.

Clinical Recommendation(s)

2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19)
1. In patients with AF, antithrombotic therapy should be individualized based on shared decision-making

after discussion of the absolute and RRs of stroke and bleeding, and the patient's values and preferences. (Class I, Level of Evidence: C)

2. Selection of antithrombotic therapy should be based on the risk of thromboembolism irrespective of whether the AF pattern is paroxysmal, persistent, or permanent (35-38). (Class I, Level of Evidence: B)

3. In patients with nonvalvular AF, the CHA_2DS_2-VASc score is recommended for assessment of stroke risk (39-41). (Class I, Level of Evidence: B)

4. For patients with AF who have mechanical heart valves, warfarin is recommended and the target international normalized ratio (INR) intensity (2.0 to 3.0 or 2.5 to 3.5) should be based on the type and location of the prosthesis (42-44). (Class I, Level of Evidence: B)

5. For patients with nonvalvular AF with prior stroke, transient ischemic attack (TIA), or a CHA_2DS_2-VASc score of 2 or greater, oral anticoagulants are recommended. Options include: warfarin (INR 2.0 to 3.0) (35-38) (Class I, Level of Evidence: A), dabigatran (45) (Class I, Level of Evidence: B), rivaroxaban (46) (Class I, Level of Evidence: B), or apixaban (47) (Class I, Level of Evidence: B).

6. Among patients treated with warfarin, the INR should be determined at least weekly during initiation of antithrombotic therapy and at least monthly when anticoagulation (INR in range) is stable (48-50). (Class I, Level of Evidence: A)

7. For patients with nonvalvular AF unable to maintain a therapeutic INR level with warfarin, use of a direct thrombin or factor Xa inhibitor (dabigatran, rivaroxaban, or apixaban) is recommended. (Class I, Level of Evidence: C)

8. Re-evaluation of the need for and choice of antithrombotic therapy at periodic intervals is recommended to reassess stroke and bleeding risks. (Class I, Level of Evidence: C)

9. For patients with atrial flutter, antithrombotic therapy is recommended according to the same risk profile used for AF. (Class I, Level of Evidence: C)

Short Title: PM-5: Anticoagulation Prescribed

PM-5: Atrial Fibrillation/Atrial Flutter: Anticoagulation Prescribed	
Measure Description: Percent of patients, age 18 and older, who were prescribed warfarin or another FDA approved anticoagulant drug for the prevention of thromboembolism during the measurement period.	
Numerator	• Patients with nonvalvular atrial fibrillation or atrial flutter for whom warfarin or another FDA approved anticoagulant was prescribed.* *Prescribed-Also satisfied by documentation in current medication list.

Denominator	• All patients with nonvalvular atrial fibrillation or atrial flutter who do not have a CHA_2DS2-VASc risk score of 0 or 1 documented.
Denominator Exclusions	• Patients less than 18 years of age • Patients with transient or reversible causes of AF (e.g., pneumonia, hyperthyroidism, pregnancy, cardiac surgery) • Patients who are on comfort care measures only
Denominator Exceptions	• Documentation of a medical reason for not prescribing warfarin or another FDA approved anticoagulant to a patient with a CHA_2DS_2-VASc score of 2 or greater, including atrial appendage device in place. • Documentation of a patient reason for not prescribing warfarin or another oral anticoagulant drug that is FDA approved for the prevention of thromboembolism, including patient choice of having atrial appendage device placed. • Patient currently enrolled in a clinical trial related to atrial fibrillation/atrial flutter treatment.
Measurement Period	Reporting Year
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient

Rationale

AF, whether paroxysmal, persistent, or permanent and whether symptomatic or silent, significantly increases the risk of thromboembolic ischemic stroke. Nonvalvular atrial fibrillation increases the risk of stroke 5 times, and AF in the setting of mitral stenosis increases the risk of stroke 20 times over that of patients in sinus rhythm.

Thromboembolism occurring with AF is associated with a greater risk of recurrent stroke, more severe disability, and mortality (11). Silent AF is also associated with ischemic stroke (26-29). The appropriate use of antithrombotic therapy and the control of other risk factors, including hypertension and hypercholesterolemia, substantially reduce stroke risk.

One meta-analysis has stratified ischemic stroke risk among patients with nonvalvular AF using the following point scoring systems (30): AF Investigators; CHA_2DS_2 (Congestive heart failure, Hypertension, Age ≥75 years, Diabetes mellitus, Prior Stroke or TIA or Thromboembolism [doubled]), or CHA_2DS_2-VASc (Congestive heart failure, Hypertension, Age ≥75 years [doubled] (31), Diabetes mellitus, Prior Stroke or TIA or thromboembolism [doubled], Vascular disease, Age 65 to 74 years, Sex category).

When compared with the CHA_2DS_2 score (32), the CHA_2DS_2-VASc score for nonvalvular AF has a broader score range (0 to 9) and includes a larger number of risk factors (female sex, 65 to 74 years of age, and vascular disease) (33,34).

The selection of an antithrombotic agent should be based on shared decision making that takes into account risk factors, cost, tolerability, patient preference, potential for drug interactions, and other clinical characteristics, including time in the INR therapeutic range if the patient has been on warfarin, irrespective of whether the AF pattern is paroxysmal, persistent, or permanent.
Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) 1. In patients with AF, antithrombotic therapy should be individualized based on shared decision-making after discussion of the absolute and RRs of stroke and bleeding, and the patient's values and preferences. (Class I, Level of Evidence: C) 2. Selection of antithrombotic therapy should be based on the risk of thromboembolism irrespective of whether the AF pattern is paroxysmal, persistent, or permanent (35-38). (Class I, Level of Evidence: B) 3. In patients with nonvalvular AF, the CHA_2DS_2-VASc score is recommended for assessment of stroke risk (39-41). (Class I, Level of Evidence: B) 4. For patients with AF who have mechanical heart valves, warfarin is recommended and the target international normalized ratio (INR) intensity (2.0 to 3.0 or 2.5 to 3.5) should be based on the type and location of the prosthesis (42-44). (Class I, Level of Evidence: B) 5. For patients with nonvalvular AF with prior stroke, transient ischemic attack (TIA), or a CHA_2DS2-VASc score of 2 or greater, oral anticoagulants are recommended. Options include: warfarin (INR 2.0 to 3.0) (35-38) (Class I, Level of Evidence: A), dabigatran (45) (Class I, Level of Evidence: B), rivaroxaban (46) (Class I, Level of Evidence: B), or apixaban (47) (Class I, Level of Evidence: B). 6. Among patients treated with warfarin, the INR should be determined at least weekly during initiation of antithrombotic therapy and at least monthly when anticoagulation (INR in range) is stable (48-50). (Class I, Level of Evidence: A) 7. For patients with nonvalvular AF unable to maintain a therapeutic INR level with warfarin, use of a direct thrombin or factor Xa inhibitor (dabigatran, rivaroxaban, or apixaban) is recommended. (Class I, Level of Evidence: C) 8. Re-evaluation of the need for and choice of antithrombotic therapy at periodic intervals is recommended to reassess stroke and bleeding risks. (Class I, Level of Evidence: C) 9. For patients with atrial flutter, antithrombotic therapy is recommended according to the same risk profile used for AF. (Class I, Level of Evidence: C)

Short Title: PM-6: Monthly INR

PM-6: Atrial Fibrillation/Atrial Flutter: Monthly INR
Percentage of patients, age 18 and older, with nonvalvular atrial fibrillation or atrial flutter who have documented in the medical record an assessment of INR at least once a month if receiving anticoagulation

therapy with warfarin.	
Numerator	• The number of calendar months in which at least 1 INR measurement was made.
Denominator	• The number of calendar months in which the patient with nonvalvular atrial fibrillation or flutter was receiving warfarin therapy during the reporting year.
Denominator Exclusions	• Patients less than 18 years of age • Patients who are on comfort care measures only
Denominator Exceptions	• Documentation of a patient reason for no INR measurement. • Documentation of system reason(s) for no INR measurement.
Measurement Period	Reporting Year
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient
Rationale	
Frequent monitoring of INR level is essential to guiding warfarin dose adjustment to maintain anticoagulation intensity in the desired target range. More frequent monitoring may be required during initiation of warfarin therapy or when other drugs that interact with warfarin are started or stopped.	
Clinical Recommendation(s)	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) 1. In patients with AF, antithrombotic therapy should be individualized based on shared decision-making after discussion of the absolute and RRs of stroke and bleeding, and the patient's values and preferences. (Class I, Level of Evidence: C) 2. Selection of antithrombotic therapy should be based on the risk of thromboembolism irrespective of whether the AF pattern is paroxysmal, persistent, or permanent (35-38). (Class I, Level of Evidence: B) 3. In patients with nonvalvular AF, the CHA_2DS_2-VASc score is recommended for assessment of stroke risk (39-41). (Class I, Level of Evidence: B) 4. For patients with AF who have mechanical heart valves, warfarin is recommended and the target international normalized ratio (INR) intensity (2.0 to 3.0 or 2.5 to 3.5) should be based on the type and location of the prosthesis (42-44). (Class I, Level of Evidence: B) 5. For patients with nonvalvular AF with prior stroke, transient ischemic attack (TIA), or a CHA_2DS2-VASc score of 2 or greater, oral anticoagulants are recommended. Options include: warfarin (INR 2.0 to 3.0) (35-38) (Class I, Level of Evidence: A), dabigatran (45) (Class I, Level of Evidence: B), rivaroxaban (46) (Class I, Level of Evidence: B), or apixaban (47) (Class I, Level of Evidence: B).	

6. Among patients treated with warfarin, the INR should be determined at least weekly during initiation of antithrombotic therapy and at least monthly when anticoagulation (INR in range) is stable (48-50). (Class I, Level of Evidence: A)

7. For patients with nonvalvular AF unable to maintain a therapeutic INR level with warfarin, use of a direct thrombin or factor Xa inhibitor (dabigatran, rivaroxaban, or apixaban) is recommended. (Class I, Level of Evidence: C)

8. Re-evaluation of the need for and choice of antithrombotic therapy at periodic intervals is recommended to reassess stroke and bleeding risks. (Class I, Level of Evidence: C)

9. For patients with atrial flutter, antithrombotic therapy is recommended according to the same risk profile used for AF. (Class I, Level of Evidence: C)

Quality Improvement Measures For Inpatient or Outpatient Atrial Fibrillation or Atrial Flutter Patients

Inpatient Measures

Short Title: QM-1: Beta Blocker Prescribed Prior to Discharge	
QM-1: Atrial Fibrillation/Atrial Flutter: Beta Blocker Prescribed Prior to Discharge	
Measure Description: Percent of patients, age 18 and older, with a diagnosis of atrial fibrillation or atrial flutter and with an LVEF≤40, who were prescribed a beta blocker prior to discharge.	
Numerator	• Patients with a diagnosis of atrial fibrillation or atrial flutter and with an LVEF≤40 for whom a beta blocker was prescribed* during the measurement period. *Prescribed-Also satisfied by documentation in current medication list.
Denominator	• All patients with atrial fibrillation or atrial flutter with an LVEF≤40.
Denominator Exclusions	• Patients less than 18 years of age • Patients with transient or reversible causes of AF (e.g., pneumonia, hyperthyroidism, pregnancy, cardiac surgery) • Patients who leave against medical advice • Patients who die during hospitalization • Patients who are on comfort care measures only

	• Patients who are transferred to another acute care hospital
Denominator Exceptions	• Documentation of a medical reason for not prescribing a beta blocker. • Documentation of a patient reason for not prescribing a beta blocker. • Patient currently enrolled in a clinical trial related to atrial fibrillation/atrial flutter treatment.
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient
Rationale	
AF, whether paroxysmal, persistent, or permanent and whether symptomatic or silent, significantly increases the risk of thromboembolic ischemic stroke. Nonvalvular atrial fibrillation increases the risk of stroke 5 times, and AF in the setting of mitral stenosis increases the risk of stroke 20 times over that of patients in sinus rhythm. Rate control in AF is an important strategy. It impacts quality of life, reduces morbidity, and decreases the potential for developing tachycardia-induced cardiomyopathy. Multiple agents, including beta blockers and nondihydropyridine calcium channel blockers, certain antiarrhythmic drugs, including amiodarone and sotalol, have been evaluated with regard to efficacy in attaining rate control. When considering which agent(s) to use, clinicians must consider the patient's degree of symptoms, hemodynamic status, presence or absence of HF, and potential precipitants of AF. In general, beta blockers are the most common agents used for rate control, followed by nondihydropyridine calcium channel blockers, digoxin, and amiodarone. Patient comorbidities must be understood to avoid medications that may precipitate adverse events such as decompensation of HF, exacerbation of chronic obstructive pulmonary disease, or acceleration of conduction in patients with pre-excitation.	
Clinical Recommendation(s)	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) 1. Control of the ventricular rate using a beta blocker or nondihydropyridine calcium channel antagonist is recommended for patients with paroxysmal, persistent, or permanent AF (51-53). (Class I, Level of Evidence: B) 2. Intravenous administration of a beta blocker or nondihydropyridine calcium channel blocker is recommended to slow the ventricular heart rate in the acute setting in patients without pre-excitation. In hemodynamically unstable patients, electrical cardioversion is indicated (54-57). (Class I, Level of Evidence: B)	

1

Short Title: QM-2: ACE inhibitor (ACEI) or Angiotensin-Receptor Blocker (ARB) Prescribed Prior to Discharge	
QM-2: Atrial Fibrillation/Atrial Flutter: ACE inhibitor (ACEI) or Angiotensin-Receptor Blocker (ARB) Prescribed Prior to Discharge	
Measure Description: Percent of patients with a diagnosis of atrial fibrillation or atrial flutter, with heart failure and an LVEF≤40, who were prescribed an ACEI or ARB prior to discharge.	
Numerator	• Patients with a diagnosis of atrial fibrillation or atrial flutter, with heart failure and a LVEF≤40 for whom an ACEI or ARB† was prescribed* during the measurement period. * Prescribed-Also satisfied by documentation in current medication list. † This measure includes fixed dose combination medications that contain an ARB.
Denominator	• All patients with atrial flutter or atrial flutter with heart failure and an LVEF≤40 who are not currently on an ACEI or ARB.
Denominator Exclusions	• Patients less than 18 years of age • Patients who leave against medical advice • Patients who die during hospitalization • Patients who are on comfort care measures only • Patients who are transferred to another acute care hospital
Denominator Exceptions	• Documentation of a medical reason for not prescribing an ACEI or ARB. • Documentation of a patient reason for not prescribing an ACEI or ARB. • Patient currently enrolled in a clinical trial related to atrial fibrillation/atrial flutter.
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) Patients with HF are more likely than the general population to develop AF (5). There is a direct relationship between the New York Heart Association (NYHA) Class and prevalence of AF in patients with HF progressing from 4% in those who are NYHA Class I to 40% in those who are NYHA Class IV (58). AF is also a strong independent risk factor for subsequent development of HF. In addition to those	

with heart failure with reduced ejection fraction (HFrEF), patients with heart failure with a preserved EF (HFpEF) are also at greater risk for AF than the general age matched population (59). HF and AF can interact to promote their perpetuation and worsening through mechanisms such as rate-dependent worsening of cardiac function, fibrosis, and activation of neurohumoral vasoconstrictors. AF can worsen symptoms in patients with HF, and, conversely, worsened HF can promote a rapid ventricular response in AF.

ACE inhibitors can reduce the risk of death and reduce hospitalization in HFrEF. The benefits of ACE inhibition were seen in patients with mild, moderate, or severe symptoms of HF and in patients with or without coronary artery disease (CAD). ACE inhibitors should be prescribed to all patients with HFrEF. Unless there is a contraindication, ACE inhibitors are used together with a beta blocker. Patients should not be given an ACE inhibitor if they have experienced life-threatening adverse reactions (i.e., angioedema) during previous medication exposure or if they are pregnant or plan to become pregnant. Clinicians should prescribe an ACE inhibitor with caution if the patient has very low systemic blood pressures (systolic blood pressure <80 mm Hg), markedly increased serum levels of creatinine (>3 mg/dL), bilateral renal artery stenosis, or elevated levels of serum potassium (>5.0 mEq/L).

ARBs are used in patients with HFrEF who are ACE inhibitor intolerant; an ACE-inhibition intolerance primarily related to cough is the most common indication. In addition, an ARB may be used as an alternative to an ACE inhibitor in patients who are already taking an ARB for another reason, such as hypertension, and who subsequently develop HF. Angioedema occurs in <1% of patients who take an ACE inhibitor, but it occurs more frequently in blacks. Because its occurrence may be life-threatening, clinical suspicion of this reaction justifies the subsequent avoidance of all ACE inhibitors for the lifetime of the patient. ACE inhibitors should not be initiated in any patient with a history of angioedema. Although ARBs may be considered as alternative therapy for patients who have developed angioedema while taking an ACE inhibitor, there are some patients who have also developed angioedema with ARBs, and caution is advised when substituting an ARB in a patient who has had angioedema associated with use of an ACE inhibitor (60-63).

Clinical Recommendation(s)

2013 ACCF/AHA Guideline for Management of Heart Failure (20)

1. ACE inhibitors are recommended in patients with HFrEF and current or prior symptoms, unless contraindicated, to reduce morbidity and mortality (64-67). (Class I, Level of Evidence: A)

2. In all patients with a recent or remote history of myocardial infarction or acute coronary syndrome (ACS) and reduced EF, ACE inhibitors should be used to prevent symptomatic HF and reduce mortality (64,68,69). In patients intolerant of ACE inhibitors, ARBs are appropriate unless contraindicated (68,70). (Class I, Level of Evidence: A)

3. ARBs are recommended in patients with HFrEF with current or prior symptoms who are ACE inhibitor intolerant, unless contraindicated, to reduce morbidity and mortality (68,71-73). (Class I, Level of Evidence: A)

4. ARBs are reasonable to reduce morbidity and mortality as alternatives to ACE inhibitors as first-line therapy for patients with HFrEF, especially for patients already taking ARBs for other indications, unless contraindicated (74-79). (Class IIa, Level of Evidence: A)

5. Addition of an ARB may be considered in persistently symptomatic patients with HFrEF who are already being treated with an ACE inhibitor and a beta blocker in whom an aldosterone antagonist is not

indicated or tolerated (80,81). (Class IIb, Level of Evidence: A)

1
2
3

Short Title: QM-3: Inappropriate Prescription of Antiarrhythmic Drugs to Patients with Permanent Atrial Fibrillation	
QM-3: Atrial Fibrillation: Inappropriate Prescription of Antiarrhythmic Drugs to Patients with Permanent Atrial Fibrillation Prior to Discharge for Rhythm Control	
Measure Description: Percentage of patients, age 18 and older, with permanent atrial fibrillation who were prescribed an antiarrhythmic medication prior to discharge for rhythm control.	
Numerator	• Patients with a diagnosis of atrial fibrillation who were inappropriately prescribed an antiarrhythmic medication for rhythm control. For purposes of this measure antiarrhythmic drugs includes the medications provided in the below table. **Vaughan Williams Class IA** Disopyramide Quinidine **Vaughan Williams Class IC** Flecainide Propafenone **Vaughan Williams Class III** Dofetilide Dronedarone Sotalol
Denominator	• All patients with permanent atrial fibrillation.
Denominator Exclusions	• Patients less than 18 years of age • Patients prescribed amiodarone for rate control
Denominator Exceptions	• None
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19)	

In selecting a strategy of rhythm control with an antiarrhythmic drug, providing for adequate rate control in the event of AF recurrence should also be considered. Once antiarrhythmic drug therapy is initiated, patient symptoms may improve without complete AF suppression. The transition from frequent AF to infrequent, well-tolerated recurrence of AF is a reasonable outcome and does not necessarily indicate that the therapy should be discontinued. However, if attempts at rhythm control are abandoned (e.g., after AF has been declared permanent), the antiarrhythmic drug should be discontinued.
Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) Antiarrhythmic drugs for rhythm control should not be continued when AF becomes permanent (Class III, Level of Evidence: C) including dronedarone (82). (Class III Level of Evidence: B)

1
2
3

Short Title: QM-4: Inappropriate Prescription of a Specific Type of Antiarrhythmic Drugs

QM-4: Atrial Fibrillation: Inappropriate Prescription of a Specific Type of Antiarrhythmic Drugs Prior to Discharge in Atrial Fibrillation Patients With Coronary Artery Disease and/or an NYHA Class III or Class IV Heart Failure	
Measure Description: Percentage of patients, age 18 and older, with atrial fibrillation that also have coronary artery disease and/or an NYHA Class III or Class IV heart failure who were inappropriately prescribed antiarrhythmic medications prior to discharge.	
Numerator	• Patients with a diagnosis of atrial fibrillation with coronary artery disease and/or an NYHA Class III or Class IV heart failure who were prescribed* a specific type of antiarrhythmic medication prior to discharge. *Patients with coronary artery disease should not be prescribed flecainide and propafenone and patients with heart failure should not be prescribed flecainide, propafenone, sotalol, and dronedarone.
Denominator	• All patients with atrial fibrillation with coronary artery disease and/or an NYHA Class III or Class IV heart failure.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• None
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.

Care Setting	Inpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) Flecainide and Propafenone are Vaughan Williams Class IC drugs that may be considered for rhythm control in patients with AF without structural heart disease. Flecainide, along with other potent sodium channel–blocking drugs, increased mortality in patients with prior myocardial infarction (MI) and therefore should be avoided in patients with ischemic heart disease (83). In addition, both drugs are negative inotropes and should be avoided in patients with left ventricular (LV) dysfunction. Sotalol is renally cleared and should be used with caution or avoided in patients with CKD or unstable renal function. Sotalol causes drug-induced QT interval prolongation, so it should be administered with caution or avoided when administered with other drugs known to prolong the QT interval. Table 13 in the 2014 ACC/AHA/HRS Guidelines for Management for Patients with Atrial Fibrillation provides more guidance in types of patients who should be excluded. Trends toward increased mortality for sotalol (OR: 3.44; 95% CI: 1.02 to 11.59) were observed in a comparison study (84), and it is likely that proarrhythmia is a contributing mechanism. Dronedarone increases mortality in patients with recently decompensated HF and depressed left ventricular function (85) and is contraindicated in patients with NYHA Class III or IV HF and in patients who have had an episode of decompensated HF in the past 4 weeks, especially if they have depressed LV function. In patients with permanent AF, dronedarone increases the combined endpoint of stroke, cardiovascular death, and hospitalization (82). Therefore, dronedarone is contraindicated in patients whose sinus rhythm is not restored.	
Clinical Recommendation(s)	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) 1. The following antiarrhythmic drugs are recommended in patients with AF to maintain sinus rhythm, depending on underlying heart disease and comorbidities (Class I, Level of Evidence: A): a. Amiodarone (86-89) b. Dofetilide (90,91) c. Dronedarone (92-94) d. Flecainide (87,95) e. Propafenone (88,96-99) f. Sotalol (87,97,100) 2. The risks of the antiarrhythmic drug, including proarrhythmia, should be considered before initiating therapy with each drug. (Class I, Level of Evidence: C) 3. Dronedarone should not be used for treatment of AF in patients with New York Heart Association Class III and IV HF or patients who have had an episode of decompensated HF in the past 4 weeks (85). (Class III, Level of Evidence: B)	

Short Title: QM-5: Inappropriate Prescription of Dofetilide or Sotalol Prior to Discharge

QM-5: Atrial Fibrillation: Inappropriate Prescription of Dofetilide or Sotalol Prior to Discharge in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease (CKD) or on Dialysis

Measure Description: Percentage of patients, age 18 and older, with atrial fibrillation that also have end stage chronic kidney disease (CrCl <15 mL/min) or are on dialysis, who were prescribed dofetilide or sotalol prior to discharge.

Numerator	Patients with a diagnosis of atrial fibrillation that also have end stage chronic kidney disease or are on dialysis who were prescribed dofetilide or sotalol prior to discharge.
Denominator	• All patients with atrial fibrillation who also have end stage chronic kidney disease (CrCl <15 mL/min) or are on dialysis.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• Patients less than 18 years of age.
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Inpatient

Rationale

2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19)
Sotalol and Dofetilide are predominantly renally cleared and should be used with caution or avoided in patients with end-stage CKD or on dialysis. Table 11 in the 2014 ACC/AHA/HRS Guidelines for Management for Patients with Atrial Fibrillation provides more guidance in types of patients who should be excluded. Manufacturer/FDA recommendations suggest that both drugs are contraindicated due increased risk for toxicity (including potentially life-threatening pro-arrhythmic effects) in patients with severely reduced renal function.

Clinical Recommendation(s)

2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19)
1. The following antiarrhythmic drugs are recommended in patients with AF to maintain sinus rhythm, depending on underlying heart disease and comorbidities (Class I, Level of Evidence: A):
   a. Amiodarone (86-89)
   b. Dofetilide (90,91)
   c. Dronedarone (92-94)
   d. Flecainide (87,95)
   e. Propafenone (88,96-99)
   f. Sotalol (87,97,100)

2. The risks of the antiarrhythmic drug, including proarrhythmia, should be considered before initiating therapy with each drug. (Class I, Level of Evidence: C)

1
2
3

Short Title: QM-6: Inappropriate Prescription of a Direct Thrombin or Factor Xa Inhibitor Prior to Discharge

QM-6: Atrial Fibrillation: Inappropriate Prescription of a Direct Thrombin or Factor Xa Inhibitor Prior to Discharge in Atrial Fibrillation Patients with a Mechanical Heart Valve	
Measure Description: Percentage of patients, age 18 and older, with a mechanical heart valve and with a diagnosis of atrial fibrillation that were inappropriately prescribed a direct thrombin or factor Xa inhibitor prior to discharge.	
Numerator	• Patients with a diagnosis of atrial fibrillation and a mechanical heart valve who were prescribed a direct thrombin or factor Xa inhibitor prior to discharge.
Denominator	• All patients with a diagnosis of atrial fibrillation with a mechanical heart valve.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• None
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) Patients with atrial fibrillation and a mechanical heart valve should not be prescribed dabigatran. Patients with mechanical heart valves or hemodynamically significant mitral stenosis were excluded from all 3 major trials (RE-LY [Randomized Evaluation of Long-Term Anticoagulation Therapy], ROCKET AF [Rivaroxaban-once daily, oral, direct factor Xa inhibition compared with vitamin K antagonism for prevention of stroke and Embolism], and ARISTOTLE [Apixaban for Reduction in Stroke and Other Thromboembolic Events in Atrial Fibrillation]) (101-103) therefore, these patients should be managed with warfarin. Patients with aortic stenosis or aortic insufficiency who, in the estimation of the local RCT principal investigator, would not need a surgical procedure before the conclusion of the trial were included. The RE-ALIGN (Randomized, Phase II Study to Evaluate the Safety and Pharmacokinetics of Oral Dabigatran Etexilate in Patients After Heart Valve Replacement) trial, a phase 2 dose-range study of	

the use of dabigatran compared with warfarin in patients with mechanical heart valves, was stopped because dabigatran users were more likely to experience strokes, MI, and thrombus forming on the mechanical heart valves than were warfarin users (104-106). There was also more bleeding after valve surgery in the dabigatran users than in the warfarin users; thus, dabigatran is contraindicated for use in patients with mechanical heart valves. Similar drug safety and efficacy information is lacking for rivaroxaban and apixaban and mechanical heart valves. Bioprosthetic heart valves have not been studied with any of the new anticoagulants. None of the 3 major trials included pregnant or lactating women, children, patients with reversible causes of AF, or patients with severe hypertension (systolic blood pressure >180 mmHg or diastolic blood pressure >100 mmHg). Patients with a recent stroke (within 7 to 14 days), patients with significant liver disease, and complex patients with multiple chronic conditions were excluded from all trials.
Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) The direct thrombin inhibitor dabigatran should not be used in patients with AF and a mechanical heart valve (104). (Class III, Level of Evidence: B)

Short Title: QM-7: Inappropriate Prescription of a Direct Thrombin and Factor Xa inhibitor (Rivaroxaban or Edoxaban) Prior to Discharge	
QM-7: Atrial Fibrillation: Inappropriate Prescription of a Direct Thrombin and Factor Xa inhibitor (Rivaroxaban or Edoxaban) Prior to Discharge in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease or on Dialysis	
Measure Description: Percentage of patients, age 18 and older, with atrial fibrillation that also have end stage chronic kidney disease (CrCl <15 mL/min) or are on dialysis, who were prescribed a direct thrombin or factor Xa inhibitor (rivaroxaban or edoxaban) prior to discharge.	
Numerator	• Patients with a diagnosis of atrial fibrillation that also have end stage chronic kidney disease or are on dialysis who were prescribed a direct thrombin or factor Xa inhibitor (rivaroxaban or edoxaban) prior to discharge.
Denominator	• All patients with atrial fibrillation who also have end stage chronic kidney disease (CrCl <15 mL/min) or are on dialysis.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• None
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.

Care Setting	Inpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) For patients with CKD, dose modifications of the new agents are available (Table 8); however, for those with severe or end-stage CKD, warfarin remains the anticoagulant of choice, as there are no or very limited data for these patients. Among patients on hemodialysis, warfarin has been used with acceptable risks of hemorrhage (104).	
Clinical Recommendation(s)	
1. The direct thrombin inhibitor dabigatran and the factor Xa inhibitor rivaroxaban are not recommended in patients with AF and end-stage CKD or on dialysis because of the lack of evidence from clinical trials regarding the balance of risks and benefits (45-47,107-109). (Class III, Level of Evidence: C)	

1
2
3

Short Title: QM-8: Inappropriate Prescription of Aspirin and Oral Anticoagulation Therapy Prior to Discharge

QM-8: Atrial Fibrillation: Inappropriate Prescription of Aspirin and Oral Anticoagulation Therapy Prior to Discharge for Patients Who Do Not Have Coronary Artery Disease and/or Vascular Disease	
Measure Description: Percentage of patients, age 18 and older, with atrial fibrillation who do not currently have coronary artery disease and/or vascular disease that where inappropriately prescribed both aspirin and an oral anticoagulant prior to discharge.	
Numerator	• Patients with a diagnosis of atrial fibrillation who do not currently have coronary artery disease and/or vascular disease that were prescribed both aspirin and an anticoagulant prior to discharge.
Denominator	• All patients with atrial fibrillation who do not currently have coronary artery disease and/or vascular disease.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• None
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient

Rationale
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) The combination of oral anticoagulants and antiplatelet therapy ("triple therapy") is associated with a high annual risk of fatal and nonfatal bleeding episodes (110-113). Therefore, dual therapy should only be considered in patients with who also have vascular disease.
Clinical Recommendation(s)
Other guidelines or supporting recommendations:

1

Short Title: QM-9: Inappropriate Prescription of Nondihydropyridine Calcium Channel Antagonist Prior to Discharge

QM-9: Atrial Fibrillation: Inappropriate Prescription of Nondihydropyridine Calcium Channel Antagonist Prior to Discharge in Patients with Reduced Ejection Fraction or Decompensated Heart Failure	
Measure Description: Percentage of patients, age 18 and older, with reduced ejection fraction (≤40) or decompensated heart failure and a diagnosis of atrial fibrillation that were inappropriate prescribed nondihydropyridine calcium channel antagonist prior to discharge.	
Numerator	• Patients with a diagnosis of atrial fibrillation and reduced ejection fraction (≤40) or decompensated heart failure who were prescribed a nondihydropyridine calcium channel antagonist prior to discharge.
Denominator	• All patients with atrial fibrillation and reduced ejection fraction (≤40) or decompensated heart failure.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• None
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) In general, beta blockers are the most common agents used for rate control, followed by nondihydropyridine calcium channel blockers, digoxin, and amiodarone. Patient comorbidities must be understood to avoid medications that may precipitate adverse events such as decompensation of HF, exacerbation of chronic obstructive pulmonary disease, or acceleration of conduction in patients with pre-excitation.	

Nondihydropyridine calcium channel blockers should not be used in patients with LV systolic dysfunction and decompensated HF because of their negative inotropic effects, but they may be used in patients with HF with preserved LV systolic function. In addition, these agents should not be used in patients with pre-excitation and AF due to the potential for shortening bypass tract refractoriness, which may accelerate the ventricular rate to precipitate hypotension or ventricular fibrillation.
Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) Nondihydropyridine calcium channel antagonists should not be used in patients with decompensated HF as these may lead to further hemodynamic compromise. (Class III, Level of Evidence: C)

1
2
3

Short Title: QM-10: Patients Who Underwent Atrial Fibrillation Catheter Ablation Who Were Not Treated with Anticoagulation Therapy During or After a Procedure	
QM-10: Atrial Fibrillation: Patients Who Underwent Atrial Fibrillation Catheter Ablation Who Were Not Treated with Anticoagulation Therapy During or After a Procedure	
Measure Description: Percentage of patients, age 18 and older, who underwent atrial fibrillation ablation that were not treated with anticoagulation therapy both during and after a procedure.	
Numerator	• Patients who were not treated with anticoagulation both during and after a procedure.
Denominator	• All patients with atrial fibrillation who underwent catheter ablation.
Denominator Exclusions	• Patients less than 18 years of age • Patients who leave against medical advice • Patients who die during hospitalization • Patients who are on comfort care measures only • Patients who are transferred to another acute care hospital
Denominator Exceptions	• None
Measurement Period	Encounter
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19)	

Because of the well-established risk of periprocedure stroke or transient ischemic attack (TIA) associated with AF catheter ablation, there is consensus that anticoagulation is indicated to prevent thromboembolism around the time of radiofrequency catheter ablation regardless of the patient's baseline thromboembolic risk. Detailed consensus recommendations have been published about the approach to anticoagulation before, during, and after catheter ablation (24). Both intraprocedural heparin and oral anticoagulation are recommended for ≥2 months post-procedure. AF catheter ablation should not be performed in patients who cannot be treated with anticoagulant therapy during and after the procedure.
Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) 1. AF catheter ablation should not be performed in patients who cannot be treated with anticoagulant therapy during and after the procedure. (Class III, Level of Evidence: C)

1
2
3

Short Title: QM-11: Shared Decision Making Regarding Anticoagulation Prescription Prior to Discharge

QM-11: Atrial Fibrillation/Atrial Flutter: Shared Decision Making Between Physician and Patient in Anticoagulation Prescription Prior to Discharge	
Measure Description: Percent of patients, age 18 and older, with atrial fibrillation or atrial flutter who were educated on the benefits and risk of anticoagulation and for the specific type of anticoagulation therapy recommended by the physician and were consulted in the decision making process of whether to prescribe and which anticoagulant was prescribed prior to discharge.	
Numerator	• Patients with atrial fibrillation or atrial flutter with documentation of engagement in the decision making process regarding the benefits and risk of anticoagulation and for the specific type of anticoagulation therapy for atrial fibrillation or atrial flutter.
Denominator	• All patients with atrial fibrillation or atrial flutter.
Denominator Exclusions	• Patients less than 18 years of age • Patients who leave against medical advice • Patients who die during hospitalization • Patients who are on comfort care measures only • Patients who are transferred to another acute care hospital
Denominator Exceptions	• Documentation of a medical reason for not prescribing warfarin or another FDA approved anticoagulant to a patient with a CHA_2DS_2-VASc score of 2 or greater. • Patient currently enrolled in a clinical trial related to atrial fibrillation/atrial flutter.
Measurement Period	Encounter

Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or physician level.
Care Setting	Inpatient

Rationale

AF, whether paroxysmal, persistent, or permanent and whether symptomatic or silent, significantly increases the risk of thromboembolic ischemic stroke. Nonvalvular atrial fibrillation increases the risk of stroke 5 times, and AF in the setting of mitral stenosis increases the risk of stroke 20 times over that of patients in sinus rhythm.

Thromboembolism occurring with AF is associated with a greater risk of recurrent stroke, more severe disability, and mortality. Silent AF is also associated with ischemic stroke. The appropriate use of antithrombotic therapy and the control of other risk factors, including hypertension and hypercholesterolemia, substantially reduce stroke risk.

One meta-analysis has stratified ischemic stroke risk among patients with nonvalvular AF using the following point scoring systems (30): AF Investigators; CHADS2 (Congestive heart failure, Hypertension, Age ≥75 years, Diabetes mellitus, Prior Stroke or TIA or Thromboembolism [doubled]), or CHA_2DS_2-VASc (Congestive heart failure, Hypertension, Age ≥75 years [doubled] (31), Diabetes mellitus, Prior Stroke or TIA or thromboembolism [doubled], Vascular disease, Age 65 to 74 years, Sex category).

When compared with the $CHADS_2$ score (32), the CHA_2DS_2-VASc score for nonvalvular AF has a broader score range (0 to 9) and includes a larger number of risk factors (female sex, 65 to 74 years of age, and vascular disease) (33,34).

The selection of an antithrombotic agent should be based on shared decision making that takes into account risk factors, cost, tolerability, patient preference, potential for drug interactions, and other clinical characteristics, including time in the INR therapeutic range if the patient has been on warfarin, irrespective of whether the AF pattern is paroxysmal, persistent, or permanent.

Selection of agents for antithrombotic therapy depends on a large number of variables, including clinical factors, clinician and patient preference, and, in some circumstances, cost. The new agents are currently considerably more expensive than warfarin. However, dietary limitations and the need for repeated INR testing are eliminated with the new agents. If patients are stable, their condition is easily controlled, and they are satisfied with warfarin therapy, it is not necessary to change to a new agent. However, it is important to discuss this option with patients who are candidates for the new agents.

All 3 new oral anticoagulants [dabigatran, rivaroxaban, apixaban] represent important advances over warfarin because they have more predictable pharmacological profiles, fewer drug–drug interactions, an absence of major dietary effects, and less risk of intracranial bleeding than warfarin. They have rapid onset and offset of action so that bridging with parenteral anticoagulant therapy is not needed during initiation, and bridging may not be needed in patients on chronic therapy requiring brief interruption of anticoagulation for invasive procedures. However, strict compliance with these new oral anticoagulants is critical. Missing even 1 dose could result in a period without protection from thromboembolism. As a result, the FDA issued black box warnings that discontinuation of these new agents can increase the risk of thromboembolism and that coverage with another anticoagulant may be needed. In addition, reversal agents, while in development, are not available, although the short half-lives lessen the need for an antidote. Although dose adjustments may be warranted for those with CKD or body weight extremes,

these new agents do not require regular monitoring of INR or activated partial thromboplastin time.
Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) 1. In patients with AF, antithrombotic therapy should be individualized based on shared decision-making after discussion of the absolute and RRs of stroke and bleeding, and the patient's values and preferences. (Class I, Level of Evidence: C) 2. Selection of antithrombotic therapy should be based on the risk of thromboembolism irrespective of whether the AF pattern is paroxysmal, persistent, or permanent (35-38). (Class I, Level of Evidence: B) 3. In patients with nonvalvular AF, the CHA_2DS_2-VASc score is recommended for assessment of stroke risk (39-41). (Class I, Level of Evidence: B) 4. For patients with AF who have mechanical heart valves, warfarin is recommended and the target international normalized ratio (INR) intensity (2.0 to 3.0 or 2.5 to 3.5) should be based on the type and location of the prosthesis (42-44). (Class I, Level of Evidence: B) 5. For patients with nonvalvular AF with prior stroke, transient ischemic attack (TIA), or a CHA_2DS_2-VASc score of 2 or greater, oral anticoagulants are recommended. Options include: warfarin (INR 2.0 to 3.0) (35-38) (Class I, Level of Evidence: A), dabigatran (45) (Class I, Level of Evidence: B), rivaroxaban (46) (Class I, Level of Evidence: B), or apixaban (47) (Class I, Level of Evidence: B). 6. Among patients treated with warfarin, the INR should be determined at least weekly during initiation of antithrombotic therapy and at least monthly when anticoagulation (INR in range) is stable (48-50). (Class I, Level of Evidence: A) 7. For patients with nonvalvular AF unable to maintain a therapeutic INR level with warfarin, use of a direct thrombin or factor Xa inhibitor (dabigatran, rivaroxaban, or apixaban) is recommended. (Class I, Level of Evidence: C) 8. Re-evaluation of the need for and choice of antithrombotic therapy at periodic intervals is recommended to reassess stroke and bleeding risks. (Class I, Level of Evidence: C) 9. For patients with atrial flutter, antithrombotic therapy is recommended according to the same risk profile used for AF. (Class I, Level of Evidence: C)

Outpatient Measures

Short Title: QM-12: Beta Blocker Prescribed

QM-12: Atrial Fibrillation/Atrial Flutter: Beta Blocker Prescribed
Measure Description: Percent of patients, age 18 and older, with a diagnosis of atrial fibrillation or atrial

flutter and with an LVEF≤40, who were prescribed a beta blocker during the measurement period.	
Numerator	• Patients with a diagnosis of atrial fibrillation or atrial flutter and with an LVEF≤40 for whom a beta blocker was prescribed* during the measurement period. *Prescribed–Also satisfied by documentation in current medication list.
Denominator	• All patients with atrial fibrillation or atrial flutter and with an LVEF≤40.
Denominator Exclusions	• Patients less than 18 years of age • Patients who are on comfort care measures only
Denominator Exceptions	• Documentation of a medical reason for not prescribing a beta blocker. • Documentation of a patient reason for not prescribing a beta blocker. • Patient currently enrolled in a clinical trial related to atrial fibrillation/atrial flutter treatment.
Measurement Period	Reporting Year.
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient
Rationale	
AF, whether paroxysmal, persistent, or permanent and whether symptomatic or silent, significantly increases the risk of thromboembolic ischemic stroke. Nonvalvular atrial fibrillation increases the risk of stroke 5 times, and AF in the setting of mitral stenosis increases the risk of stroke 20 times over that of patients in sinus rhythm. Rate control in AF is an important strategy. It impacts quality of life, reduces morbidity, and decreases the potential for developing tachycardia-induced cardiomyopathy. Multiple agents, including beta blockers and nondihydropyridine calcium channel blockers, certain antiarrhythmic drugs, including amiodarone and sotalol, have been evaluated with regard to efficacy in attaining rate control. When considering which agent(s) to use, clinicians must consider the patient's degree of symptoms, hemodynamic status, presence or absence of HF, and potential precipitants of AF. In general, beta blockers are the most common agents used for rate control, followed by nondihydropyridine calcium channel blockers, digoxin, and amiodarone. Patient comorbidities must be understood to avoid medications that may precipitate adverse events such as decompensation of HF, exacerbation of chronic obstructive pulmonary disease, or acceleration of conduction in patients with pre-excitation.	

Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) 1. Control of the ventricular rate using a beta blocker or nondihydropyridine calcium channel antagonist is recommended for patients with paroxysmal, persistent, or permanent AF (51-53). (Class I, Level of Evidence: B)

1
2
3

Short Title: QM-13: Inappropriate Prescription of Antiarrhythmic Drugs to Patients with Permanent Atrial Fibrillation

QM-13: Atrial Fibrillation: Inappropriate Prescription of Antiarrhythmic Drugs to Patients with Permanent Atrial Fibrillation for Rhythm Control	
Measure Description: Percentage of patients, age 18 and older, with permanent atrial fibrillation who were inappropriately prescribed antiarrhythmic medications for rhythm control.	
Numerator	Patients with a diagnosis of atrial fibrillation who were prescribed antiarrhythmic medications for rhythm control. For purposes of this measure antiarrhythmic drugs includes the medications provided in the below table. **Vaughan Williams Class IA** Disopyramide Quinidine **Vaughan Williams Class IC** Flecainide Propafenone **Vaughan Williams Class III** Dofetilide Dronedarone Sotalol
Denominator	• All patients with permanent atrial fibrillation.
Denominator Exclusions	• Patients less than 18 years of age • Patients prescribed amiodarone for rate control
Denominator Exceptions	• None
Measurement Period	Reporting Year
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.

Care Setting	Outpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) In selecting a strategy of rhythm control with an antiarrhythmic drug, providing for adequate rate control in the event of AF recurrence should also be considered. Once antiarrhythmic drug therapy is initiated, patient symptoms may improve without complete AF suppression. The transition from frequent AF to infrequent, well-tolerated recurrence of AF is a reasonable outcome and does not necessarily indicate that the therapy should be discontinued. However, if attempts at rhythm control are abandoned (e.g., after AF has been declared permanent), the antiarrhythmic drug should be discontinued.	
Clinical Recommendation(s)	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) Antiarrhythmic drugs for rhythm control should not be continued when AF becomes permanent (Class III, Level of Evidence: C) including dronedarone (82). (Class III Level of Evidence: B)	

1
2
3

Short Title: QM-14: Inappropriate Prescription of a Specific Type of Antiarrhythmic Drugs

QM-14: Atrial Fibrillation/Atrial Flutter: Inappropriate Prescription of a Specific Type of Antiarrhythmic Drugs in Atrial Fibrillation Patients With Coronary Artery Disease and/or an NYHA Class III or Class IV Heart Failure	
Measure Description: Percentage of patients, age 18 and older, with atrial fibrillation that also have coronary artery disease and/or an NYHA Class III or Class IV heart failure who were inappropriately prescribed antiarrhythmic medications.	
Numerator	• Patients with a diagnosis of atrial fibrillation who also have coronary artery disease and/or an NYHA Class III or Class IV heart failure that were inappropriately prescribed* a specific type of antiarrhythmic medication. *Patients with coronary artery disease should not be prescribed flecainide and propafenone and patients with heart failure should not be prescribed flecainide, propafenone, sotalol, and dronedarone.
Denominator	• All patients with atrial fibrillation who also have coronary artery disease and/or an NYHA Class III or Class IV heart failure.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• None
Measurement Period	Reporting Year

Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient

Rationale

Flecainide and Propafenone are Vaughan Williams Class IC drugs that may be considered for rhythm control in patients with AF without structural heart disease. Flecainide, along with other potent sodium channel– blocking drugs, increased mortality in patients with prior myocardial infarction (MI) and therefore should be avoided in patients with ischemic heart disease (83). In addition, both drugs are negative inotropes and should be avoided in patients with LV dysfunction.

Sotalol is renally cleared and should be used with caution or avoided in patients with CKD or unstable renal function. Sotalol causes drug-induced QT interval prolongation, so it should be administered with caution or avoided when administered with other drugs known to prolong the QT interval. Table 13 in the 2014 ACC/AHA/HRS Guidelines for Management for Patients with Atrial Fibrillation provides more guidance in types of patients who should be excluded. Trends toward increased mortality for sotalol (OR: 3.44; 95% CI: 1.02 to 11.59) were observed in a comparison study (84), and it is likely that proarrhythmia is a contributing mechanism.

Dronedarone increases mortality in patients with recently decompensated HF and depressed LV function (85) and is contraindicated in patients with NYHA Class III or IV HF and in patients who have had an episode of decompensated HF in the past 4 weeks, especially if they have depressed LV function. In patients with permanent AF, dronedarone increases the combined endpoint of stroke, cardiovascular death, and hospitalization (82). Therefore, dronedarone is contraindicated in patients whose sinus rhythm is not restored.

Clinical Recommendation(s)

2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19)

1. The following antiarrhythmic drugs are recommended in patients with AF to maintain sinus rhythm, depending on underlying heart disease and comorbidities (Class I, Level of Evidence: A):
   a. Amiodarone (86-89)
   b. Dofetilide (90,91)
   c. Dronedarone (92-94)
   d. Flecainide (87,95)
   e. Propafenone (88,96-99)
   f. Sotalol (87,97,100)

2. The risks of the antiarrhythmic drug, including proarrhythmia, should be considered before initiating therapy with each drug. (Class I, Level of Evidence: C)

3. Dronedarone should not be used for treatment of AF in patients with New York Heart Association Class III and IV HF or patients who have had an episode of decompensated HF in the past 4 weeks (85). (Class III, Level of Evidence: B)

Short Title: QM-15: Inappropriate Prescription of Dofetilide or Sotalol

QM-15: Atrial Fibrillation: Inappropriate Prescription of Dofetilide or Sotalol in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease or on Dialysis	
Measure Description: Percentage of patients, age 18 and older, with atrial fibrillation that also have end stage chronic kidney disease (CrCl <15 mL/min) or are on dialysis, who were prescribed dofetilide or sotalol.	
Numerator	Patients with a diagnosis of atrial fibrillation that also have end stage chronic kidney disease or are on dialysis who were prescribed dofetilide or sotalol.
Denominator	• All patients with atrial fibrillation who also have end stage chronic kidney disease (CrCl <15 mL/min) or are on dialysis.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• Patients less than 18 years of age.
Measurement Period	Reporting Year
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) Sotalol and Dofetilide are predominantly renally cleared and should be used with caution or avoided in patients with end-stage CKD or on dialysis. Table 11 in the 2014 ACC/AHA/HRS Guidelines for Management for Patients with Atrial Fibrillation provides more guidance in types of patients who should be excluded. Manufacturer/FDA recommendations suggest that both drugs are contraindicated due increased risk for toxicity (including potentially life-threatening pro-arrhythmic effects) in patients with severely reduced renal function.	
Clinical Recommendation(s)	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) 1. The following antiarrhythmic drugs are recommended in patients with AF to maintain sinus rhythm, depending on underlying heart disease and comorbidities (Class I, Level of Evidence: A): a. Amiodarone (86-89) b. Dofetilide (90,91) c. Dronedarone (92-94) d. Flecainide (87,95) e. Propafenone (88,96-99) f. Sotalol (87,97,100) 2. The risks of the antiarrhythmic drug, including proarrhythmia, should be considered before initiating	

therapy with each drug. (Class I, Level of Evidence: C)

1
2
3
4
5

Short Title: QM-16: Inappropriate Prescription of a Direct Thrombin or Factor Xa Inhibitor

QM-16: Atrial Fibrillation: Inappropriate Prescription of a Direct Thrombin or Factor Xa Inhibitor in Atrial Fibrillation Patients With Mechanical Heart Valve	
Measure Description: Percentage of patients, age 18 and older, with a mechanical heart valve and with a diagnosis of atrial fibrillation that were inappropriately prescribed a direct thrombin or factor Xa inhibitor.	
Numerator	• Patients with a diagnosis of atrial fibrillation who were prescribed a direct thrombin or factor Xa inhibitor despite having a mechanical heart valve.
Denominator	• All patients with a diagnosis of atrial fibrillation with a mechanical heart valve.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• None
Measurement Period	Reporting Year
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) Patients with atrial fibrillation and a mechanical heart valve should not be prescribed dabigatran. Patients with mechanical heart valves or hemodynamically significant mitral stenosis were excluded from all 3 major trials (RE-LY, ROCKET AF, and ARISTOTLE) (101-103); therefore, these patients should be managed with warfarin. Patients with aortic stenosis or aortic insufficiency who, in the estimation of the local RCT principal investigator, would not need a surgical procedure before the conclusion of the trial were included. The RE-ALIGN (Randomized, Phase II Study to Evaluate the Safety and Pharmacokinetics of Oral Dabigatran Etexilate in Patients After Heart Valve Replacement) trial, a phase 2 dose-range study of the use of dabigatran compared with warfarin in patients with mechanical heart valves, was stopped because dabigatran users were more likely to experience strokes, MI, and thrombus forming on the mechanical heart valves than were warfarin users (104-106). There was also more	

bleeding after valve surgery in the dabigatran users than in the warfarin users; thus, dabigatran is contraindicated for use in patients with mechanical heart valves. Similar drug safety and efficacy information is lacking for rivaroxaban and apixaban and mechanical heart valves. Bioprosthetic heart valves have not been studied with any of the new anticoagulants. None of the 3 major trials included pregnant or lactating women, children, patients with reversible causes of AF, or patients with severe hypertension (systolic blood pressure >180 mmHg or diastolic blood pressure >100 mmHg). Patients with a recent stroke (within 7 to 14 days), patients with significant liver disease, and complex patients with multiple chronic conditions were excluded from all trials.
Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) The direct thrombin inhibitor dabigatran should not be used in patients with AF and a mechanical heart valve (104). (Class III, Level of Evidence: B)

1
2
3

Short Title: QM-17: Inappropriate Prescription of a Direct Thrombin and Factor Xa Inhibitor (Rivaroxaban or Edoxaban)

QM-17: Atrial Fibrillation: Inappropriate Prescription of a Direct Thrombin and Factor Xa Inhibitor (Rivaroxaban or Edoxaban) in Patients with Atrial Fibrillation and End-Stage Chronic Kidney Disease or on Dialysis	
Measure Description: Percentage of patients, age 18 and older, with atrial fibrillation that also have end stage chronic kidney disease (CrCl <15 mL/min) or are on dialysis, who were prescribed a direct thrombin or factor Xa inhibitor (rivaroxaban or edoxaban).	
Numerator	• Patients with a diagnosis of atrial fibrillation, that also have and end stage chronic kidney disease or are on dialysis, who were prescribed a direct thrombin or factor Xa inhibitor (rivaroxaban or edoxaban).
Denominator	• All patients with atrial fibrillation that also have and end stage chronic kidney disease (CrCl <15 mL/min or are on dialysis.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• None
Measurement Period	Reporting Year
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient

Rationale
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) For patients with CKD, dose modifications of the new agents are available (Table 8); however, for those with severe or end-stage CKD, warfarin remains the anticoagulant of choice, as there are no or very limited data for these patients. Among patients on hemodialysis, warfarin has been used with acceptable risks of hemorrhage (114).
Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) The direct thrombin inhibitor dabigatran and the factor Xa inhibitor rivaroxaban are not recommended in patients with AF and end-stage CKD or on dialysis because of the lack of evidence from clinical trials regarding the balance of risks and benefits (45-47,107-109). (Class III, Level of Evidence: C)

1
2
3

Short Title: QM-18: Inappropriate Prescription of Aspirin and Oral Anticoagulation Therapy

QM-18: Atrial Fibrillation: Inappropriate Prescription of Aspirin and Oral Anticoagulation Therapy for Patients Who Do Not Have Coronary Artery Disease and/or Vascular Disease	
Measure Description: Percentage of patients, age 18 and older, with atrial fibrillation who do not currently have coronary artery disease and/or vascular disease that were inappropriately prescribed both aspirin and an oral anticoagulant.	
Numerator	• Patients with a diagnosis of atrial fibrillation who do not have coronary artery disease and/or vascular disease that were inappropriately prescribed both aspirin and an oral anticoagulant.
Denominator	• All patients with atrial fibrillation who do not currently have coronary artery disease and/or vascular disease.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• None
Measurement Period	Reporting Year
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient
Rationale	

2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) The combination of oral anticoagulants and antiplatelet therapy ("triple therapy") is associated with a high annual risk of fatal and nonfatal bleeding episodes (110-113). Therefore, dual therapy should only be considered in patients with who also have vascular disease.
Clinical Recommendation(s)
Other guidelines or supporting recommendations:

1

Short Title: QM-19: Inappropriate Prescription of Nondihydropyridine Calcium Channel Antagonist

QM-19: Atrial Fibrillation: Inappropriate Prescription of Nondihydropyridine Calcium Channel Antagonist in Patients with Reduce Ejection Fraction or Decompensated Heart Failure	
Measure Description: Percentage of patients, age 18 and older, with reduced ejection fraction (≤40) or decompensated heart failure and a diagnosis of atrial fibrillation that were inappropriate prescribed nondihydropyridine calcium channel antagonist.	
Numerator	• Patients with a diagnosis of atrial fibrillation and reduced ejection fraction (≤40) or decompensated heart failure who were prescribed nondihydropyridine calcium channel antagonist.
Denominator	• All patients with atrial fibrillation and reduced ejection fraction (≤40) or decompensated heart failure.
Denominator Exclusions	• Patients less than 18 years of age
Denominator Exceptions	• None
Measurement Period	Reporting Year
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient
Rationale	
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) In general, beta blockers are the most common agents used for rate control, followed by nondihydropyridine calcium channel blockers, digoxin, and amiodarone. Patient comorbidities must be understood to avoid medications that may precipitate adverse events such as decompensation of HF, exacerbation of chronic obstructive pulmonary disease, or acceleration of conduction in patients with pre-excitation. Nondihydropyridine calcium channel blockers should not be used in patients with left ventricular systolic dysfunction and decompensated HF because of their negative inotropic effects, but they may be used in patients with HF with preserved LV systolic function. In addition, these agents should not be used in	

patients with pre-excitation and AF due to the potential for shortening bypass tract refractoriness, which may accelerate the ventricular rate to precipitate hypotension or ventricular fibrillation.
Clinical Recommendation(s)
2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19) Nondihydropyridine calcium channel antagonists should not be used in patients with decompensated HF as these may lead to further hemodynamic compromise. (Class III, Level of Evidence: C)

Short Title: QM-20: Shared Decision Making in Anticoagulation Prescription

QM-20: Atrial Fibrillation/Atrial Flutter: Shared Decision Making Between Physician and Patient in Anticoagulation Prescription	
Measure Description: Percent of patients, age 18 and older, with atrial fibrillation or atrial flutter who were educated on the benefits and risk of anticoagulation and for the specific type of anticoagulation therapy recommended by the physician and were consulted in the decision making process of whether to prescribe and which anticoagulant was prescribed during the measurement period.	
Numerator	• Patients with atrial fibrillation or atrial flutter with documentation of engagement in the decision making process regarding the benefits and risk of anticoagulation and for the specific type of anticoagulation therapy for atrial fibrillation or atrial flutter.
Denominator	• All patients with atrial fibrillation or atrial flutter.
Denominator Exclusions	• Patients less than 18 years of age • Patients who are on comfort care measures only
Denominator Exceptions	• Documentation of a medical reason for not prescribing warfarin or another FDA approved anticoagulant to a patient with a CHA_2DS_2-VASc score of 2 or greater. • Patient currently enrolled in a clinical trial related to atrial fibrillation/atrial flutter.
Measurement Period	Reporting Year
Sources of Data	Medical record or other database (e.g., administrative, clinical, registry).
Attribution	Measure reportable at the facility or provider level.
Care Setting	Outpatient
Rationale	
AF, whether paroxysmal, persistent, or permanent and whether symptomatic or silent, significantly increases the risk of thromboembolic ischemic stroke. Nonvalvular atrial fibrillation increases the risk of stroke 5 times, and AF in the setting of mitral stenosis increases the risk of stroke 20 times over that of	

patients in sinus rhythm.

Thromboembolism occurring with AF is associated with a greater risk of recurrent stroke, more severe disability, and mortality. Silent AF is also associated with ischemic stroke. The appropriate use of antithrombotic therapy and the control of other risk factors, including hypertension and hypercholesterolemia, substantially reduce stroke risk.

One meta-analysis has stratified ischemic stroke risk among patients with nonvalvular AF using the following point scoring systems (30): AF Investigators; CHADS2 (Congestive heart failure, Hypertension, Age ≥75 years, Diabetes mellitus, Prior Stroke or TIA or Thromboembolism [doubled]), or CHA_2DS_2-VASc (Congestive heart failure, Hypertension, Age ≥75 years [doubled] (31), Diabetes mellitus, Prior Stroke or TIA or thromboembolism [doubled], Vascular disease, Age 65 to 74 years, Sex category).

When compared with the $CHADS_2$ score (32), the CHA_2DS_2-VASc score for nonvalvular AF has a broader score range (0 to 9) and includes a larger number of risk factors (female sex, 65 to 74 years of age, and vascular disease) (33,34).

The selection of an antithrombotic agent should be based on shared decision making that takes into account risk factors, cost, tolerability, patient preference, potential for drug interactions, and other clinical characteristics, including time in the INR therapeutic range if the patient has been on warfarin, irrespective of whether the AF pattern is paroxysmal, persistent, or permanent.

Selection of agents for antithrombotic therapy depends on a large number of variables, including clinical factors, clinician and patient preference, and, in some circumstances, cost. The new agents are currently considerably more expensive than warfarin. However, dietary limitations and the need for repeated INR testing are eliminated with the new agents. If patients are stable, their condition is easily controlled, and they are satisfied with warfarin therapy, it is not necessary to change to a new agent. However, it is important to discuss this option with patients who are candidates for the new agents.

All 3 new oral anticoagulants [dabigatran, rivaroxaban, apixaban] represent important advances over warfarin because they have more predictable pharmacological profiles, fewer drug–drug interactions, an absence of major dietary effects, and less risk of intracranial bleeding than warfarin. They have rapid onset and offset of action so that bridging with parenteral anticoagulant therapy is not needed during initiation, and bridging may not be needed in patients on chronic therapy requiring brief interruption of anticoagulation for invasive procedures. However, strict compliance with these new oral anticoagulants is critical. Missing even 1 dose could result in a period without protection from thromboembolism. As a result, the FDA issued black box warnings that discontinuation of these new agents can increase the risk of thromboembolism and that coverage with another anticoagulant may be needed. In addition, reversal agents, while in development, are not available, although the short half-lives lessen the need for an antidote. Although dose adjustments may be warranted for those with CKD or body weight extremes, these new agents do not require regular monitoring of INR or activated partial thromboplastin time.

Clinical Recommendation(s)

2014 ACC/AHA/HRS Guidelines for the Management of Patients With Atrial Fibrillation (19)

1. In patients with AF, antithrombotic therapy should be individualized based on shared decision-making after discussion of the absolute and RRs of stroke and bleeding, and the patient's values and preferences. (Class I, Level of Evidence: C)

2. Selection of antithrombotic therapy should be based on the risk of thromboembolism irrespective of whether the AF pattern is paroxysmal, persistent, or permanent (35-38). (Class I, Level of Evidence: B)

3. In patients with nonvalvular AF, the CHA_2DS_2-VASc score is recommended for assessment of stroke

risk (39-41). (Class I, Level of Evidence: B)

4. For patients with AF who have mechanical heart valves, warfarin is recommended and the target international normalized ratio (INR) intensity (2.0 to 3.0 or 2.5 to 3.5) should be based on the type and location of the prosthesis (42-44). (Class I, Level of Evidence: B)

5. For patients with nonvalvular AF with prior stroke, transient ischemic attack (TIA), or a CHA_2DS2-VASc score of 2 or greater, oral anticoagulants are recommended. Options include: warfarin (INR 2.0 to 3.0) (35-38) (Class I, Level of Evidence: A), dabigatran (45) (Class I, Level of Evidence: B), rivaroxaban (46) (Class I, Level of Evidence: B), or apixaban (47) (Class I, Level of Evidence: B).

6. Among patients treated with warfarin, the INR should be determined at least weekly during initiation of antithrombotic therapy and at least monthly when anticoagulation (INR in range) is stable (48-50). (Class I, Level of Evidence: A)

7. For patients with nonvalvular AF unable to maintain a therapeutic INR level with warfarin, use of a direct thrombin or factor Xa inhibitor (dabigatran, rivaroxaban, or apixaban) is recommended. (Class I, Level of Evidence: C)

8. Re-evaluation of the need for and choice of antithrombotic therapy at periodic intervals is recommended to reassess stroke and bleeding risks. (Class I, Level of Evidence: C)

9. For patients with atrial flutter, antithrombotic therapy is recommended according to the same risk profile used for AF. (Class I, Level of Evidence: C)

Appendix B. Author Listing of Relationships With Industry and Other Entities (Relevant)—2016 ACC/AHA Atrial Fibrillation

Committee Member	Employment	Consultant	Speaker	Ownership/ Partnership/ Principal	Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness
Paul Heidenreich, *Chair*	Stanford VA Palo Alto Health Care System — Professor of Medicine	None	None	None	None	None	None
David D. McManus	University of Massachusetts Memorial Medical Center — Assistant Professor of Medicine	None	None	None	• Biotronik - IMPACT study • Philip Healthcare – SENTINEL-HF study	None	None
Gregg C. Fonarow	Ahmanson-UCLA Cardiomyopathy Center Division of Cardiology — Director	• Boston Scientific • Medtronic	None	None	• Medtronic	• Medtronic- IMPROVE HF Steering Committee*	None

Committee Member	Employment	Consultant	Speaker	Ownership/ Partnership/ Principal	Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness
N. A. Mark Estes	Tufts Medical Center — Professor of Medicine	• Boston Scientific† • Medtronic† • St. Jude Medical†	None	None	• Boston Scientific	• Medtronic† • St. Jude Medical† • Boston Scientific†	None
Joseph E. Marine	Johns Hopkins School of Medicine — Associate Professor of Medicine	None	None	None	None	None	None
Robert L. McNamara	Yale University School of Medicine Section of Cardiology — Associate Professor of Medicine	None	None	None	None	None	None
Corrine Y. Jurgens	Stony Brook University School of Nursing — Associate Professor	None	None	None	None	None	None
Penelope Solis	American College of Cardiology	None	None	None	None	None	None

This table represents the relationships of committee members with industry and other entities that were determined to be relevant to this document. These relationships were reviewed and updated in conjunction with all meetings and/or conference calls of the writing committee during the document development process. The table does not necessarily reflect relationships with industry at the time of publication. A person is deemed to have a

significant interest in a business if the interest represents ownership of ≥5% of the voting stock or share of the business entity, or ownership of ≥$5,000 of the fair market value of the business entity; or if funds received by the person from the business entity exceed 5% of the person's gross income for the previous year. Relationships that exist with no financial benefit are also included for the purpose of transparency. Relationships in this table are modest unless otherwise noted.

According to the ACC/AHA, a person has a *relevant* relationship IF: a) the *relationship or interest* relates to the same or similar subject matter, intellectual property or asset, topic, or issue addressed in the *document*; or b) the *company/entity* (with whom the relationship exists) makes a drug, drug class, or device addressed in the *document*, or makes a competing drug or device addressed in the *document*; or c) the *person or a member of the person's household* has a reasonable potential for financial, professional, or other personal gain or loss as a result of the issues/content addressed in the *document*.

*No financial relationship.
†Significant (greater than $5,000) relationship.

ACC indicates American College of Cardiology; ACCF, American College of Cardiology Foundation; AHA, American Heart Association; GWTG, Get With The Guidelines; IBHRE, International Board of Heart Rhythm Examiners; IMPACT; IMPROVE HF, Improve the Use of Evidence-Based Heart Failure Therapies in the Outpatient Setting; PRT, Pharmacy Round Table; UCLA, University of California, Los Angeles;NIH/NIAID, National Institute Health/ The National Institute of Allergy and Infectious Diseases; NHBLI, National Heart, Lung, and Blood Institute; SENTINEL-HF study and VA, Veterans Affairs.

Appendix C. Peer Reviewer Relationships With Industry and Other Entities—ACC/AHA 2016 Atrial Fibrillation

[This table will be populated post comment period with the peer reviewer relevant RWI]

Peer Reviewer	Representation	Consultant	Speaker's Bureau	Ownership/Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness

This table represents the relationships of reviewers with industry and other entities that were disclosed at the time of peer review and determined to be relevant. It does not necessarily reflect relationships with industry at the time of publication. A person is deemed to have a significant interest in a business if the interest represents ownership of ≥5% of the voting stock or share of the business entity, or ownership of ≥$ 5 000 of the fair market value of the business entity; or if funds received by the person from the business entity exceed 5% of the person's gross income for the previous year. A relationship is considered to be modest if it is less than significant under the preceding definition. Relationships that exist with no financial benefit are also included for the purpose of transparency. Relationships in this table are modest unless otherwise noted.

According to the ACC/AHA, a person has a ***relevant*** relationship IF: a) the ***relationship or interest*** relates to the same or similar subject matter, intellectual property or asset, topic, or issue addressed in the ***document***; or b) **the *company/entity* (with whom the relationship exists)** makes a drug, drug class, or device addressed in the *document*, or makes a competing drug or device addressed in the ***document***; or c) the ***person or a member of the person's household*** has a reasonable potential for financial, professional, or other personal gain or loss as a result of the issues/content addressed in the ***document*.**

*No financial relationship.
†Significant (greater than $5 000) relationship.

ACC indicates American College of Cardiology; AHA, American Heart Association; BOT, Board of Trustees; BOG, Board of Governors; HRS, Heart Rhythm Society; PI, principal investigator; NCDR, National Cardiovascular Data Registry; and GWTG, Get With the Guidelines

References

1. Spertus JA, Eagle KA, Krumholz HM, et al. American College of Cardiology and American Heart Association methodology for the selection and creation of performance measures for quantifying the quality of cardiovascular care. J Am Coll Cardiology. 2005;45:1147-56.

2. Estes III, Halperin JL, Calkins H, et al. ACC/AHA/AMA Physician Consortium 2008 clinical performance measures for adults with nonvalvular atrial fibrillation or atrial flutter: a report of the American College of Cardiology/American Heart Association Task Force on Performance Measures and the AMA Physician Consortium for Performance Improvement (Writing Committee to Develop Clinical Performance Measures for Atrial Fibrillation) developed in Collaboration With the Heart Rhythm Society. J Am Coll Cardiology. 2008;51:865-84.

3. Albert NM, Heidenreich PA, Erwin III FJ, et al. Implementation notes 1.0 for the ACC/AHA/Physician Consortium 2008 clinical performance measures for adults with nonvalvular atrial fibrillation or atrial flutter: Available at: http://www.cardiosource.org/Science-And-Quality/Practice-Guidelines-and-Quality-Standards.aspx. Accessed July 29, 2015.

4. Mamas MA, Caldwell JC, Chacko S, et al. A meta-analysis of the prognostic significance of atrial fibrillation in chronic heart failure. European Journal of Heart Failure. 2009;11:676-83.

5. Wang TJ, Larson MG, Levy D, et al. Temporal relations of atrial fibrillation and congestive heart failure and their joint influence on mortality: the Framingham Heart Study. Circulation. 2003;107:2920-5.

6. Zakeri R, Chamberlain AM, Roger VrL, et al. Temporal relationship and prognostic significance of atrial fibrillation in heart failure patients with preserved ejection fraction: a community-based study. Circulation. 2013;128:1085-93.

7. Jabre P, Jouven X, Adnet F, et al. Atrial fibrillation and death after myocardial infarction: a community study. Circulation. 2011;123:2094-100.

8. Jabre P, Roger VL, Murad MH, et al. Mortality associated with atrial fibrillation in patients with myocardial infarction: a systematic review and meta-analysis. Circulation. 2011;123:1587-93.

9. Alonso A, Krijthe BP, Aspelund T, et al. Simple risk model predicts incidence of atrial fibrillation in a racially and geographically diverse population: the CHARGE−−AF consortium. Journal of the American Heart Association. 2013;2:e000102.

10. Chamberlain AM, Agarwal SK, Folsom AR, et al. A clinical risk score for atrial fibrillation in a biracial prospective cohort (from the Atherosclerosis Risk In Communities [ARIC] Study). Am J Cardiol. 2008;107:85-91.

11. Lin HJ, Wolf PA, Kelly-Hayes M, et al. Stroke severity in atrial fibrillation: the framingham study. Stroke. 1996;27:1760-4.

12. Ramirez AH, Shaffer CM, Delaney JT, et al. Novel rare variants in congenital cardiac arrhythmia genes are frequent in drug-induced torsades de pointes. Pharmacogenomics J. 2013;13:325-9.

13. Miyasaka Y, Barnes ME, Gersh BJ, et al. Secular trends in incidence of atrial fibrillation in olmsted county, minnesota, 1980 to 2000, and implications on the projections for future prevalence. Circulation. 2006;114:119-25.

14. Go A, Hylek E, Phillips K, et al. Prevalence of diagnosed atrial fibrillation in adults: national implications for rhythm management and stroke prevention: the Anticoagulation and Risk Factors in Atrial Fibrillation (ATRIA) Study. JAMA. 2001;285(18):2370-5.

15. Piccini JP, Hammill BG, Sinner MF, et al. Incidence and prevalence of atrial fibrillation and associated mortality among medicare beneficiaries. Circulation: Cardiovascular Quality and Outcomes. 2012;5:85-93.

16. Khairallah F, Ezzedine R, Ganz LI, et al. Epidemiology and determinants of outcome of admissions for atrial fibrillation in the United States from 1996 to 2001. Am J Cardiol. 2004;94:500-4.

17. Centers for Disease Control and Prevention (CDC) National Center for Health Statistics Division of Health Care Statistics. Distribution of firstlisted diagnoses among hospital discharges with diabetes as any listed diagnosis, adults aged 18 years and older, United States, 2010: Available at: http://www.cdc.gov/diabetes/statistics/hosp/adulttable1.htm. Accessed July 28, 2015.

18. Mozaffarian D, Benjamin EJ, Go AS, et al. Heart Disease and Stroke Statistics––2015 Update: A Report From the American Heart Association. Circulation. 2015;131:e29-e322.

19. January CT, Wann LS, Alpert JS, et al. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society. J Am Coll Cardiology. 2014;64:e1-e76.

20. Yancy CW, Jessup M, Bozkurt B, et al. 2013 ACCF/AHA guideline for the management of heart-failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiology. 2013;62:e147-e239.

21. Al-Khatib S, Allen, Lapointe N, et al. Treatment of atrial fibrillation. comparative effectiveness Review 119. (prepared by the Duke Evidence-based Practice Center under contract No. 290-2007-10066-I.) AHRQ publication no.13-EHC095-EF. Rockville, MD: Agency for Healthcare Research and Quality; June 2013: Available at: http://www.effectivehealthcare.ahrq.gov/reports/final.cfm. Accessed August 14, 2014.

22. Lopes R, Crowley M, Shah B. Stroke prevention in atrial fibrillation. comparative effectiveness review no. 123. (prepared by the Duke Evidence-based Practice Center under contract no. 290-2007-10066-I.) AHRQ publication no. 13-EHC113-EF. Rockville, MD: Agency for Healthcare Research and Quality; August 2013: Available at: http://www.effectivehealthcare.ahrq.gov/reports/final.cfm. Accessed August 14, 2014.

23. Furie KL, Goldstein LB, Albers GW, et al. Oral antithrombotic agents for the prevention of stroke in nonvalvular atrial fibrillation: a science advisory for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2012;43:3442-53.

24. Calkins H, Kuck KH, Cappato R, et al. 2012 HRS/EHRA/ECAS expert consensus statement on catheter and surgical ablation of atrial fibrillation: recommendations for patient selection, procedural techniques, patient management and follow-up, definitions, endpoints, and research trial design: a report of the Heart Rhythm Society (HRS) Task Force on Catheter and Surgical Ablation of Atrial Fibrillation. Developed in partnership with the European Heart Rhythm Association (EHRA), a registered branch of the European Society of Cardiology (ESC) and the European Cardiac Arrhythmia Society (ECAS); and in collaboration with the American College of Cardiology (ACC), American Heart Association (AHA), the Asia Pacific Heart Rhythm Society (APHRS), and the Society of Thoracic Surgeons (STS). Heart Rhythm. 2012;9:632-96.

25. National Institute For Health Care And Excellence. Nice guidelines: atrial fibrillation: the management of atrial fibrillation: Available at: http://www.nice.org.uk/guidance/cg180/chapter/1-recommendations. Accessed August 6, 2015.

26. Glotzer TV, Hellkamp AS, Zimmerman J, et al. Atrial high rate episodes detected by pacemaker diagnostics predict death and stroke: report of the Atrial Diagnostics Ancillary Study of the MOde Selection Trial (MOST). Circulation. 2003;107:1614-9.

27. Glotzer TV, Daoud EG, Wyse DG, et al. The relationship between daily atrial tachyarrhythmia burden from implantable device diagnostics and stroke risk: the TRENDS study. Circ Arrhythm Electrophysiol. 2009;2:474-80.

28. Ziegler PD, Glotzer TV, Daoud EG, et al. Incidence of newly detected atrial arrhythmias via implantable devices in patients with a history of thromboembolic events. Stroke. 2010;41:256-60.

29. Ziegler PD, Glotzer TV, Daoud EG, et al. Detection of previously undiagnosed atrial fibrillation in patients with stroke risk factors and usefulness of continuous monitoring in primary stroke prevention. Am J Cardiol. 2012;110:1309-14.

30. Risk factors for stroke and efficacy of antithrombotic therapy in atrial fibrillation. Analysis of pooled data from five randomized controlled trials. Arch Intern Med. 1994;154:1449-57.

31. Gage BF, Waterman AD, Shannon W, et al. Validation of clinical classification schemes for predicting stroke: results from the National Registry of Atrial Fibrillation. JAMA. 2001;285:2864-70.

32. Camm AJ, Lip GY, De CR, et al. 2012 Focused update of the ESC Guidelines for the management of atrial fibrillation: an update of the 2010 ESC Guidelines for the management of atrial fibrillation*. Developed with the special contribution of the European Heart Rhythm Association. Eur Heart J. 2012;33:2719-47.

33. Lip GY, Tse HF, Lane DA. Atrial fibrillation. Lancet. 2012;379:648-61.

34. Lane DA, Lip GY. Use of the CHA(2)DS(2)-VASc and HAS-BLED scores to aid decision making for thromboprophylaxis in nonvalvular atrial fibrillation. Circulation. 2012;126:860-5.

35. Ahmad Y, Lip GY, Apostolakis S. New oral anticoagulants for stroke prevention in atrial fibrillation: impact of gender, heart failure, diabetes mellitus and paroxysmal atrial fibrillation. Expert Rev Cardiovasc Ther. 2012;10:1471-80.

36. Chiang CE, Naditch-Brule L, Murin J, et al. Distribution and risk profile of paroxysmal, persistent, and permanent atrial fibrillation in routine clinical practice: insight from the real-life global survey evaluating patients with atrial fibrillation international registry. Circ Arrhythm Electrophysiol. 2012;5:632-9.

37. Flaker G, Ezekowitz M, Yusuf S, et al. Efficacy and safety of dabigatran compared to warfarin in patients with paroxysmal, persistent, and permanent atrial fibrillation: results from the RE-LY (Randomized Evaluation of Long-Term Anticoagulation Therapy) study. J Am Coll Cardiol. 2012;59:854-5.

38. Hohnloser S.H, Duray G.Z, Baber U, et al. Prevention of stroke in patients with atrial fibrillation: current strategies and future directions. European heart journal. 2007;10:H4-10.

39. Lip GY, Nieuwlaat R, Pisters R, et al. Refining clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach: the Euro Heart Survey on Atrial Fibrillation. Chest. 2010;137:263-72.

40. Olesen JB, Torp-Pedersen C, Hansen ML, et al. The value of the CHA2DS2-VASc score for refining stroke risk stratification in patients with atrial fibrillation with a CHADS2 score 0-1: a nationwide cohort study. Thromb Haemost. 2012;107:1172-9.

41. Mason PK, Lake DE, DiMarco JP, et al. Impact of the CHA2DS2-VASc score on anticoagulation recommendations for atrial fibrillation. Am J Med. 2012;125:603-6.

42. Cannegieter SC, Rosendaal FR, Wintzen AR, et al. Optimal oral anticoagulant therapy in patients with mechanical heart valves. N Engl J Med. 1995;333:11-7.

43. Acar J, Iung B, Boissel JP, et al. AREVA: multicenter randomized comparison of low-dose versus standard-dose anticoagulation in patients with mechanical prosthetic heart valves. Circulation. 1996;94:2107-12.

44. Hering D, Piper C, Bergemann R, et al. Thromboembolic and bleeding complications following St. Jude Medical valve replacement: results of the German Experience With Low-Intensity Anticoagulation Study. Chest. 2005;127:53-9.

45. Connolly SJ, Ezekowitz MD, Yusuf S, et al. Dabigatran versus warfarin in patients with atrial fibrillation. N Engl J Med. 2009;361:1139-51.

46. Patel MR, Mahaffey KW, Garg J, et al. Rivaroxaban versus warfarin in nonvalvular atrial fibrillation. N Engl J Med. 2011;365:883-91.

47. Granger CB, Alexander JH, McMurray JJ, et al. Apixaban versus warfarin in patients with atrial fibrillation. N Engl J Med. 2011;365:981-92.

48. Matchar DB, Jacobson A, Dolor R, et al. Effect of home testing of international normalized ratio on clinical events. N Engl J Med. 2010;363:1608-20.

49. Ezekowitz MD, James KE, Radford MJ, et al. Initiating and maintaining patients on warfarin anticoagulation: the importance of monitoring. J Cardiovasc Pharmacol Ther. 1999;4:3-8.

50. Hirsh J, Fuster V. Guide to anticoagulant therapy. Part 2: oral anticoagulants. American Heart Association. Circulation. 1994;89:1469-80.

51. Farshi R, Kistner D, Sarma JS, et al. Ventricular rate control in chronic atrial fibrillation during daily activity and programmed exercise: a crossover open-label study of five drug regimens. J Am Coll Cardiol. 1999;33:304-10.

52. Steinberg JS, Katz RJ, Bren GB, et al. Efficacy of oral diltiazem to control ventricular response in chronic atrial fibrillation at rest and during exercise. J Am Coll Cardiol. 1987;9:405-11.

53. Olshansky B, Rosenfeld LE, Warner AL, et al. The Atrial Fibrillation Follow-up Investigation of Rhythm Management (AFFIRM) study: approaches to control rate in atrial fibrillation. J Am Coll Cardiol. 2004;43:1201-8.

54. Abrams J, Allen J, Allin D, et al. Efficacy and safety of esmolol vs propranolol in the treatment of supraventricular tachyarrhythmias: a multicenter double-blind clinical trial. Am Heart J. 1985;110:913-22.

55. Ellenbogen KA, Dias VC, Plumb VJ, et al. A placebo-controlled trial of continuous intravenous diltiazem infusion for 24-hour heart rate control during atrial fibrillation and atrial flutter: a multicenter study. J Am Coll Cardiol. 1991;18:891-7.

56. Siu CW, Lau CP, Lee WL, et al. Intravenous diltiazem is superior to intravenous amiodarone or digoxin for achieving ventricular rate control in patients with acute uncomplicated atrial fibrillation. Crit Care Med. 2009;37:2174-9.

57. Platia EV, Michelson EL, Porterfield JK, et al. Esmolol versus verapamil in the acute treatment of atrial fibrillation or atrial flutter. Am J Cardiol. 1989;63:925-9.

58. Maisel WH, Stevenson LW. Atrial fibrillation in heart failure: epidemiology, pathophysiology, and rationale for therapy. Am J Cardiol. 2003;91:2D-8D.

59. Tsang TS, Gersh BJ, Appleton CP, et al. Left ventricular diastolic dysfunction as a predictor of the first diagnosed nonvalvular atrial fibrillation in 840 elderly men and women. J Am Coll Cardiol. 2002;40:1636-44.

60. Cicardi M, Zingale LC, Bergamaschini L, et al. Angioedema associated with angiotensin-converting enzyme inhibitor use: outcome after switching to a different treatment. Arch Intern Med. 2004;164:910-3.

61. Makani H, Messerli FH, Romero J, et al. Meta-analysis of randomized trials of angioedema as an adverse event of renin-angiotensin system inhibitors. Am J Cardiol. 2012;110:383-91.

62. Toh S, Reichman ME, Houstoun M, et al. Comparative risk for angioedema associated with the use of drugs that target the renin-angiotensin-aldosterone system. Arch Intern Med. 2012;172:1582-9.

63. Warner KK, Visconti JA, Tschampel MM. Angiotensin II receptor blockers in patients with ACE inhibitor-induced angioedema. Ann Pharmacother. 2000;34:526-8.

64. Effect of enalapril on mortality and the development of heart failure in asymptomatic patients with reduced left ventricular ejection fractions. The SOLVD Investigators. N Engl J Med. 1992;327:685-91.

65. Cohn JN, Johnson G, Ziesche S, et al. A comparison of enalapril with hydralazine-isosorbide dinitrate in the treatment of chronic congestive heart failure. N Engl J Med. 1991;325:303-10.

66. Effect of enalapril on survival in patients with reduced left ventricular ejection fractions and congestive heart failure. The SOLVD Investigators. N Engl J Med. 1991;325:293-302.

67. Garg R, Yusuf S. Overview of randomized trials of angiotensin-converting enzyme inhibitors on mortality and morbidity in patients with heart failure. Collaborative Group on ACE Inhibitor Trials. JAMA. 1995;273:1450-6.

68. Pfeffer MA, McMurray JJ, Velazquez EJ, et al. Valsartan, captopril, or both in myocardial infarction complicated by heart failure, left ventricular dysfunction, or both. N Engl J Med. 2003;349:1893-906.

69. Effects of enalapril on mortality in severe congestive heart failure. Results of the Cooperative North Scandinavian Enalapril Survival Study (CONSENSUS). The CONSENSUS Trial Study Group. N Engl J Med. 1987;316:1429-35.

70. Verdecchia P, Sleight P, Mancia G, et al. Effects of telmisartan, ramipril, and their combination on left ventricular hypertrophy in individuals at high vascular risk in the Ongoing Telmisartan Alone and in Combination With Ramipril Global End Point Trial and the Telmisartan Randomized Assessment Study in ACE Intolerant Subjects With Cardiovascular Disease. Circulation. 2009;120:1380-9.

71. Cohn JN, Tognoni G. A randomized trial of the angiotensin-receptor blocker valsartan in chronic heart failure. N Engl J Med. 2001;345:1667-75.

72. Maggioni AP, Anand I, Gottlieb SO, et al. Effects of valsartan on morbidity and mortality in patients with heart failure not receiving angiotensin-converting enzyme inhibitors. J Am Coll Cardiol. 2002;40:1414-21.

73. Granger CB, McMurray JJ, Yusuf S, et al. Effects of candesartan in patients with chronic heart failure and reduced left-ventricular systolic function intolerant to angiotensin-converting-enzyme inhibitors: the CHARM-Alternative trial. Lancet. 2003;362:772-6.

74. Crozier I, Ikram H, Awan N, et al. Losartan in heart failure. Hemodynamic effects and tolerability. Losartan Hemodynamic Study Group. Circulation. 1995;91:691-7.

75. Gottlieb SS, Dickstein K, Fleck E, et al. Hemodynamic and neurohormonal effects of the angiotensin II antagonist losartan in patients with congestive heart failure. Circulation. 1993;88:1602-9.

76. Mazayev VP, Fomina IG, Kazakov EN, et al. Valsartan in heart failure patients previously untreated with an ACE inhibitor. Int J Cardiol. 1998;65:239-46.

77. McKelvie RS, Yusuf S, Pericak D, et al. Comparison of candesartan, enalapril, and their combination in congestive heart failure: randomized evaluation of strategies for left ventricular dysfunction (RESOLVD) pilot study. The RESOLVD Pilot Study Investigators. Circulation. 1999;100:1056-64.

78. Riegger GA, Bouzo H, Petr P, et al. Improvement in exercise tolerance and symptoms of congestive heart failure during treatment with candesartan cilexetil. Symptom, Tolerability, Response to Exercise Trial of Candesartan Cilexetil in Heart Failure (STRETCH) Investigators. Circulation. 1999;100:2224-30.

79. Sharma D, Buyse M, Pitt B, et al. Meta-analysis of observed mortality data from all-controlled, double-blind, multiple-dose studies of losartan in heart failure. Losartan Heart Failure Mortality Meta-analysis Study Group. Am J Cardiol. 2000;85:187-92.

80. Pfeffer MA, Swedberg K, Granger CB, et al. Effects of candesartan on mortality and morbidity in patients with chronic heart failure: the CHARM-Overall programme. Lancet. 2003;362:759-66.

81. Velazquez EJ, Pfeffer MA, McMurray JV, et al. VALsartan In Acute myocardial iNfarcTion (VALIANT) trial: baseline characteristics in context. Eur J Heart Fail. 2003;5:537-44.

82. Connolly SJ, Camm AJ, Halperin JL, et al. Dronedarone in high-risk permanent atrial fibrillation. N Engl J Med. 2011;365:2268-76.

83. Echt DS, Liebson PR, Mitchell LB, et al. Mortality and morbidity in patients receiving encainide, flecainide, or placebo. The Cardiac Arrhythmia Suppression Trial. N Engl J Med. 1991;324:781-8.

84. Freemantle N, Lafuente-Lafuente C, Mitchell S, et al. Mixed treatment comparison of dronedarone, amiodarone, sotalol, flecainide, and propafenone, for the management of atrial fibrillation. Europace. 2011;13:329-45.

85. Kober L, Torp-Pedersen C, McMurray JJ, et al. Increased mortality after dronedarone therapy for severe heart failure. N Engl J Med. 2008;358:2678-87.

86. Singh BN, Singh SN, Reda DJ, et al. Amiodarone versus sotalol for atrial fibrillation. N Engl J Med. 2005;352:1861-72.

87. Lafuente-Lafuente C, Mouly S, Longas-Tejero MA, et al. Antiarrhythmics for maintaining sinus rhythm after cardioversion of atrial fibrillation. Cochrane Database Syst Rev. 2007;CD005049.

88. Channer KS, Birchall A, Steeds RP, et al. A randomized placebo-controlled trial of pre-treatment and short- or long-term maintenance therapy with amiodarone supporting DC cardioversion for persistent atrial fibrillation. Eur Heart J. 2004;25:144-50.

89. Galperin J, Elizari MV, Chiale PA, et al. Efficacy of amiodarone for the termination of chronic atrial fibrillation and maintenance of normal sinus rhythm: a prospective, multicenter, randomized, controlled, double blind trial. J Cardiovasc Pharmacol Ther. 2001;6:341-50.

90. Pedersen OD, Bagger H, Keller N, et al. Efficacy of dofetilide in the treatment of atrial fibrillation-flutter in patients with reduced left ventricular function: a Danish Investigations of Arrhythmia and Mortality on Dofetilide (DIAMOND) Substudy. Circulation. 2001;104:292-6.

91. Singh S, Zoble RG, Yellen L, et al. Efficacy and safety of oral dofetilide in converting to and maintaining sinus rhythm in patients with chronic atrial fibrillation or atrial flutter: the symptomatic atrial fibrillation investigative research on dofetilide (SAFIRE-D) study. Circulation. 2000;102:2385-90.

92. Hohnloser SH, Crijns HJ, van Eickels M., et al. Effect of dronedarone on cardiovascular events in atrial fibrillation. N Engl J Med. 2009;360:668-78.

93. Singh BN, Connolly SJ, Crijns HJ, et al. Dronedarone for maintenance of sinus rhythm in atrial fibrillation or flutter. N Engl J Med. 2007;357:987-99.

94. Touboul P, Brugada J, Capucci A, et al. Dronedarone for prevention of atrial fibrillation: a dose-ranging study. Eur Heart J. 2003;24:1481-7.

95. Van Gelder IC, Crijns HJ, Van Gilst WH, et al. Efficacy and safety of flecainide acetate in the maintenance of sinus rhythm after electrical cardioversion of chronic atrial fibrillation or atrial flutter. Am J Cardiol. 1989;64:1317-21.

96. Roy D, Talajic M, Dorian P, et al. Amiodarone to prevent recurrence of atrial fibrillation. Canadian Trial of Atrial Fibrillation Investigators. N Engl J Med. 2000;342:913-20.

97. Bellandi F, Simonetti I, Leoncini M, et al. Long-term efficacy and safety of propafenone and sotalol for the maintenance of sinus rhythm after conversion of recurrent symptomatic atrial fibrillation. Am J Cardiol. 2001;88:640-5.

98. Dogan A, Ergene O, Nazli C, et al. Efficacy of propafenone for maintaining sinus rhythm in patients with recent onset or persistent atrial fibrillation after conversion: a randomized, placebo-controlled study. Acta Cardiol. 2004;59:255-61.

99. Pritchett EL, Page RL, Carlson M, et al. Efficacy and safety of sustained-release propafenone (propafenone SR) for patients with atrial fibrillation. Am J Cardiol. 2003;92:941-6.

100. Benditt DG, Williams JH, Jin J, et al. Maintenance of sinus rhythm with oral d,l-sotalol therapy in patients with symptomatic atrial fibrillation and/or atrial flutter. d,l-Sotalol Atrial Fibrillation/Flutter Study Group. Am J Cardiol. 1999;84:270-7.

101. Shah D. ECG manifestations of left atrial flutter. Curr Opin Cardiol. 2009;24:35-41.

102. Li D, Fareh S, Leung TK, et al. Promotion of atrial fibrillation by heart failure in dogs: atrial remodeling of a different sort. Circulation. 1999;100:87-95.

103. Akoum N, McGann C, Vergara G, et al. Atrial fibrosis quantified using late gadolinium enhancement MRI is associated with sinus node dysfunction requiring pacemaker implant. J Cardiovasc Electrophysiol. 2012;23:44-50.

104. Van de Werf F, Brueckmann M, Connolly SJ, et al. A comparison of dabigatran etexilate with warfarin in patients with mechanical heart valves: The Randomized, phase II study to Evaluate

the sAfety and pharmacokinetics of oraL dabIGatran etexilate in patients after heart valve replacemeNt (RE-ALIGN). Am Heart J. 2012;163:931-7.

105. US Food and Drug Administration. AtriCure Synergy Ablation System - P100046: Available at: http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/DeviceApprovalsandClearances/Recently-ApprovedDevices/ucm284063.htm. Accessed May 8, 2014.

106. Eikelboom JW, Connolly SJ, Brueckmann M, et al. Dabigatran versus warfarin in patients with mechanical heart valves. N Engl J Med. 2013;369:1206-14.

107. Connolly SJ, Eikelboom J, Joyner C, et al. Apixaban in patients with atrial fibrillation. N Engl J Med. 2011;364:806-17.

108. Hariharan S, Madabushi R. Clinical pharmacology basis of deriving dosing recommendations for dabigatran in patients with severe renal impairment. J Clin Pharmacol. 2012;52:119S-25S.

109. Lehr T, Haertter S, Liesenfeld KH, et al. Dabigatran etexilate in atrial fibrillation patients with severe renal impairment: dose identification using pharmacokinetic modeling and simulation. J Clin Pharmacol. 2012;52:1373-8.

110. Hansen ML, Sorensen R, Clausen MT, et al. Risk of bleeding with single, dual, or triple therapy with warfarin, aspirin, and clopidogrel in patients with atrial fibrillation. Arch Intern Med. 2010;170:1433-41.

111. Karjalainen PP, Porela P, Ylitalo A, et al. Safety and efficacy of combined antiplatelet-warfarin therapy after coronary stenting. Eur Heart J. 2007;28:726-32.

112. Orford JL, Fasseas P, Melby S, et al. Safety and efficacy of aspirin, clopidogrel, and warfarin after coronary stent placement in patients with an indication for anticoagulation. Am Heart J. 2004;147:463-7.

113. Doyle BJ, Rihal CS, Gastineau DA, et al. Bleeding, blood transfusion, and increased mortality after percutaneous coronary intervention: implications for contemporary practice. J Am Coll Cardiol. 2009;53:2019-27.

114. Winkelmayer WC, Liu J, Setoguchi S, et al. Effectiveness and safety of warfarin initiation in older hemodialysis patients with incident atrial fibrillation. Clin J Am Soc Nephrol. 2011;6:2662-8.