

AHA/ACC/HHS Strategies to Enhance Application of Clinical Practice Guidelines in Patients With Cardiovascular Disease and Comorbid Conditions: From the American Heart Association, American College of Cardiology, and US Department of Health and Human Services

Donna K. Arnett, Richard A. Goodman, Jonathan L. Halperin, Jeffrey L. Anderson, Anand K. Parekh and William A. Zoghbi

Circulation. 2014;130:1662-1667; originally published online September 11, 2014;
doi: 10.1161/CIR.000000000000128

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2014 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the
World Wide Web at:

<http://circ.ahajournals.org/content/130/18/1662>

Data Supplement (unedited) at:

<http://circ.ahajournals.org/content/suppl/2014/09/11/CIR.000000000000128.DC1.html>

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Circulation* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the [Permissions and Rights Question and Answer](#) document.

Reprints: Information about reprints can be found online at:
<http://www.lww.com/reprints>

Subscriptions: Information about subscribing to *Circulation* is online at:
<http://circ.ahajournals.org/subscriptions/>

AHA/ACC/HHS Strategies to Enhance Application of Clinical Practice Guidelines in Patients With Cardiovascular Disease and Comorbid Conditions

From the American Heart Association, American College of Cardiology, and US Department of Health and Human Services

Donna K. Arnett, MSPH, PhD; Richard A. Goodman, MD, MPH*; Jonathan L. Halperin, MD; Jeffrey L. Anderson, MD; Anand K. Parekh, MD, MPH; William A. Zoghbi, MD

Background

Cardiovascular disease, the leading cause of death in the United States and worldwide, accounts for substantial suffering and healthcare-related expenditures.¹⁻³ For more than 30 years, the American Heart Association (AHA) and the American College of Cardiology (ACC) have partnered with other organizations to translate the best available scientific evidence into clinical practice guidelines (CPGs) for cardiovascular conditions. These efforts reflect a shared vision and responsibility for using scientific evidence and the expert clinical opinion of leaders in the field to develop recommendations for healthcare providers. These CPGs, based on systematic methods to evaluate and classify evidence, have provided the cornerstones for delivering quality cardiovascular care.

CPGs are essential tools for optimizing care for patients with cardiovascular conditions. Enhancing the utility of CPGs requires that the development process reflect the evolution of relevant foundational domains, such as biomedical discoveries, public policy, clinical care systems, and epidemiological knowledge. Dynamic changes in these domains pose substantial implications for organizations that develop CPGs. Among these changes is the increasing prevalence of ≥ 2 chronic conditions among individual Americans, estimated to be present in more than one quarter of adults.⁴ In the large population of Medicare beneficiaries, the prevalence of persons with multiple chronic conditions is considerably greater: more than two

thirds (68%) have ≥ 2 chronic conditions, and 14% have ≥ 6 chronic conditions.^{5,6}

Comorbidities and CPGs for Cardiovascular Conditions

CPGs jointly developed by the AHA/ACC are cardiovascular disease-specific documents focused on the prevention, diagnosis, and management of conditions such as ischemic heart disease, heart failure, and atrial fibrillation. These CPGs often contain considerations for special factors (eg, older adults) and common problems affecting pharmacokinetics (eg, renal impairment). For example, the 2014 CPG on atrial fibrillation⁷ highlights special considerations for acute myocardial infarction, pregnancy, hyperthyroidism, and other conditions. With the exception of the CPGs on atrial fibrillation and heart failure,^{7,8} CPGs have not systematically incorporated recommendations on how common comorbidities that accompany a specific cardiovascular condition might affect the care and management of patients with comorbidities.

With progressive growth in the size of the older adult population and the increased prevalence of comorbidities in patients with cardiovascular conditions, CPGs need to address the complex implications of comorbidity for the care of cardiovascular patients. This issue is particularly important for some older adults, because clinicians must select from among treatments on the basis of evidence for risk and benefit.⁹

*The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the US Centers for Disease Control and Prevention

This document was approved by the American Heart Association Science Advisory and Coordinating Committee, the American College of Cardiology Board of Trustees, and the US Department of Health and Human Services in July 2014.

The online-only Comprehensive RWI Data Supplement table is available with this article at <http://circ.ahajournals.org/lookup/suppl/doi:10.1161/CIR.000000000000128/-/DC1>.

The American Heart Association requests that this document be cited as follows: Arnett DK, Goodman RA, Halperin JL, Anderson JL, Parekh AK, Zoghbi WA. AHA/ACC/HHS strategies to enhance application of clinical practice guidelines in patients with cardiovascular disease and comorbid conditions: from the American Heart Association, American College of Cardiology, and US Department of Health and Human Services. *Circulation*. 2014;130:1662-1667.

This article has been copublished in the *Journal of the American College of Cardiology*

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 (my.americanheart.org). A copy of the document is available at <http://my.americanheart.org/statements> by selecting either the "By Topic" link or the "By Publication Date" link. To purchase additional reprints, call 843-216-2533 or e-mail kelle.ramsay@wolterskluwer.com.

Expert peer review of AHA Scientific Statements is conducted by the AHA Office of Science Operations. For more on AHA statements and guidelines development, visit <http://my.americanheart.org/statements> and select the "Policies and Development" link.

Permissions: Multiple copies, modification, alteration, enhancement, and/or distribution of this document are not permitted without the express permission of the American Heart Association. Instructions for obtaining permission are located at http://www.heart.org/HEARTORG/General/Copyright-Permission-Guidelines_UCM_300404_Article.jsp. A link to the "Copyright Permissions Request Form" appears on the right side of the page.

(*Circulation*. 2014;130:1662-1667.)

© 2014 by the American Heart Association, Inc., and the American College of Cardiology Foundation.

Circulation is available at <http://circ.ahajournals.org>

DOI: 10.1161/CIR.000000000000128

Table 1. The 10 Most Common Comorbidities for 4 Index Cardiovascular Conditions: 2012 Data for Medicare Beneficiaries ≥65 Years of Age¹³

Comorbidity	Ischemic Heart Disease* (N=8 678 060)	HF* (N=4 366 489)	AF* (N=2 556 839)	Stroke* (N=1 145 719)
Hypertension	1 (81.3)	1 (85.6)	1 (84.5)	1 (89.0)
Hyperlipidemia	2 (69.1)	3 (62.6)	2 (64.4)	2 (69.9)
Diabetes mellitus	3 (41.7)	5 (47.1)	7 (37.1)	6 (41.5)
Arthritis	4 (40.6)	6 (45.6)	6 (41.7)	5 (44.2)
Anemia	5 (38.7)	4 (51.2)	5 (43.0)	4 (46.8)
HF	6 (36.3)	Index	4 (50.9)	7 (37.2)
Ischemic heart disease	Index	2 (72.1)	3 (63.5)	3 (58.1)
Chronic kidney disease	7 (30.2)	7 (44.8)	8 (34.4)	8 (35.2)
Cataract	8 (21.6)	†	10 (22.6)	†
COPD	9 (21.0)	8 (30.9)	9 (23.8)	†
AF	10 (18.7)	9 (28.8)	Index	†
Alzheimer's disease/dementia	†	10 (26.3)	†	9 (33.8)
Depression	†	†	†	10 (29.7)
Stroke	†	†	†	Index

*Data shown as rank and percentage of persons with index condition who also had a comorbidity. The percentage is included parenthetically when applicable.

†Comorbidity was not in the top 10 for this index condition.¹³

AF indicates atrial fibrillation; COPD, chronic obstructive pulmonary disease; and HF, heart failure.

Recognizing this imperative, the AHA/ACC have taken steps to address comorbidities more consistently in CPGs, including actions resulting from the US Department of Health and Human Services initiative on multiple chronic conditions.¹⁰ The centerpiece of this initiative—a strategic framework on multiple chronic conditions—explicitly focuses on the need for developers of CPGs to address chronic conditions.¹¹ Accordingly, the Department of Health and Human Services and the Institute of Medicine convened a stakeholder meeting that included the AHA/ACC to identify core principles for CPGs in the effective management of people with multiple chronic conditions and related actions that might be taken by developers of CPGs.¹² At the request of the AHA/ACC, the Centers for Medicare & Medicaid Services (CMS) provided the data for analysis of the most common comorbidities in Medicare beneficiaries with selected cardiovascular conditions for potential use in development of CPGs.

Prevalence of Comorbidities Among Patients Presenting With Index Cardiovascular Conditions

To assess the frequency of comorbidities, the 10 most common comorbid conditions among Medicare beneficiaries were identified using CMS administrative enrollment and claims data¹³ for 4 index cardiovascular conditions: ischemic heart disease, heart failure, atrial fibrillation, and stroke. The Medicare population was limited to beneficiaries ≥65 years of age who were continuously enrolled in Medicare fee-for-service (both Parts A and B) during 2012. Beneficiaries enrolled in Medicare Advantage during 2012 were excluded because claims data

were unavailable for these beneficiaries. Beneficiaries who died during the year were included up to the date of death.

For each of the 4 index cardiovascular conditions, comorbidity was determined with the following conditions: acquired hypothyroidism, acute myocardial infarction, Alzheimer's disease or dementia, anemia, arthritis (osteoarthritis and rheumatoid arthritis), asthma, atrial fibrillation, autism spectrum disorder, benign prostatic hyperplasia, breast cancer (female and male), cataract, chronic kidney disease, colon cancer, chronic obstructive pulmonary disease, depression, diabetes mellitus, endometrial cancer, glaucoma, heart failure, hip or pelvic fracture, hyperlipidemia, hypertension, ischemic heart disease, lung cancer, osteoporosis, prostate cancer, schizophrenia and other psychotic disorders, or stroke. A Medicare beneficiary was considered to have a chronic condition if the CMS administrative data included a claim indicating that the beneficiary received service or treatment for the specific condition. Detailed information on the identification of chronic conditions is available from the CMS Chronic Conditions Data Warehouse.¹³

Table 1 shows the 10 most common comorbidities for each index cardiovascular condition for beneficiaries ≥65 years of age in 2012.¹³ The numbers of Medicare beneficiaries with the 4 index cardiovascular conditions were 8 678 060 with ischemic heart disease, 4 366 489 with heart failure, 2 556 839 with atrial fibrillation, and 1 145 719 with stroke. Two conditions that are major cardiovascular risk factors—hypertension and hyperlipidemia—constitute the most frequent dyad. Hypertension, hyperlipidemia, and ischemic heart disease were the 3 most prevalent comorbidities for patients with heart failure, atrial fibrillation, and stroke,

Table 2. The 5 Most Prevalent Comorbidities for 2012 Medicare Beneficiaries ≥ 65 Years of Age With at Least 2 (Dyads) or 3 (Triads) Chronic Conditions¹⁴

Comorbidities	Prevalence (%)
<i>Dyads</i> (beneficiaries with ≥ 2 comorbidities; N=19 139 696)	
High cholesterol and high BP	57.2
High BP and ischemic heart disease	36.8
High BP and arthritis	33.3
High BP and diabetes mellitus	32.7
High cholesterol and ischemic heart disease	31.3
<i>Triads</i> (beneficiaries with ≥ 3 comorbidities; N=14 908 988)	
High cholesterol, high BP, and ischemic heart disease	35.8
High cholesterol, high BP, and diabetes mellitus	31.7
High cholesterol, high BP, and arthritis	28.8
High BP, diabetes mellitus, and ischemic heart disease	21.5
High BP, arthritis, and ischemic heart disease	20.6

BP indicates blood pressure.

Reproduced with permission from the Centers for Medicare & Medicaid Services.¹⁴

whereas hypertension, hyperlipidemia, and diabetes mellitus were the most prevalent comorbidities in those with ischemic heart disease; however, arthritis, anemia, chronic obstructive pulmonary disease, and Alzheimer's disease also appeared.

Table 2 lists the top 5 most prevalent dyad and triad comorbidities for beneficiaries ≥ 65 years of age with at least 2 (for dyads) or 3 (for triads) chronic conditions. Combinations of high cholesterol, high blood pressure, and ischemic heart disease were most frequently represented in the dyads and triads, with diabetes mellitus and arthritis completing the remaining prevalent combinations.¹⁴

Implications and Future Directions In the Development of CPGs

Two general, but important, points emerge from the CMS data. First, a beneficiary with cardiovascular disease but without at least 1 comorbid chronic condition is the exception rather than the rule. Second, whereas common risk factors such as hypertension and hyperlipidemia are associated with the index cardiovascular conditions, the index conditions are associated with a constellation of comorbidities, the pathophysiology of which may be distinct from the index condition and for which prevalence increases with age or other factors.

Organizations that develop CPGs must now consider comorbidities during the development process for disease-specific CPGs. For high-prevalence index conditions, few CPGs address comorbidities,¹⁵ and even fewer provide guidance for patients with specific combinations of diseases. Managing patients with multiple conditions is more complex than managing patients with a single disease, and the presence of multiple conditions increases challenges for health-care providers and patients. Comorbidities may constitute barriers to adherence to CPGs, and caring for patients with multiple comorbidities can affect patient safety if recommendations for diagnosis and treatment in one CPG conflict with those for another condition.¹⁶ The complexity of various regimens for multiple comorbidities adds to the difficulty in

patient management and assessment of clinical outcomes.¹⁷ Furthermore, limited attention has been given to the physical, cognitive, social, psychological, and financial implications of managing comorbidities. Involving patients in the CPG development process, which the AHA/ACC recently initiated, is critically important to fully appreciate patient perspectives.^{18,19}

Currently, there are important challenges in addressing common comorbidities in the development and implementation of CPGs. Patients with comorbidities are often excluded from clinical trials, limiting the evidence with which to make generalizable recommendations.^{20–22} This concern is explicitly addressed in the Department of Health and Human Services strategic framework, which emphasizes the need for external validation of clinical and drug approval trials by ensuring that persons with multiple comorbid conditions are not excluded unnecessarily.¹¹ In support of this objective, the US Food and Drug Administration now instructs that a regular part of its assessment of clinical trials incorporate a closer examination of the populations to be included in such trials and presumes that drug developers include patients with multiple comorbid conditions.²³ The increasing use of electronic health records and clinical registries would also allow a longitudinal evaluation of the management strategies and clinical outcomes of patients with cardiovascular disease and comorbidities, which often is not afforded by randomized clinical trials. Other challenges to addressing comorbidities in CPGs are the number of comorbidities to be considered and those that may be underreported, such as obesity, depression, significant cognitive impairment, and frailty, several of which become increasingly common with age and affect patient management and outcome. Thus, given the current lack of trial evidence and the complexity of treating patients with common cardiovascular comorbidities, CPGs may, in certain instances, need to be more nuanced to account for clinical judgement and acknowledge the role of individualized, patient-centered decision making in implementation.

In the future, the AHA/ACC CPGs will explicitly discuss the applicability and quality of recommendations for the most frequent combinations of comorbidities that accompany cardiovascular conditions. An important step in this direction is the collaboration between the AHA/ACC and the Department of Health and Human Services that includes development of comorbidity data for selected cardiovascular conditions that, in turn, can be included and addressed in CPGs such as the most recent guidelines on atrial fibrillation and heart failure.^{7,8} The AHA/ACC aim to partner with various organizations to determine how best to highlight and address the complex issues arising from comorbidities in clinical medicine.

References

- Go AS, Mozaffarian D, Roger VL, et al. Heart disease and stroke statistics—2014 update: a report from the American Heart Association. *Circulation*. 2014;129:e28–292.
- Hoyert DL, Xu JQ. Deaths: preliminary data for 2011. *National Vital Statistics Reports*. Centers for Disease Control and Prevention. 2011. Available at: http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_06.pdf. Accessed July 9, 2013.
- Mensah GA, Brown DW. An overview of cardiovascular disease burden in the United States. *Health Aff (Millwood)*. 2007;26:38–48.
- Ward BW, Schiller JS. Prevalence of multiple chronic conditions among US adults: estimates from the National Health Interview Survey, 2010. *Prev Chronic Dis*. 2013;10:E65.

5. Centers for Medicare and Medicaid Services. Chronic Conditions among Medicare Beneficiaries. Chartbook, 2012 ed. 2012. Available at: <http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions/Downloads/2012Chartbook.pdf>. Accessed March 5, 2014.
6. Lochner KA, Cox CS. Prevalence of multiple chronic conditions among Medicare beneficiaries, United States, 2010. *Prev Chronic Dis*. 2013;10:E61.
7. 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. Developed in collaboration with the Society of Thoracic Surgeons [published online ahead of print March 28, 2014]. *Circulation*. doi: 10.1161/CIR.0000000000000041.
8. 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. Developed in collaboration with the American College of Chest Physicians, Heart Rhythm Society, and International Society for Heart and Lung Transplantation. *Circulation*. 2013;128:e240–327.
9. Uhlig K, Leff B, Kent D, et al. A framework for crafting clinical practice guidelines that are relevant to the care and management of people with multi-morbidity. *J Gen Intern Med*. 2014;29:670–9.
10. US Department of Health and Human Services. HHS Initiative on Multiple Chronic Conditions. 2014. Available at: <http://www.hhs.gov/ash/initiatives/mcc/>. Accessed March 5, 2014.
11. US Department of Health and Human Services. Multiple Chronic Conditions—A Strategic Framework: Optimum Health and Quality of Life for Individuals with Multiple Chronic Conditions. 2010. Available at: http://www.hhs.gov/ash/initiatives/mcc/mcc_framework.pdf. Accessed March 5, 2014.
12. Goodman RA, Boyd C, Tinetti ME, et al. IOM and DHHS meeting on making clinical practice guidelines appropriate for patients with multiple chronic conditions. *Ann Fam Med*. 2014;12:256–9.
13. Chronic Conditions Data Warehouse. Unpublished data from the Office of Information Products and Data Analytics, Centers for Medicare and Medicaid Services. 2014. Available at: <http://www.ccwdata.org>. Accessed January 1, 2014.
14. Centers for Medicare & Medicaid Services. Chronic conditions overview. 2014. Available at: <http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions/index.html>. Accessed May 9, 2014.
15. Lugtenberg M, Burgers JS, Clancy C, et al. Current guidelines have limited applicability to patients with comorbid conditions: a systematic analysis of evidence-based guidelines. *PLoS One*. 2011;6:e25987.
16. Boyd CM, Darer J, Boulton C, et al. Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: implications for pay for performance. *JAMA*. 2005;294:716–24.
17. Piette JD, Kerr EA. The impact of comorbid chronic conditions on diabetes care. *Diabetes Care*. 2006;29:725–31.
18. Montori VM, Brito JP, Murad MH. The optimal practice of evidence-based medicine: incorporating patient preferences in practice guidelines. *JAMA*. 2013;310:2503–4.
19. Bayliss EA, Bonds DE, Boyd CM, et al. Understanding the context of health for persons with multiple chronic conditions: moving from what is the matter to what matters. *Ann Fam Med*. 2014;12:260–9.
20. Jadad AR, To MJ, Emara M, et al. Consideration of multiple chronic diseases in randomized controlled trials. *JAMA*. 2011;306:2670–2.
21. Boyd CM, Vollenweider D, Puhon MA. Informing evidence-based decision-making for patients with comorbidity: availability of necessary information in clinical trials for chronic diseases. *PLoS One*. 2012;7:e41601.
22. US Food and Drug Administration. Digital Infuzion, Inc. US Food and Drug Administration (FDA) inventory of clinical trials protocols and clinical study data. 2011. Available at: <http://www.fda.gov/downloads/Drugs/DevelopmentApprovalProcess/ConductingClinicalTrials/UCM309552.pdf>. Accessed April 9, 2014.
23. US Food and Drug Association. Development & approval process (drugs). 2014. Available at: <http://www.fda.gov/Drugs/DevelopmentApprovalProcess/ConductingClinicalTrials/ucm379576.htm>. Accessed February 17, 2014.

KEY WORDS: AHA Scientific Statements ■ epidemiology ■ health care ■ methodology ■ comorbidity ■ multiple chronic conditions

Author Relationships With Industry and Other Entities (Relevant)*—AHA/ACC/HHS Strategies to Enhance Application of Clinical Practice Guidelines in Patients With Cardiovascular Disease and Comorbid Conditions (March 2014)

Committee Member	Employment	Consultant	Speaker's Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness
Donna K. Arnett (Past President, AHA)	University of Alabama School of Public Health, Department of Epidemiology—Professor and Chair	None	None	None	None	None	None
Richard A. Goodman (HHS)	US Department of Health and Human Services, Office of the Assistant Secretary for Health, and the National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention—Senior Medical Advisor	None	None	None	None	None	None
Jonathan L. Halperin (ACC/AHA Task Force on Practice Guidelines)	The Cardiovascular Institute, Mount Sinai Medical Center, Division of Cardiology—Professor of Medicine	None	None	None	None	None	None
Jeffrey L. Anderson (ACC/AHA Task Force on Practice Guidelines)	Intermountain Heart Institute, Intermountain Healthcare—Associate Chief of Cardiology	None	None	None	None	None	None
Anand K. Parekh (HHS)	US Department of Health and Human Services—Deputy Assistant Secretary for Health (Science and Medicine)	None	None	None	None	None	None
William A. Zoghbi (Past President, ACC)	Houston Methodist DeBakey Heart and Vascular Center—William L. Winters Chair of Cardiovascular Imaging; Houston Methodist Hospital—Director, Cardiovascular Imaging	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 $\geq 5\%$ of the voting stock or share of the business entity, or ownership of $\geq \$10\,000$ 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. Please refer to <http://www.cardiosource.org/Science-And-Quality/Practice-Guidelines-and-Quality-Standards/Relationships-With-Industry-Policy.aspx> for definitions of disclosure categories or additional information about the ACC Disclosure Policy for Writing Committees.

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*.

*For transparency, the authors' comprehensive disclosure information is available as an online supplement (<http://circ.ahajournals.org/lookup/suppl/doi:10.1161/CIR.000000000000128/-/DC1>).

ACC indicates American College of Cardiology; AHA, American Heart Association; and HHS, US Department of Health and Human Services.

Reviewer Relationships With Industry and Other Entities (Relevant)—AHA/ACC/HHS Strategies to Enhance Application of Clinical Practice Guidelines in Patients With Cardiovascular Disease and Comorbid Conditions (March 2014)

Reviewer	Representation	Employment	Consultant	Speaker's Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness
Karen P. Alexander	Official Reviewer—AHA	Duke University, Duke Clinical Research Institute—Associate Professor	None	None	None	None	None	None
Deborah A. Chyun	Official Reviewer—AHA	New York University College of Nursing—Professor and Executive Associate Dean	None	None	None	None	None	None
Robert A. Harrington	Official Reviewer—ACC Board of Trustees	Stanford University—Professor and Chair, Department of Medicine	None	None	None	None	None	None
Geetha Raghuvver	Official Reviewer—ACC Board of Governors	Children's Mercy Hospital—Cardiologist; University of Missouri Kansas City—Associate Professor of Pediatrics	None	None	None	None	None	None
Shannon Dunlay	Content Reviewer—AHA	Mayo Clinic—Cardiologist and Assistant Professor of Medicine	None	None	None	None	None	None
Samuel S. Gidding	Content Reviewer—ACC/AHA Task Force on Practice Guidelines	Nemours/Alfred I. duPont Hospital for Children—Chief, Division of Pediatric Cardiology	None	None	None	None	None	None
Michael Mansour	Content Reviewer—ACC Board of Governors	University of Mississippi Medical School; Delta Regional Medical Center, Cardiac Catheterization Laboratory—Director; Cardiovascular Physicians	None	None	None	None	None	None
Michael W. Rich	Content Reviewer—AHA	Washington University of Medicine—Professor of Medicine	None	None	None	None	None	None
Win-Kuang Shen	Content Reviewer—ACC/AHA Task Force on Practice Guidelines	Mayo Clinic Arizona, Phoenix Campus—Professor of Medicine	None	None	None	None	None	None

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 $\geq 5\%$ of the voting stock or share of the business entity, or ownership of $\geq \$10\,000$ 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. Names are listed in alphabetical order within each category of review.

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*.

ACC indicates American College of Cardiology; AHA, American Heart Association; and HHS, US Department of Health and Human Services.

Author Relationships With Industry and Other Entities (Comprehensive)—ACC/AHA/HHS Strategies to Enhance Application of Clinical Practice Guidelines in Patients With Cardiovascular Disease and Comorbid Conditions (March 2014)

Committee Member	Employment	Consultant	Speaker's Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness
Donna K. Arnett (Past President, AHA)	University of Alabama School of Public Health, Department of Epidemiology—Professor and Chair	None	None	None	None	None	None
Jeffrey L. Anderson (ACC/AHA Task Force on Practice Guidelines)	Intermountain Heart Institute, Intermountain Healthcare—Associate Chief of Cardiology	<ul style="list-style-type: none"> • The Medicines Company • Sanofi-aventis 	None	None	<ul style="list-style-type: none"> • Academic Research Group (DSMB) • Harvard (DSMB) • ICON Clinical Research (DSMB) • NIH† 	• NIH†	None
Richard A. Goodman (HHS)	U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, and the National Center for Chronic Disease Prevention and Health Promotion, Center for Disease Control and Prevention	None	None	None	None	None	None
Jonathan L. Halperin (ACC/AHA Task Force on Practice Guidelines)	The Cardiovascular Institute, Mount Sinai Medical Center, Division of Cardiology—Professor of Medicine	<ul style="list-style-type: none"> • AstraZeneca • Bayer • Biotronik* • Boehringer Ingelheim* • Boston Scientific • Bristol-Myers Squibb • Daiichi-Sankyo • Janssen Pharmaceuticals • Johnson & Johnson • Medtronic • Pfizer • Sanofi-aventis 	None	None	None	None	None

Anand K. Parekh (HHS)	U.S. Department of Health and Human Services—Deputy Assistant Secretary for Health (Science and Medicine)	None	None	None	None	None	None
William A. Zoghbi (Past President, ACC)	Methodist DeBakey Heart and Vascular Center—William L. Winters Chair of Cardiovascular Imaging; The Methodist Hospital—Director, Cardiovascular Imaging	None	None	• GE Healthcare*	None	None	None

This table represents all relationships of committee members with industry and other entities that were reported by authors, including those not deemed to be relevant to this document, at the time this document was under development. 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 $\geq 5\%$ of the voting stock or share of the business entity, or ownership of $\geq \$10,000$ 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. Please refer to <http://www.cardiosource.org/Science-And-Quality/Practice-Guidelines-and-Quality-Standards/Relationships-With-Industry-Policy.aspx> for definitions of disclosure categories or additional information about the ACC/AHA Disclosure Policy for Writing Committees.

*Significant relationship.

†No Financial Benefit.

ACC indicates American College of Cardiology; AHA, American Heart Association; DSMB, data safety monitoring board; and HHS, U.S. Department of Health and Human Services.