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PII: S0735-1097(15)06797-2
DOI: 10.1016/j.jacc.2015.10.005
Reference: JAC 21889

To appear in: Journal of the American College of Cardiology

Levine GN, et al.
2015 ACC/AHA/SCAI Focused Update on Primary PCI


A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Society for Cardiovascular Angiography and Interventions

Developed in Collaboration With the American College of Emergency Physicians

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Preamble
To ensure that guidelines reflect current knowledge, available treatment options, and optimum medical care, existing clinical practice guideline recommendations are modified and new recommendations are added in response to new data, medications or devices. To keep pace with evolving evidence, the American College of Cardiology (ACC) / American Heart Association (AHA) Task Force on Clinical Practice Guidelines (“Task Force”) has issued this focused update to revise guideline recommendations on the basis of recently published data. This update is not based on a complete literature review from the date of previous guideline publications, but it has been subject to rigorous, multilevel review and approval, similar to the full guidelines. For specific focused update criteria and additional methodological details, please see the ACC/AHA guideline methodology manual (1).

Modernization
In response to published reports from the Institute of Medicine (2,3) and ACC/AHA mandates (4-7), processes have changed leading to adoption of a “knowledge byte” format. This entails delineation of recommendations addressing specific clinical questions, followed by concise text, with hyperlinks to supportive evidence. This approach better accommodates time constraints on busy clinicians, facilitates easier access to recommendations via electronic search engines and other evolving technology (e.g., smart phone apps), and supports the evolution of guidelines as “living documents” that can be dynamically updated as needed.

Intended Use
Practice guidelines provide recommendations applicable to patients with or at risk of developing cardiovascular disease. The focus is on medical practice in the United States, but guidelines developed in collaboration with other organizations may have a broader target. Although guidelines may inform regulatory or payer decisions, they are intended to improve quality of care in the interest of patients.

Class of Recommendation and Level of Evidence
The Class of Recommendation (COR) and Level of Evidence (LOE) are derived independently of one another according to established criteria. The COR indicates the strength of recommendation, encompassing the estimated magnitude and certainty of benefit of a clinical action in proportion to risk. The LOE rates the quality of scientific evidence supporting the intervention on the basis of the type, quantity, and consistency of data from clinical trials and other sources (Table 1) (1,7,8).

Relationships With Industry and Other Entities
The ACC and AHA sponsor the guidelines without commercial support, and members volunteer their time. The

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Task Force zealously avoids actual, potential, or perceived conflicts of interest that might arise through relationships with industry or other entities (RWI). All Guideline Writing Committee (GWC) members and reviewers are required to disclose current industry relationships or personal interests from 12 months before initiation of the writing effort. Management of RWI involves selecting a balanced GWC and assuring that the chair and a majority of committee members have no relevant RWI (Appendixes 1 and 2). Members are restricted with regard to writing or voting on sections to which their RWI apply. For transparency, members’ comprehensive disclosure information is available online (http://jaccjacc.acc.org/Clinical_Document/2015_Focused_Update_on_Primary_PCI_in_STEMI_Comprehensive_RWI_Table.pdf). Comprehensive disclosure information for the Task Force is available at http://www.acc.org/guidelines/about-guidelines-and-clinical-documents/guidelines-and-documents-task-forces.

The Task Force strives to avoid bias by selecting experts from a broad array of backgrounds representing different geographic regions, sexes, ethnicities, intellectual perspectives/biases, and scopes of clinical practice, and by inviting organizations and professional societies with related interests and expertise to participate as partners or collaborators.

Related Issues
For additional information pertaining to the methodology for grading evidence, assessment of benefit and harm, shared decision making between the patient and clinician, structure of evidence tables and summaries, standardized terminology for articulating recommendations, organizational involvement, peer review, and policies for periodic assessment and updating of guideline documents, we encourage readers to consult the ACC/AHA guideline methodology manual (1).

The recommendations in this focused update represent the official policy of the ACC and AHA until superseded by published addenda, statements of clarification, focused updates, or revised full-text guidelines. To ensure that guidelines remain current, new data are reviewed biannually to determine whether recommendations should be modified. In general, full revisions are posted in 5-year cycles (1).

Jonathan L. Halperin, MD, FACC, FAHA
Chair, ACC/AHA Task Force on Clinical Practice Guidelines
Table 1. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care* (Updated August 2015)

<table>
<thead>
<tr>
<th>CLASS (STRENGTH) OF RECOMMENDATION</th>
<th>LEVEL (QUALITY) OF EVIDENCE‡</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLASS I (STRONG)</strong> Benefit &gt;&gt;&gt; Risk</td>
<td></td>
</tr>
</tbody>
</table>
| Suggested phrases for writing recommendations:
  - Is recommended
  - Is indicated/useful/effective/beneficial
  - Should be performed/administered/other
  - Comparative-Effectiveness Phrases‡:
    - Treatment/strategy A is recommended/indicated in preference to treatment B
    - Treatment A should be chosen over treatment B |
| **LEVEL A**
- High-quality evidence‡ from more than 1 RCT
- Meta-analyses of high-quality RCTs
- One or more RCTs corroborated by high-quality registry studies |

| **CLASS IIa (MODERATE)** Benefit >> Risk |
| Suggested phrases for writing recommendations:
  - Is reasonable
  - Can be useful/effective/beneficial
  - Comparative-Effectiveness Phrases‡:
    - Treatment/strategy A is probably recommended/indicated in preference to treatment B
    - It is reasonable to choose treatment A over treatment B |
| **LEVEL B-R** (Randomized)
- Moderate-quality evidence‡ from 1 or more RCTs
- Meta-analyses of moderate-quality RCTs |

| **CLASS IIb (WEAK)** Benefit ≥ Risk |
| Suggested phrases for writing recommendations:
  - May/might be reasonable
  - May/might be considered
  - Usefulness/effectiveness is unknown/unclear/uncertain or not well established |
| **LEVEL B-NR** (Nonrandomized)
- Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies
- Meta-analyses of such studies |

| **CLASS III: No Benefit (MODERATE)** Benefit = Risk |
| Suggested phrases for writing recommendations:
  - Is not recommended
  - Is not indicated/useful/effective/beneficial
  - Should not be performed/administered/other |
| **LEVEL C-LD** (Limited Data)
- Randomized or nonrandomized observational or registry studies with limitations of design or execution
- Meta-analyses of such studies
- Physiological or mechanistic studies in human subjects |

| **CLASS III: Harm (STRONG)** Risk > Benefit |
| Suggested phrases for writing recommendations:
  - Potentially harmful
  - Causes harm
  - Associated with excess morbidity/mortality
  - Should not be performed/administered/other |
| **LEVEL C-EO** (Expert Opinion)
Consensus of expert opinion based on clinical experience |

COR and LOE are determined independently (any COR may be paired with any LOE). A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective. *The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information). ‡For comparative-effectiveness recommendations (COR I and IIa: LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

The method of assessing quality is evolving, including the application of standardized, widely used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR Indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.
1. Introduction

The scope of this focused update is limited to considerations relevant to multivessel percutaneous coronary intervention (PCI) and thrombus aspiration in patients with ST-elevation myocardial infarction (STEMI) undergoing primary PCI.

1.1. Methodology and Evidence Review

Clinical trials presented at the major cardiology organizations’ 2013 to 2015 annual scientific meetings and other selected reports published in a peer-reviewed format through August 2015 were reviewed by the 2011 PCI and 2013 STEMI GWCs and the Task Force to identify trials and other key data that might affect guideline recommendations. The information considered important enough to prompt updated recommendations is included in evidence tables in the Online Data Supplement (http://jaccjacc.acc.org/Clinical_Document/2015_Focused_Update_on_Primary_PCI_in_STEMI_Data_Suppleme nts.pdf).

Consult the full-text versions of the 2011 PCI and 2013 STEMI guidelines (9,10) for recommendations in clinical areas not addressed in the focused update. The individual recommendations in this focused update will be incorporated into future revisions or updates of the full-text guidelines.

1.2. Organization of the GWC

For this focused update, representative members of the 2011 PCI and 2013 STEMI GWCs were invited to participate. Members were required to disclose all RWI relevant to the topics under consideration. The entire membership of both GWCs voted on the revised recommendations and text. The latter group was composed of experts representing cardiovascular medicine, interventional cardiology, electrophysiology, heart failure, cardiac surgery, emergency medicine, internal medicine, cardiac rehabilitation, nursing, and pharmacy. The GWC included representatives from the ACC, AHA, American College of Physicians, American College of Emergency Physicians, and Society for Cardiovascular Angiography and Interventions (SCAI).

1.3. Review and Approval

This document was reviewed predominantly by the prior reviewers from the respective 2011 and 2013 guidelines. These included 8 official reviewers jointly nominated by the ACC and AHA, 4 official/organizational reviewers nominated by SCAI, and 25 individual content reviewers. Reviewers’ RWI information was distributed to the GWC and is published in this document (Appendix 3).

This document was approved for publication by the governing bodies of the ACC, the AHA, and the SCAI and was endorsed by the (TBD).
2. Culprit Artery–Only Versus Multivessel PCI
(See Section 5.2.2.2 of 2011 PCI guideline and Section 4.1.1 of 2013 STEMI guideline for additional recommendations.)

<table>
<thead>
<tr>
<th>2013 Recommendation</th>
<th>2015 Focused Update Recommendation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class III: Harm</strong></td>
<td><strong>Class IIb</strong></td>
<td>Modified recommendation (changed class from “III: Harm” to “IIb” and expanded time frame in which multivessel PCI could be performed).</td>
</tr>
<tr>
<td>PCI should not be performed in a noninfarct artery at the time of primary PCI in patients with STEMI who are hemodynamically stable (11-13). <em>(Level of Evidence: B)</em></td>
<td>PCI of a noninfarct artery may be considered in selected patients with STEMI and multivessel disease who are hemodynamically stable, either at the time of primary PCI or as a planned staged procedure (11-24). <em>(Level of Evidence: B-R)</em></td>
<td></td>
</tr>
</tbody>
</table>

PCI indicates percutaneous coronary intervention; and STEMI, ST-elevation myocardial infarction.

Approximately 50% of patients with STEMI have multivessel disease (25,26). PCI options for patients with STEMI and multivessel disease include: 1) culprit artery–only primary PCI, with PCI of nonculprit arteries only for spontaneous ischemia or intermediate- or high-risk findings on predischarge noninvasive testing; 2) multivessel PCI at the time of primary PCI; or 3) culprit artery–only primary PCI followed by staged PCI of nonculprit arteries. Observational studies, randomized controlled trials (RCTs), and meta-analyses comparing culprit artery–only PCI with multivessel PCI have reported conflicting results (11,12,14-24,27,28), likely because of differing inclusion criteria, study protocols, timing of multivessel PCI, statistical heterogeneity, and variable endpoints (Data Supplement).

Previous clinical practice guidelines recommended against PCI of nonculprit artery stenoses at the time of primary PCI in hemodynamically stable patients with STEMI (9,10). Planning for routine, staged PCI of noninfarct artery stenoses on the basis of the initial angiographic findings was not addressed in these previous guidelines, and noninfarct artery PCI was considered only in the limited context of spontaneous ischemia or high-risk findings on predischarge noninvasive testing. The earlier recommendations were based in part on safety concerns, which included increased risks for procedural complications, longer procedural time, contrast nephropathy, and stent thrombosis in a prothrombotic and proinflammatory state (9,10), and in part on the findings from many observational studies and meta-analyses of trends toward or statistically significant worse outcomes in those who underwent multivessel primary PCI (12-16,21-23).

Four RCTs have since suggested that a strategy of multivessel PCI, either at the time of primary PCI or as a planned, staged procedure, may be beneficial and safe in selected patients with STEMI (17,18,24,27) (Data Supplement). In the PRAMI (Preventive Angioplasty in Acute Myocardial Infarction) trial (n=465) (24), the composite primary outcome of cardiac death, nonfatal myocardial infarction (MI), or refractory angina occurred in 21 patients (9%) treated with multivessel primary PCI, compared with 53 patients (22%) treated with culprit PCI.
artery–only PCI (HR: 0.35; 95% CI: 0.21 to 0.58; p<0.001). In the CvLPRIT (Complete Versus Culprit-Lesion Only Primary PCI) trial (18), 296 patients were randomized to culprit artery–only or multivessel PCI during the index hospitalization (72% underwent multivessel primary PCI). The composite primary outcome of death, reinfarction, heart failure, and ischemia-driven revascularization at 12 months occurred in 15 patients (10%) who underwent multivessel PCI, compared with 31 patients (21%) receiving culprit artery–only PCI (HR: 0.49; 95% CI: 0.24 to 0.84; p=0.009). In the DANAMI 3 PRIMULTI (Third Danish Study of Optimal Acute Treatment of Patients with ST-segment Elevation Myocardial Infarction) trial (17), the composite primary outcome of all-cause death, nonfatal MI, or ischemia-driven revascularization of nonculprit artery disease occurred in 40 of 314 patients (13%) who underwent multivessel staged PCI guided by angiography and fractional flow reserve before discharge, versus 68 of 313 patients (22%) treated with culprit artery–only PCI (HR: 0.56; 95% CI: 0.38 to 0.83; p=0.004). In the PRAGUE-13 (Primary Angioplasty in Patients Transferred From General Community Hospitals to Specialized PTCA Units With or Without Emergency Thrombolysis) trial (27), 214 patients with STEMI were randomized to staged (3 to 40 days after the index procedure) revascularization of all ≥70% diameter stenosis noninfarct lesions or culprit-only PCI. Preliminary results at 38 months’ mean follow-up showed no between-group differences in the composite primary endpoint of all-cause death, nonfatal MI, and stroke.

On the basis of these findings (17,18,24,27), the prior Class III (Harm) recommendation with regard to multivessel primary PCI in hemodynamically stable patients with STEMI has been upgraded and modified to a Class IIb recommendation to include consideration of multivessel PCI, either at the time of primary PCI or as a planned, staged procedure. The writing committee emphasizes that this change should not be interpreted as endorsing the routine performance of multivessel PCI in all patients with STEMI and multivessel disease. Rather, when considering the indications for and timing of multivessel PCI, physicians should integrate clinical data, lesion severity/complexity, and risk of contrast nephropathy to determine the optimal strategy.

The preceding discussion and recommendations apply to the strategy of routine PCI of noninfarct related arteries in hemodynamically stable patients. Recommendations in the 2013 STEMI guideline with regard to PCI of a non–infarct-related artery at a time separate from primary PCI in patients who have spontaneous symptoms and myocardial ischemia or who have intermediate- or high-risk findings on noninvasive testing (Section 6.3 of that guideline) remain operative.

Although several observational studies (19,20) and a network meta-analysis (13) have suggested that multivessel staged PCI may be associated with better outcome than multivessel primary PCI, there are insufficient observational data and no randomized data at this time to inform a recommendation with regard to the optimal timing of nonculprit vessel PCI. Additional trial data that will help further clarify this issue are awaited. Issues related to the optimal method of evaluating nonculprit lesions (e.g., percent diameter stenosis, fractional flow reserve) are beyond the scope of this focused update.
3. Aspiration Thrombectomy
(See Section 5.5.2 of the 2011 PCI guideline and Section 4.2 of the 2013 STEMI guideline for additional recommendations.)

<table>
<thead>
<tr>
<th>2011/2013 Recommendation</th>
<th>2015 Focused Update Recommendations</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class IIa</strong></td>
<td>Manual aspiration thrombectomy is reasonable for patients undergoing primary PCI (29-32). (<a href="#">Level of Evidence: B</a>)</td>
<td>Modified recommendation (Class changed from “IIa” to “IIb” for selective and bailout aspiration thrombectomy before PCI).</td>
</tr>
<tr>
<td><strong>Class IIb</strong></td>
<td>The usefulness of selective and bailout aspiration thrombectomy in patients undergoing primary PCI is not well established (33-37). (<a href="#">Level of Evidence: C-LD</a>)</td>
<td>New recommendation (“Class III: No Benefit” added for routine aspiration thrombectomy before PCI).</td>
</tr>
<tr>
<td><strong>Class III: No Benefit</strong></td>
<td>Routine aspiration thrombectomy before primary PCI is not useful (33-37). (<a href="#">Level of Evidence: A</a>)</td>
<td></td>
</tr>
</tbody>
</table>

PCI indicates percutaneous coronary intervention; and LD, limited data.

The 2011 PCI and 2013 STEMI guidelines’ (9,10) Class IIa recommendation for aspiration thrombectomy before primary PCI was based on the results of 2 RCTs (29,31,32) and 1 meta-analysis (30) and was driven in large measure by the results of TAPAS (Thrombus Aspiration During Primary Percutaneous Coronary Intervention in Acute Myocardial Infarction Study), a single-center study that randomized 1,071 patients with STEMI to aspiration thrombectomy before primary PCI or primary PCI only (29,32). Three multicenter trials, 2 of which enrolled significantly more patients than prior aspiration thrombectomy trials, have prompted reevaluation of this recommendation. In the INFUSE-AMI (Intracoronary Abciximab and Aspiration Thrombectomy in Patients With Large Anterior Myocardial Infarction) trial (37) of 452 patients with anterior STEMI due to proximal or mid-left anterior descending occlusion, infarct size was not reduced by aspiration thrombectomy before primary PCI. The TASTE (Thrombus Aspiration During ST-Segment Elevation Myocardial Infarction) trial (n=7,244) incorporated a unique design that allowed randomization within an existing national registry, resulting in enrollment of a remarkably high proportion of eligible patients (34,36). No significant 30-day or 1-year differences were found between the group that received aspiration thrombectomy before primary PCI and the group that received primary PCI only with regard to death, reinfarction, stent thrombosis, target lesion revascularization, or a composite of major adverse cardiac events. The TOTAL (Trial of Routine Aspiration Thrombectomy With PCI Versus PCI Alone in Patients With STEMI) trial randomized 10,732 patients with STEMI to aspiration thrombectomy before primary PCI or primary PCI only (35). Bailout thrombectomy was performed in 7.1% of the primary PCI–only group, whereas the rate of crossover from aspiration thrombectomy before primary PCI to primary PCI only was 4.6%. There were no differences between the 2 treatment groups, either in the primary composite endpoint of cardiovascular death, recurrent MI, cardiogenic shock, or New York Heart Association class IV heart failure at 180 days, or in the individual components of the primary endpoint, stent thrombosis, or target-vessel

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revascularization. There was a small but statistically significant increase in the rate of stroke in the aspiration thrombectomy group. An updated meta-analysis that included these 3 trials among a total of 17 trials (n=20,960) found no significant reduction in death, reinfarction, or stent thrombosis with routine aspiration thrombectomy. Aspiration thrombectomy was associated with a small but nonsignificant increase in the risk of stroke (33).

Several previous studies have found that higher thrombus burden in patients with STEMI is independently associated with higher risks of distal embolization, no-reflow phenomenon, transmural myocardial necrosis, major adverse cardiac events, stent thrombosis, and death (38-42). However, subgroup analyses from the TASTE and TOTAL trials did not suggest relative benefit from aspiration thrombectomy before primary PCI in patients with higher thrombus burden or in patients with initial Thrombolysis in Myocardial Infarction (TIMI) flow grade 0-1 or left anterior descending artery / anterior infarction (34,35).

On the basis of the results of these studies, the prior Class IIa recommendation for aspiration thrombectomy has been changed. Routine aspiration thrombectomy before primary PCI is now not recommended (Class III: No Benefit, LOE A). There are insufficient data to assess the potential benefit of a strategy of selective or bailout aspiration thrombectomy (Class IIb, LOE C-LD). “Bailout” aspiration thrombectomy is defined as thrombectomy that was initially unplanned but was later used during the procedure because of unsatisfactory initial result or procedural complication, analogous to the definition of “bailout” glycoprotein IIb/IIIa use.

It should be noted that the preceding recommendations and text apply only to aspiration thrombectomy; no clinical benefit for routine rheolytic thrombectomy has been demonstrated in patients with STEMI undergoing primary PCI (30,43,44).

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Key Words: ACC/AHA Clinical Practice Guidelines, focused update, primary PCI, culprit vessel, multivessel, thrombectomy
Appendix 1. Author Relationships With Industry and Other Entities (Relevant)—2015 ACC/AHA/SCAI Focused Update on Primary Percutaneous Coronary Intervention for Patients With ST-Elevation Myocardial Infarction (Percutaneous Coronary Intervention Writing Committee) (November 2014)

<table>
<thead>
<tr>
<th>Committee Member</th>
<th>Employer/Title</th>
<th>Consultant</th>
<th>Speakers Bureau</th>
<th>Ownership/Partnership/Principal</th>
<th>Personal Research</th>
<th>Institutional, Organizational or Other Financial Benefit</th>
<th>Expert Witness</th>
<th>Voting Recusals by Section*</th>
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</thead>
<tbody>
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<td>Baylor College of Medicine—Professor of Medicine; Director, Cardiac Care Unit</td>
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<td>None</td>
<td>None</td>
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<td>None</td>
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<tr>
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<td>None</td>
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<td>Steven R. Bailey</td>
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<td>None</td>
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<tr>
<td>John A. Bittl</td>
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<td>Robert A. Guyton</td>
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</table>
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
Levine GN, et al.
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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.

*Writing group members are required to recuse themselves from voting on sections to which their specific relationships with industry and other entities may apply.
†No financial benefit.
‡Significant relationship.

ACC indicates American College of Cardiology; AHA, American Heart Association; and SCAI, Society for Cardiovascular Angiography and Interventions.
Appendix 2. Author Relationships With Industry and Other Entities (Relevant)—2015 ACC/AHA/SCAI Focused Update on Primary Percutaneous Coronary Intervention for Patients With ST-Elevation Myocardial Infarction (ST-Elevation Myocardial Infarction Writing Committee) (February 2014)

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| Mina K. Chung | Cleveland Clinic Foundation—Professor of Medicine | • Boston Scientific† 
• Medtronic† 
• St. Jude† | None | None | • Biosense Webster‡ 
• Boston Scientific‡ 
• Medtronic‡ 
• St. Jude‡ | None | None | 2 and 3 |
| James A. de Lemos | UT Southwestern Medical Center—Professor of Medicine | • Abbott Diagnostics 
• Novo Nordisk 
• St. Jude Medical | None | None | • Abbott Diagnostics† | None | None | 2 and 3 |
<p>| Deborah B. Diercks | UT Southwestern Medical Center—Audre and Bernard Rapoport Distinguished Chair in Clinical Care and Research; Department of Emergency | None | None | None | None | None | None | None |</p>
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<td>Joseph P. Ornato</td>
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<td>Narith Ou</td>
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### Committee Members and Industry Relationships

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 $\geq \$5,000$ 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.

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Dr. Deborah D. Ascheim was not eligible to continue on the writing committee due to her employment by Capricor Therapeutics effective August 2015.

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<td>Jacqueline E. Tamis-Holland</td>
<td>Mount Sinai Saint Luke's Hospital and The Icahn School of Medicine—Program Director, Interventional Cardiology Fellowship Program</td>
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<td>Carl L. Tommaso</td>
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<td>Cynthia M. Tracy</td>
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<td>David X. Zhao</td>
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* St. Jude‡  
* Medtronic‡
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*Writing group members are required to recuse themselves from voting on sections to which their specific relationships with industry and other entities may apply.  
†Significant relationship.  
‡No financial benefit.

ACC indicates American College of Cardiology; AHA, American Heart Association; NYU, New York University; UCSF, University of California San Francisco; and UT, Utah.
Appendix 3. Reviewer Relationships With Industry and Other Entities (Relevant)—2015 Focused Update on Primary Percutaneous Coronary Intervention for Patients With ST-Elevation Myocardial Infarction (Combined Peer Reviewers From 2011 PCI and 2013 STEMI Guidelines)

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<td>Elliott M. Antman</td>
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<td>Deepak L. Bhatt</td>
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<td>Christopher P. Cannon</td>
<td>Official Reviewer—AHA</td>
<td>Harvard Medical School—Professor of Medicine; Brigham and Women’s Hospital—Senior Investigator, TIMI Study Group, Cardiovascular Division</td>
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<td>Joaquin E. Cigarroa</td>
<td>Official Reviewer—ACC/AHA Task Force on Clinical Practice Guidelines</td>
<td>Oregon Health &amp; Science University—Clinical Professor of Medicine</td>
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<td>George Dangas</td>
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| Kirk N. Garratt     | Official Reviewer—SCAI          | Hofstra University Medical School—Associate Chair of Quality and Research; Professor of Medicine | • Abbott
• Boston Scientific
• The Medicines Company
• Daiichi-Sankyo/Eli Lilly
• AstraZeneca | None            | • LifeCuff Technologies
• Global Delivery Systems | None              | • Boston Scientific                                                      | None           | None           |
| Steven L. Goldberg  | Official Reviewer—SCAI          | University of Washington Medical Center—Cath Lab Director                  | • Terumo†                                                                | None            | None                           | None              | None                                                      | None           | None           |
| G. B. John Mancini  | Official Reviewer—ACC Board of Governors | Vancouver Hospital Research Pavilion—Professor of Medicine                  | • Merck
• Sanofi-aventis/Regeneron                                                | None            | None                           | None              | None                                                      | None           | None           |
<p>| Jonathan M. Tobis   | Official Reviewer—SCAI          | University of California Los Angeles—Professor of Medicine and Cardiology   | • St. Jude Medical                                                        | None            | None                           | None              | None                                                      | None           | None           |
| Jeffrey L. Anderson | Content Reviewer—ACC/AHA Task Force on Clinical Practice | Intermountain Medical Center—Associate Chief of Cardiology                  | None                                                                      | None            | None                           | None              | None                                                      | None           | None           |</p>
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| Jonathan L. Halperin    | Content Reviewer—ACC/AHA Task Force on Clinical Practice Guidelines | Mt. Sinai Medical—Professor of Medicine | • Bayer Healthcare  
• Boston Scientific  
• Johnson & Johnson  
• Medtronic | None                          | None                            | None                      | None                           | None          | None                  |
| Howard C. Herrmann       | Content Reviewer                                    | University of Pennsylvania Perelman School of Medicine—Professor of Medicine, Director of Interventional Cardiology Program | • Siemens Medical  
• St. Jude Medical | None                          | None                            | None                      | None                           | None          | None                  |
| Morton J. Kern           | Content Reviewer                                    | University of California Irvine—Professor of Medicine, Associate Chief of the Division of Cardiology | • Acist Medical  
• Merit Medical*  
• St. Jude Medical* | None                          | None                            | None                      | None                           | None          | None                  |
<p>| Fred M. Kosumoto         | Content Reviewer                                    | Mayo Clinic—Director, Pacing and Electrophysiology Service                | None                                          | None                          | None                            | None                      | None                           | None          | None                  |
| David J. Maron           | Content Reviewer                                    | Stanford University School of Medicine—Professor of Medicine and Emergency Medicine | None                                          | None                          | None                            | None                      | None                           | None          | None                  |
| Douglass A. Morrison     | Content Reviewer                                    | University of Arizona—Professor of Medicine; Southern Arizona VA Health Care System—Cardiac Catheterization | None                                          | None                          | None                            | None                      | None                           | None          | None                  |</p>
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| Manesh R. Patel   | Content Reviewer—ACC            | Duke University Medical Center—Associate Professor of Medicine | • Bayer Healthcare*  
• Janssen Pharmaceuticals* | None              | None                       | • Johnson & Johnson* | None                        | None            |
| M. Eugene Sherman| Content Reviewer—ACC            | Aurora Denver Cardiology        | None                                                                      | None             | None                            | None              | • Bristol-Myers Squibb*  
• Hospira*         | None                          | None                      |
| Daniel I. Simon   | Content Reviewer                | University Hospitals Case Medical Center—Professor of Cardiovascular Research | • Cordis/Johnson & Johnson*  
• Janssen Pharmaceuticals/Johnson & Johnson  
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References


