

Supplemental Material

Questionnaire

Default Question Block

The goal of this survey is to describe the current organizational structure, medical staffing, medical care provided, and therapeutic modalities delivered in contemporary CICUs in the United States. This survey is entirely voluntarily. Protected health information (PHI) will not be collected or used at any time during the conduct of this survey, or subsequent analysis. The data will be analyzed and reported in aggregate only. Your information will remain anonymous.

What is your American Hospital Association hospital number? (You may skip this question if you do not know the number.)

What best describes your hospital? (check one)

- Academic medical center
- Tertiary non-academic center
- Community hospital
- Veteran's Administration Hospital

Describe your CICU structure. (check one)

- Open (variety of attending physicians simultaneously caring for patients)
- Closed (single dedicated physician or team primarily caring for patients)

Is your unit currently in the process of transitioning to a closed unit? (check one)

- Yes
- No

What best describes your Coronary Intensive Care Unit (CICU) patient population? (check one)

- CICU only
- Mixed CICU and cardiothoracic surgical ICU units
- Mixed CICU and medical ICU
- Mixed general medical and surgical ICU units
- Other - Specify

Which of the following services are available onsite? (check one)

- Primary PCI
- Cardiac Surgery
- Primary PCI and cardiac surgery
- Neither

What best describes your hospital's primary PCI capabilities? (check one)

- 24 hour/7 days a week coverage
- < 24 hour/7 days a week coverage

Which of the following therapies can be delivered by your Coronary Intensive Care Unit (CICU)? (check all that apply)

- Mechanical ventilation
- Continuous renal replacement therapy
- Hemodialysis
- Pulmonary artery catheters
- Temporary transvenous pacing
- Implantable ventricular assist devices
- Therapeutic hypothermia
- Non-invasive mechanical ventilation
- Invasive hemodynamic monitoring with arterial and central lines
- Intra-aortic balloon pumps
- Fiberoptic bronchoscopy
- Percutaneous ventricular assist devices (not including intra-aortic balloon pumps)
- Pericardiocentesis
- Transesophageal echocardiography
- None of these

What best describes the training of the physician leadership of your Coronary Intensive Care Unit (CICU)? (check one)

- Cardiologist without intensive care training
- Cardiologist-Intensivist (a physician with dual cardiology and intensive care certification)
- Cardiologist who has had at least 10 years of intensive care focus (on average of at least 6 weeks per year with dedicated ICU care)
- General Intensivist
- Joint Leadership by cardiologist and a general intensivist
- Internist
- Other - Specify

Is a critical care physician (non-cardiologist) available onsite for consultation? (check one)

- Yes
- No

What role does an intensivist play in the management of most critically ill cardiac patient? (check one)

- Co-management by cardiology and intensive care (including for example automatic consult for all mechanically ventilated patients)
- Cardiologist management with intensive care consultation as needed (not automatic)
- Cardiac intensivist (a physician with dual cardiology and intensive care training) manages the patient
- Intensive care management with cardiology consultation
- No intensivist available

Is there a cardiac-intensivist (a physician with dual cardiology and formal intensive care training) currently attending in your CICU? (check one)

- Yes
- No

Is your institution currently looking to hire or recruit a cardiac intensivist? (check one)

- Yes
- No

What is the lowest nurse to patient ratio your Coronary Intensive Care Unit (CICU) is able to provide the most acutely ill patient? (check one)

- 1:1
- 2:1
- 3:1

Is your Coronary Intensive Care Unit (CICU) involved in the education or training of medical students, residents, or advanced care practitioners? (check one)

- Yes
- No

Which of the following type of trainees rotate through your CICU? (check all that apply)

- Advanced practice providers
- Cardiology specialty fellows
- Internal medicine residents
- Medical students
- Critical care intensivists
- Non-internal medicine residents
- None of these

Does your institution have a critical care cardiology subspecialty training program designed to provide advanced training in intensive care to cardiology graduates? (check one)

- Yes
- Our institution is in the process of establishing a program
- Our institution is considering and/or exploring establishing such a program
- No

Which training program is formally administering the critical care cardiology training program? (check one)

- Cardiology
- Intensive care
- Joint cardiology and intensive care administration
- Other

Are you aware of the suggested categorization of Coronary Intensive Care Unit proposed by the AHA Position Paper on the Evolution of Critical Care Cardiology (Morrow et al Circulation 2012)? (check one)

- Yes
- No

What is your CICU's goal level of categorization according to the AHA Position Paper? [Click here for a definition of the levels.](#) (check one)

- 1
- 2
- 3
- Don't know

What is your CICU's current level of categorization according to the AHA Position Paper? [Click here for a definition of the levels.](#) (check one)

- 1
- 2
- 3
- Don't know

Has this position paper contributed to changing your planning for your Coronary Intensive Care Unit (CICU)? (check one)

- Yes
- No

What percentage of patients with Non ST-segment elevation acute coronary syndromes are initially admitted to the Coronary Intensive Care Unit at your institution? (please estimate; check one)

- $\geq 90\%$
- 50-89%
- 11-49%
- $\leq 10\%$
- Don't know

What variables factor into your decision to admit patients to a Coronary Intensive Care Unit? (check all that apply)

- Coronary Intensive Care Unit bed availability
- Goals of care (ex: do not resuscitate status)
- Clinical scoring systems (ex: GRACE score, TIMI score, or equivalent)
- Institutional policies or procedures
- Need for Coronary Intensive Care Unit restricted therapies (ex: intravenous vasoactive agents or mechanical ventilation)
- Clinical acuity (ex: heart failure, shock, ventricular tachycardia)
- Positive troponin
- Other - Specify

Study Programs and Registries

The AHA's Mission: Lifeline program was established in 2007 to promote networks of emergency medical services, non-percutaneous coronary intervention (PCI)-capable, and PCI-capable hospitals committed to improving the delivery of timely primary PCI for ST-elevation myocardial infarction (STEMI) patients through the implementation of regional care systems that would improve efficiency, reduce disparity, measure outcomes, and incentivize quality.^{1,2} The ACTION Registry-GWTG was created in 2008 following the merger between the National Cardiovascular Data Registry (NCDR) ACTION registry and the GWTG program.³ Its objectives were to serve as a national surveillance system, to optimize outcomes through evidence-based practice implementation, and to facilitate quality and safety efforts for patients with myocardial infarction.

Statistical Methods

Discrete variables are presented as frequencies and percentages. The Kruskal-Wallis test was used for all statistical comparisons. AHA Level 1 CICUs were defined as units that had all of the following medical, diagnostic, and therapeutic resources: 24/7 interventional cardiology, invasive and non-invasive hemodynamic monitoring, transesophageal echocardiography, pulmonary artery catheterization, intra-aortic balloon pumps, invasive and non-invasive mechanical ventilation, therapeutic hypothermia, continuous renal replacement therapy, percutaneous assist devices or implantable ventricular assist devices, cardiac-intensivists or joint cardiologist-intensivist CICU leadership, intensivist available onsite, 1:1 or 1:2 nurse: patient ratios, and involvement in trainee education.⁴ P-values <0.05 from two-sided tests were considered statistically significant. Analyses were carried out by Duke Clinical Research Institute in Durham, North Carolina, USA and were performed using SAS 9.4 (SAS Institute Inc. Cary, North Carolina, USA).

Supplemental Results

Among the 89.8% of centers that did not meet Level 1 CICU criteria, the lack of continuous renal replacement therapy, percutaneous or implantable ventricular assist devices, CICU medical leadership by either a cardiac-intensivists or joint cardiology-intensive care, and participation in trainee education were the most frequently-missing criteria.

Supplemental Discussion

Scientific statements on CICU staffing and organizational structure from the AHA and Canada have proposed a three-tiered CICU classification system that mirrors the American College of Surgeons trauma centre classification, wherein Level 1 centers would serve as tertiary referral centers with medical resources, technologies, and staffing necessary to comprehensively care for all acute cardiovascular illnesses.⁵⁻⁶ In this study, among survey respondents who were aware of the AHA CICU scientific statement, more than 50% felt their institution met Level 1 standards; however, using an objective set of criteria, only 10.8% met all proposed AHA standards for an advanced CICU. Moreover, in academic and tertiary non-academic medical centers, the traditional referral hospitals for community sites, only 26.1% and 18.3% met all Level 1 standards. Our findings also identified a lack of select medical technologies, recommended medical leadership, and trainee education as the most frequent barriers to achieving Level 1 status. We acknowledge both the limited response rates to these questions and the uncertain clinical significance of this finding as professional society statements on CICU staffing have recognized that it is not necessary for most centers to provide the highly specialized services of a Level 1 CICU, and that the appropriate number of Level 1 centers within regionalized systems of care remains unclear. These findings do, however, suggest that few centers are currently equipped and staffed to comprehensively centralize the care of all critically ill cardiac patients. These findings may

present opportunities for CICUs to adapt available CICU resources to meet their local and regional patient care needs.⁷ Further research will be required to evaluate whether regional systems of care for all acute cardiovascular illness including centralization of the most critically ill patients in high volume Level 1 centers can improve clinical outcomes.^{8,9}

Limitations

First, the hospitals in the Mission: Lifeline program and ACTION Registry-GWTG are committed to data reporting and quality improvement. Additionally, the survey respondents were predominantly primary PCI capable hospitals and the true number of hospitals in the United States with CICUs remains unknown. Thus, the survey results may not represent the full spectrum of CICUs in the United States. Second, the survey response rate was modest and response bias cannot be excluded. However, our response rate exceeds other broad-based contemporary surveys of cardiovascular health professionals.¹⁰⁻¹² Third, the survey did not use a validated instrument; however, there are no validated CICU surveys available. Fourth, no Veterans Administration hospitals responded to this survey; though the hospitals responding to this survey represent a broad range of institutions across the United States, making the results generalizable. Lastly, we acknowledge the majority of evidence supporting unit-based staffing models recommended herein, are garnered from medical and surgical intensive care studies.

Supplemental References

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Supplemental Table 1: Cardiac intensive care unit organizational, staffing, and resources by hospital type

| | All Hospitals (n=612) | Academic Tertiary (n=115) | Tertiary Non-Academic (n=115) | Community Hospital (n=382) | p value* |
|---|--------------------------|------------------------------|----------------------------------|-------------------------------|----------|
| CICU structure | | | | | |
| Open [†] | 74.2% | 62.6% | 75.7% | 77.2% | 0.007 |
| Closed [‡] | 25.8% | 37.4% | 24.3% | 22.8% | |
| Plan to transition to closed CICU[§] (valid n=420) | 8.8% | 11.9% | 8.1% | 8.2% | 0.615 |
| CICU patient population (valid n=512) | | | | | |
| CICU only | 8.2% | 23.6% | 5.3% | 4.3% | <0.001 |
| Mixed CICU and CSICU | 21.2% | 30.9% | 32.7% | 14.4% | |
| Mixed CICU and MICU | 32.2% | 28.2% | 34.5% | 32.8% | |
| Mixed MICU and SICU | 33.1% | 13.6% | 20.4% | 43.4% | |
| Other | 5.3% | 3.6% | 7.1% | 5.2% | |
| CICU physician leadership (valid n=502) | | | | | <0.001 |
| Cardiologist without ICU training | 11.6% | 18.2% | 16.7% | 7.7% | |
| Cardiologist-Intensivist | 8.5% | 14.1% | 9.3% | 6.5% | |
| Cardiologist with ≥ 10 years of ICU focus | 7.7% | 14.1% | 11.1% | 4.5% | |
| General Intensivist | 25.9% | 17.2% | 18.5% | 31.3% | |
| Joint cardiologist - intensivist leadership | 34.8% | 33.3% | 38.9% | 33.9% | |
| Other | 9.7% | 3.0% | 5.6% | 13.2% | |
| Missing | 1.7% | 0% | 0% | 2.9% | |
| Cardiac-intensivist CICU attending (valid n=517) | 14.7% | 25.3% | 13.9% | 11.6% | 0.004 |
| Looking to hire a cardiac-intensivist (valid n=433) | 9.7% | 18.3% | 14.3% | 5.3% | <0.001 |
| ICU role with critically ill CICU patients (valid n=517) | 44.7% | 32.3% | 52.8% | 45.8% | 0.0388 |
| Cardiology and ICU co-management | 26.9% | 46.5% | 27.8% | 20.3% | |
| Cardiologist management with ICU consultation as needed | 0.6% | 0.0% | 0.9% | 0.6% | |
| Cardiac-intensivist manages the patient | 21.7% | 20.2% | 17.6% | 23.5% | |
| ICU management with cardiology consultation | 6.2% | 1.0% | 0.9% | 9.7% | |
| No intensivist available | 44.7% | 32.3% | 52.8% | 45.8% | |

| | | | | | |
|---|-------|-------|-------|-------|--------|
| Lowest CICU nurse:patient ratio (valid n=508) | | | | | |
| 1:1 | 76.8% | 77.1% | 76.4% | 76.8% | 0.9702 |
| 1:2 | 19.1% | 20.8% | 17.9% | 19.0% | |
| 1:3 | 4.1% | 2.1% | 5.7% | 4.2% | |
| CICU involved in education (valid n=508) | | | | | |
| Cardiology specialty fellows | 39.1% | 75.8% | 20.8% | 12.8% | <0.001 |
| Internal medicine resident | 61.8% | 84.6% | 43.8% | 48.9% | <0.001 |
| Non-medicine residents | 44.2% | 56.0% | 39.6% | 35.1% | 0.013 |
| Medical students | 76.0% | 85.7% | 64.6% | 72.3% | 0.012 |
| Advanced practice providers | 55.8% | 59.3% | 54.2% | 53.2% | 0.6803 |
| Critical care intensivists | 24.0% | 38.5% | 22.9% | 10.6% | <0.001 |
| Critical care cardiology subspecialty training program (valid n=504) | | | | | <0.001 |
| Yes | 6.5% | 24.2% | 3.8% | 2.0% | <0.001 |
| In the process of establishing a program | 0.6% | 3.2% | 0.0% | 0.0% | |
| Our institution is considering a program | 2.8% | 6.3% | 1.9% | 2.0% | |
| No | 90.1% | 66.3% | 94.3% | 96.0% | |
| Aware of the AHA position paper? (valid n=503) | 11.3% | 17.9% | 12.3% | 8.9% | 0.053 |
| NSTE ACS CICU admissions (valid n=499) | | | | | 0.9215 |
| ≥90% | 12.8% | 11.8% | 7.6% | 15.0% | |
| 50-89% | 20.2% | 25.8% | 21.9% | 17.9% | |
| 11-49% | 25.3% | 17.2% | 33.3% | 24.9% | |
| ≤10% | 22.2% | 20.4% | 21.0% | 23.3% | |
| Don't know | 19.4% | 24.7% | 16.2% | 18.9% | |
| Onsite Services (valid n=571) | | | | | <0.001 |
| Primary PCI only | 23.1% | 5.5% | 9.7% | 33.0% | |
| Cardiac surgery only | 0.5% | 0.0% | 0.9% | 0.6% | |
| Primary PCI and cardiac Surgery | 74.1% | 94.5% | 89.4% | 62.6% | |
| Neither | 2.3% | 0.0% | 0.0% | 3.7% | |

* p value for comparisons across hospital types; †defined as a variety of attending physicians simultaneously being primarily responsible for patients; ‡defined as single dedicated physician or team primarily caring for all patients; § Open units only; || physician with dual cardiology and intensive care training; valid n=number of survey respondents

Abbreviations: AHA, American Heart Association; CICU: coronary intensive care unit; CSICU, cardiothoracic surgical intensive care unit; MICU, medical ICU; NSTE ACS, non ST-segment elevation acute coronary syndrome; PCI, percutaneous coronary intervention; SICU, surgical ICU.

Supplemental Table 2: Cardiac intensive care unit organization, staffing, and resources in Mission: Lifeline and ACTION registry sites

| Characteristics | Mission: Lifeline (N=138) | ACTION Registry (N=474) | p value |
|--|------------------------------|----------------------------|---------|
| Hospital type | | | 0.905 |
| Academic medical center | 17.4% | 19.2% | |
| Tertiary non-academic center | 20.3% | 18.4% | |
| Community hospital | 62.3% | 62.4% | |
| CICU Structure | | | 0.423 |
| Open* | 76.8% | 73.4% | |
| Closed† | 23.2% | 26.6% | |
| Plan to transition to closed CICU[‡] (valid n=420) | 5.0% | 10.0% | 0.124 |
| CICU population (valid n=571) | | | 0.660 |
| CICU only | 6.1% | 8.9% | |
| Mixed CICU and CSICU | 22.1% | 20.9% | |
| Mixed CICU and MICU | 32.1% | 32.3% | |
| Mixed general medical and surgical | 35.1% | 32.5% | |
| Other | 4.6% | 5.5% | |
| Onsite Services (valid n=571) | | | 0.779 |
| Primary PCI only | 21.4% | 23.6% | |
| Cardiac surgery only | 0.0% | 0.7% | |
| Primary PCI and cardiac Surgery | 77.9% | 73.0% | |
| Neither | 0.8% | 2.7% | |
| Primary PCI capabilities (valid n=502) | | | 0.484 |
| 24/7 | 95.8% | 97.1% | |
| < 24/7 | 4.2% | 2.9% | |
| Available CICU tests and therapies (valid n=517) | | | |
| Non-invasive mechanical ventilation | 88.4% | 91.7% | 0.278 |
| Mechanical ventilation | 99.2% | 98.5% | 0.567 |
| Intra-aortic balloon pumps | 197.5% | 93.2% | 0.074 |
| Percutaneous ventricular assist devices | 52.1% | 57.8% | 0.263 |
| Implantable ventricular assist devices | 45.5% | 39.9% | 0.277 |
| Therapeutic hypothermia | 89.3% | 391.2% | 0.527 |
| Hemodialysis | 94.2% | 94.9% | 0.751 |
| Continuous renal replacement therapy | 66.1% | 69.2% | 0.524 |
| Temporary transvenous pacing | 99.2% | 97.7% | 0.313 |
| Pericardiocentesis | 91.7% | 91.4% | 0.912 |

| | | | |
|---|-------|-------|--------|
| Transesophageal echocardiography | 96.7% | 94.9% | 0.425 |
| Invasive hemodynamic monitoring | 99.2% | 98.2% | 0.463 |
| Pulmonary artery catheters | 85.1% | 88.6% | 0.301 |
| Fiberoptic bronchoscopy | 89.3% | 87.6% | 0.629 |
| CICU physician leadership (valid n=517) | | | 0.9848 |
| Cardiologist | 9.1% | 12.4% | |
| Cardiologist-intensivist ^s | 9.9% | 8.1% | |
| Cardiologist with ≥ 10 years of ICU focus | 8.3% | 7.6% | |
| General intensivist | 25.6% | 26.0% | |
| Joint cardiologist- intensivist leadership | 38.8% | 33.6% | |
| Other | 6.6% | 10.6% | |
| Missing | 1.7% | 1.8% | |
| Onsite Critical Care Physician (valid n=517) | 89.3% | 90.4% | 0.711 |
| Cardiologist-Intensivist^s in CICU (valid n=517) | 14.9% | 14.6% | 0.950 |
| Plan to hire Cardiologist-Intensivist?^s (valid n=433) | 11.0% | 9.3% | 0.616 |
| ICU role with critically ill CICU patients (valid n=517) | | | 0.772 |
| Cardiology and ICU co-management | 42.2% | 45.5% | |
| Cardiologist management with ICU consultation as needed | 30.6% | 25.8% | |
| Cardiac-intensivist ^s manages the patient | 0% | 0.8% | |
| ICU management with cardiology consultation | 21.5% | 21.8% | |
| No intensivist available | 5.8% | 6.3% | |
| Lowest nurse: patient ratio (valid n=508) | | | 0.883 |
| 1:1 | 77.1% | 76.7% | |
| 1:2 | 19.5% | 19.0% | |
| 1:3 | 3.4% | 4.4% | |
| CICU involved in education (valid n=508) | | | |
| Cardiology speciality fellows | 39.1% | 39.0% | 0.991 |
| Internal medicine resident | 63.0% | 61.5% | 0.847 |
| Non-medicine residents | 43.5% | 44.4% | 0.912 |
| Medical students | 73.9% | 76.5% | 0.716 |
| Advanced practice providers | 63.0% | 54.0% | 0.270 |
| Critical care intensivists | 19.6% | 25.1% | 0.429 |
| Cardiac critical care subspecialty program? (valid n=504) | | | 0.864 |
| Yes | 8.5% | 6.0% | |
| In the process of establishing a program | 0.0% | 0.8% | |
| Our institution is considering a program | 1.7% | 3.1% | |
| No | 89.8% | 90.2% | |

| | | | |
|--|-------|-------|-------|
| Aware of the AHA CICU position paper (n=503) | 9.3% | 11.9% | 0.431 |
| NSTE ACS CICU admissions (valid n=499) | | | 0.890 |
| ≥90% | 12.7% | 12.9% | |
| 50-89% | 22.0% | 19.7% | |
| 11-49% | 23.7% | 25.7% | |
| ≤10% | 18.6% | 23.4% | |
| Don't Know | 22.9% | 18.4% | |
| NSTE ACS CICU admission factors (valid n=422) | | | |
| Goals of care | 32.3% | 33.4% | 0.837 |
| Positive troponin | 32.3% | 27.9% | 0.392 |
| CICU bed availability | 33.3% | 32.5% | 0.878 |
| Clinical scoring systems | 24.2% | 26.6% | 0.637 |
| Institutional policies and procedures | 44.4% | 41.2% | 0.565 |
| Clinical acuity | 91.9% | 94.7% | 0.299 |
| Needs for CICU restricted therapies | 85.9% | 85.4% | 0.919 |
| Level 1 CICU hospital | 11.6% | 10.6% | 0.728 |

* defined as a variety of attending physicians simultaneously being primarily responsible for patients; †defined as single dedicated physician or team primarily caring for all patients; ‡ Open units only §physician with dual cardiology and intensive care training; ||Limited to sites with <90% NSTE ACS admission rates

Abbreviations: AHA, American Heart Association; CICU: coronary intensive care unit; CSICU, cardiothoracic surgical intensive care unit; MICU, medical ICU; NSTE ACS, non ST-segment elevation acute coronary syndrome; PCI, percutaneous coronary intervention; SICU, surgical ICU.

Supplemental Table 3: Frequency of level 1 cardiac intensive care unit capabilities in all hospital and by hospital type

| Level 1 CICU Capabilities | All Hospitals (n=517) | Academic Tertiary (n=99) | Tertiary Non-Academic (n=108) | Community Hospital (n=310) | p value |
|---|------------------------------|---------------------------------|--------------------------------------|-----------------------------------|----------------|
| Diagnostic and therapeutic technologies (valid n=517) | | | | | |
| Invasive hemodynamic monitoring | 98.5% | 100.0% | 100.0% | 97.4% | 0.067 |
| Non-invasive mechanical ventilation | 90.9% | 93.9% | 97.2% | 87.7% | 0.007 |
| Mechanical ventilation | 98.6% | 99.0% | 99.1% | 98.4% | 0.823 |
| Transesophageal echocardiography | 95.4% | 97.0% | 96.3% | 94.5% | 0.524 |
| Pulmonary artery catheters | 87.8% | 97.0% | 91.7% | 83.5% | <0.001 |
| Therapeutic hypothermia | 90.7% | 99.0% | 92.6% | 87.4% | 0.002 |
| Continuous renal replacement therapy | 68.5% | 86.9% | 78.7% | 59.0% | <0.001 |
| Intra-aortic balloon pumps | 94.2% | 98.0% | 99.1% | 91.3% | 0.002 |
| Percutaneous or implantable VADs | 64.4 | 77.8 | 79.6 | 54.8 | <0.001 |
| Primary PCI 24/7 (valid n=502) | 96.8% | 100.0% | 98.1% | 95.3% | 0.047 |
| Cardiac-intensivists or joint cardiologist-intensivist CICU leadership | 43.3% | 47.4% | 48.1% | 40.3% | 0.2405 |
| Onsite Intensivist (valid n=517) | 90.1% | 96.0% | 94.4% | 86.8% | 0.007 |
| Nurse:patient ratio 1:1-2 (valid n=508) | 95.9% | 97.9% | 94.3% | 95.8% | 0.439 |
| Trainee education (valid n=508) | 46.5% | 95.8% | 45.3% | 31.4% | <0.001 |
| Level 1 CICU classification | 10.8% | 26.1% | 18.3% | 3.9% | <0.001 |

Abbreviations: CICU, coronary intensive care unit; PCI, percutaneous coronary intervention; VAD, ventricular assist devices; valid n=number of survey respondents

Supplemental Table 4: Cardiac intensive care unit organizational, staffing, and resources by coronary intensive care unit population

| Characteristics | All Hospital (n=571) | Mixed Units (=524) | CICU Only (N=47) | p value * |
|---|----------------------|--------------------|------------------|-----------|
| Hospital type | | | | <0.001 |
| Academic medical center | 19.3% | 16.0% | 55.3% | |
| Tertiary non-academic center | 19.8% | 20.4% | 12.8% | |
| Community hospital | 60.9% | 63.5% | 31.9% | |
| CICU Structure | | | | 0.009 |
| Open* | 73.6% | 75.0% | 57.4% | |
| Closed† | 26.4% | 25.0% | 42.6% | |
| Plan to transition to closed CICU[§] (valid n=420) | 8.8% | 8.4% | 14.8% | 0.256 |
| CICU population | | | | <0.001 |
| CICU only | 8.2% | 0.0% | 100.0% | |
| Mixed CICU and CSICU | 21.2% | 23.1% | 0.0% | |
| Mixed CICU and MICU | 32.2% | 35.1% | 0.0% | |
| Mixed general medical and surgical | 33.1% | 36.1% | 0.0% | |
| Other | 5.3% | 5.7% | 0.0% | |
| Onsite Services | | | | 0.004 |
| Primary PCI only | 23.1% | 25.0% | 2.1% | |
| Cardiac surgery only | 0.5% | 0.4% | 2.1% | |
| Primary PCI and cardiac Surgery | 74.1% | 72.1% | 95.7% | |
| Neither | 2.3% | 2.5% | 0.0% | |
| 24/7 Primary PCI (valid n=502) | 96.8% | 96.5% | 100.0% | 0.232 |
| CICU physician leadership (valid n=502) | | | | <0.001 |
| Cardiologist without ICU training | 11.6% | 10.3% | 26.8% | |
| Cardiologist-Intensivist | 8.5% | 8.4% | 9.8% | |
| Cardiologist with ≥ 10 years of ICU focus | 7.7% | 6.3% | 24.4% | |
| General Intensivist | 25.9% | 27.5% | 7.3% | |
| Joint cardiologist - intensivist leadership | 34.8% | 35.3% | 29.3% | |
| Other | 1.7% | 1.9% | 0.0% | |
| Missing | 59.7% | 10.3% | 2.4% | |
| Cardiac-intensivist CICU attending (valid n=517) | 14.7% | 14.5% | 17.1% | 0.655 |
| Looking to hire a cardiac-intensivist (valid n=433) | 9.7% | 8.8% | 21.2% | 0.020 |
| Onsite critical care physician (valid n=517) | 90.1% | 89.5% | 97.6% | 0.098 |
| ICU role with critically ill CICU patients (valid n=517) | | | | 0.768 |
| Cardiology and ICU co-management | 44.7% | 29.3% | 46.0% | |
| Cardiologist management with ICU consultation as needed | 26.9% | 24.2% | 58.5% | |
| Cardiac-intensivist manages the patient | 0.6% | 0.6% | 0% | |
| ICU management with cardiology consultation | 21.7% | 22.9% | 7.3% | |
| No intensivist available | 6.2% | 6.3% | 4.9% | |
| Lowest CICU nurse:patient ratio (valid n=508) | | | | 0.944 |
| 1:1 | 76.8% | 76.9% | 75.0% | |

| | | | | |
|---|-------|--------|-------|--------|
| 1:2 | 19.1% | 19.0% | 20.0% | |
| 1:3 | 4.1% | 4.1% | 5.0% | |
| CICU involved in education (valid n=508) | | | | |
| Cardiology specialty fellows | 39.1% | 34.2% | 71.0% | <0.001 |
| Internal medicine resident | 61.8% | 60.9% | 67.7% | 0.465 |
| Non-medicine residents | 44.2% | 42.1% | 58.1% | 0.095 |
| Medical students | 76.0% | 76.2% | 74.2% | 0.804 |
| Advanced practice providers | 55.8% | 55.9% | 54.8% | 0.6803 |
| Critical care intensivists | 24.0% | 21.3% | 41.9% | 0.012 |
| Critical care cardiology subspecialty training program (valid n=504) | | | | <0.001 |
| Yes | 6.5% | 5.8% | 15.4% | |
| In the process of establishing a program | 0.6% | 0.0% | 7.7% | |
| Our institution is considering a program | 2.8% | 2.4% | 7.7% | |
| No | 90.1% | 91.8% | 69.2% | |
| Aware of the AHA position paper? (valid n=503) | 11.3% | 9.7% | 30.8% | <0.001 |
| CICUs goal level (valid n=55) | | | | 0.902 |
| Level 1 | 61.8% | 58.1% | 75.0% | |
| Level 2 | 3.6% | 4.7% | 0.0% | |
| Level 3 | 3.6% | 4.7% | 0.0% | |
| Don't Know | 30.9% | 32.6% | 25.0% | |
| CICUs current level (valid n=55) | | | | 0.373 |
| Level 1 | 52.7% | 46.5% | 75.0% | |
| Level 2 | 10.9% | 14.0% | 0.0% | |
| Level 3 | 3.6% | 4.7% | 0.0% | |
| Don't Know | 32.7% | 34.9% | 25.0% | |
| Has the paper changed your CICUs planning? (valid n=55) | 45.5% | 46.5% | 41.7% | 0.766 |
| NSTE ACS CICU admissions (valid n=499) | | | | 0.205 |
| ≥90% | 12.8% | 12.4% | 17.9% | |
| 50-89% | 20.2% | 819.3% | 30.8% | |
| 11-49% | 25.3% | 25.9% | 17.9% | |
| ≤10% | 22.2% | 22.2% | 23.1% | |
| Don't know | 19.4% | 20.2% | 10.3% | |
| NSTE ACS CICU admission factors[#] (valid n=422) | | | | |
| Goals of care (ex: do not resuscitate status) | 33.2% | 32.4% | 43.3% | 0.220 |
| Positive troponin | 28.9% | 28.6% | 33.3% | 0.579 |
| CICU bed availability | 32.7% | 31.4% | 50.0% | 0.036 |
| Clinical scoring systems | 26.1% | 26.5% | 20.0% | 0.432 |
| Institutional policies or procedures | 41.9% | 42.1% | 40.0% | 0.823 |
| Clinical acuity | 94.1% | 93.9% | 96.7% | 1.000 |
| Need for CICU restricted therapies | 85.5% | 86.5% | 73.3% | 0.059 |
| Diagnostic and therapeutic technologies (valid n=517) | | | | |
| Non-invasive mechanical ventilation | 90.9% | 90.5% | 95.1% | 0.568 |
| Mechanical ventilation | 98.6% | 98.7% | 97.6% | 0.441 |
| Intra-aortic balloon pumps | 94.2% | 94.5% | 90.2% | 0.285 |
| Percutaneous ventricular assist devices | 56.5% | 54.4% | 80.5% | 0.001 |
| Implantable ventricular assist devices | 41.2% | 39.7% | 58.5% | 0.019 |

| | | | | |
|--|--------------|--------------|--------------|--------------|
| Therapeutic hypothermia | 90.7% | 90.3% | 95.1% | 0.3114 |
| Hemodialysis | 94.8% | 94.7% | 95.1% | 0.9178 |
| Continuous renal replacement therapy | 68.5% | 67.4% | 80.5% | 0.084 |
| Temporary transvenous pacing | 98.1% | 98.3% | 95.1% | 0.1542 |
| Pericardiocentesis | 91.5% | 91.4% | 92.7% | 0.7755 |
| Transesophageal echocardiography | 95.4% | 95.4% | 95.1% | 0.9404 |
| Invasive hemodynamic monitoring | 98.5% | 98.3% | 100.0% | 0.4033 |
| Pulmonary artery catheters | 87.8% | 87.2% | 95.1% | 0.1364 |
| Fiberoptic bronchoscopy | 88.0% | 88.0% | 87.8% | 0.9668 |
| Level 1 CICU hospital (valid n=571) | 11.6% | 11.6% | 10.6% | 0.837 |

* p value for comparisons across unit types †defined as a variety of attending physicians simultaneously being primarily responsible for patients; ‡defined as single dedicated physician or team primarily caring for all patients; § Open units only; || physician with dual cardiology and intensive care training; Limited to sites who responded yes to AHA position paper question; #Limited to sites with <90% NSTEMI ACS admission rates

Abbreviations: AHA, American Heart Association; CICU: coronary intensive care unit; CSICU, cardiothoracic surgical intensive care unit; MICU, medical ICU; NSTEMI ACS, non ST-segment elevation acute coronary syndrome; PCI, percutaneous coronary intervention; SICU, surgical ICU

Supplemental Figure 1: Differences between dedicated coronary intensive care units and mixed intensive care units

