# Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

# Supplementary Appendix

**American Heart Association Get With the Guidelines-Resuscitation (formerly the National Registry of Cardiopulmonary Resuscitation) Investigators**


Besides the author Paul S. Chan, MD, MSc, members of GWTG-Resuscitation include:


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**Figure S1.** Derivation of the Study Cohort
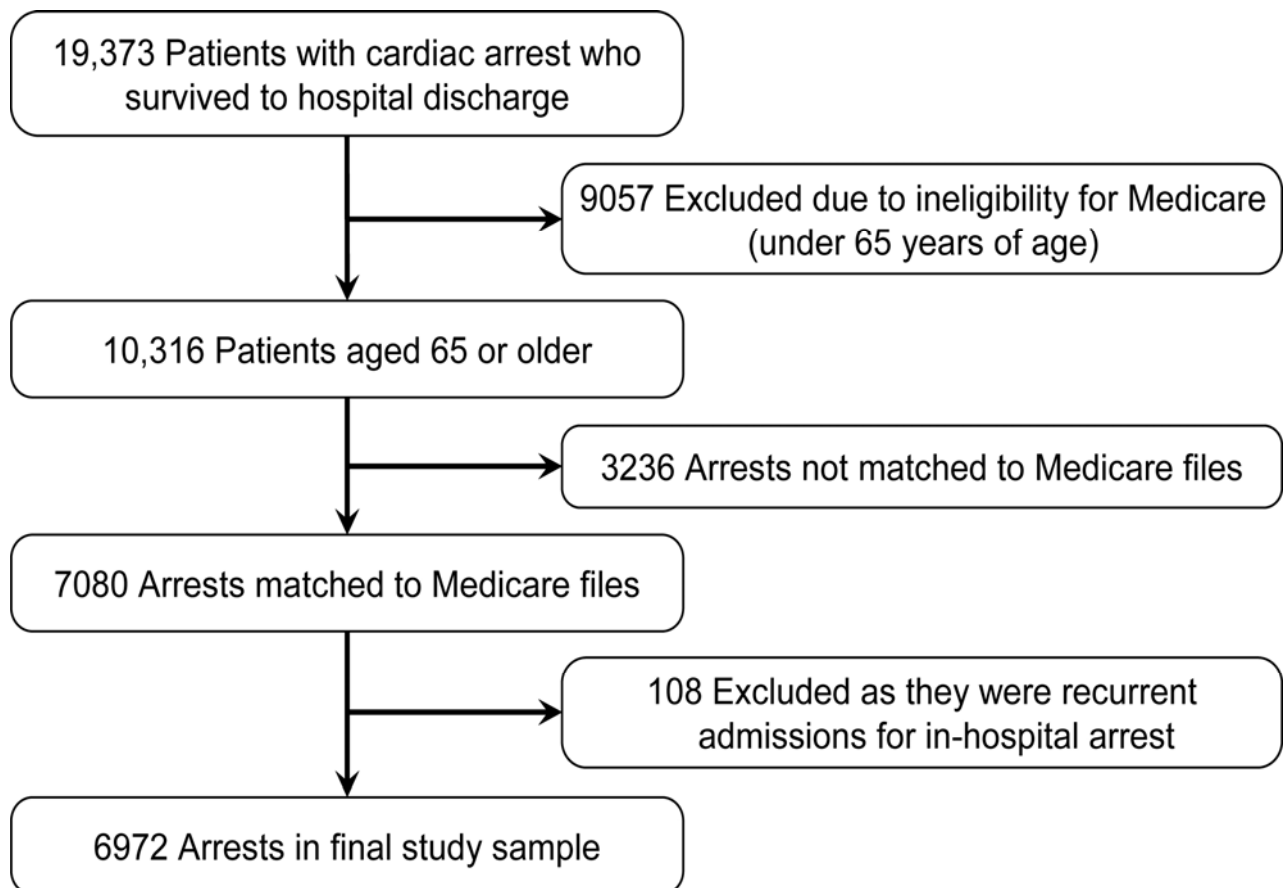
**Figure S2.** Trends in 1-Year Risk-Adjusted Survival by Cardiac Arrest Rhythm.* No significant survival trend was observed for either rhythm group.
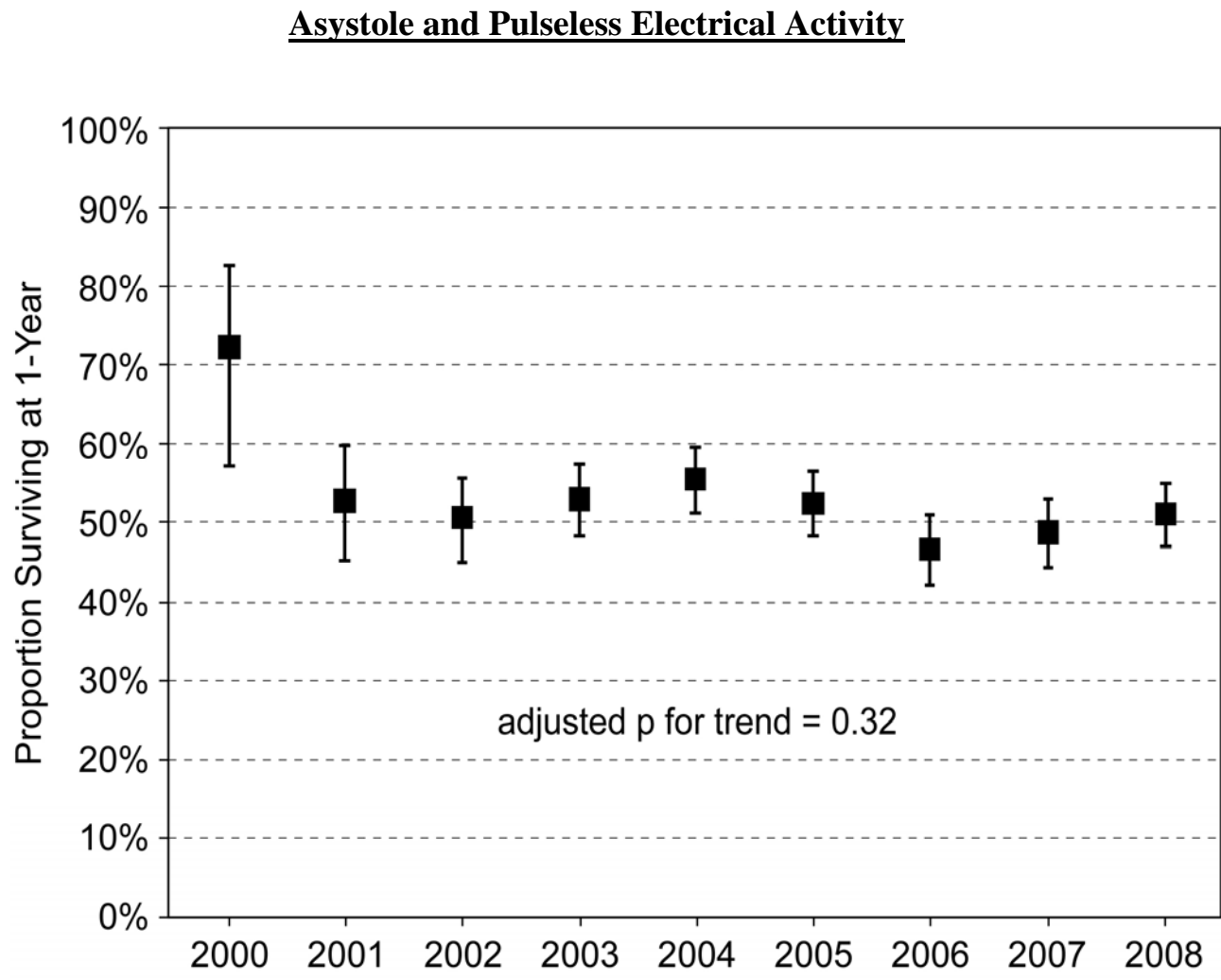
## Asystole and Pulseless Electrical Activity



* Multivariable hierarchical model adjusted for hospital site and the variables listed in Table S1.

**Figure S2** (continued).
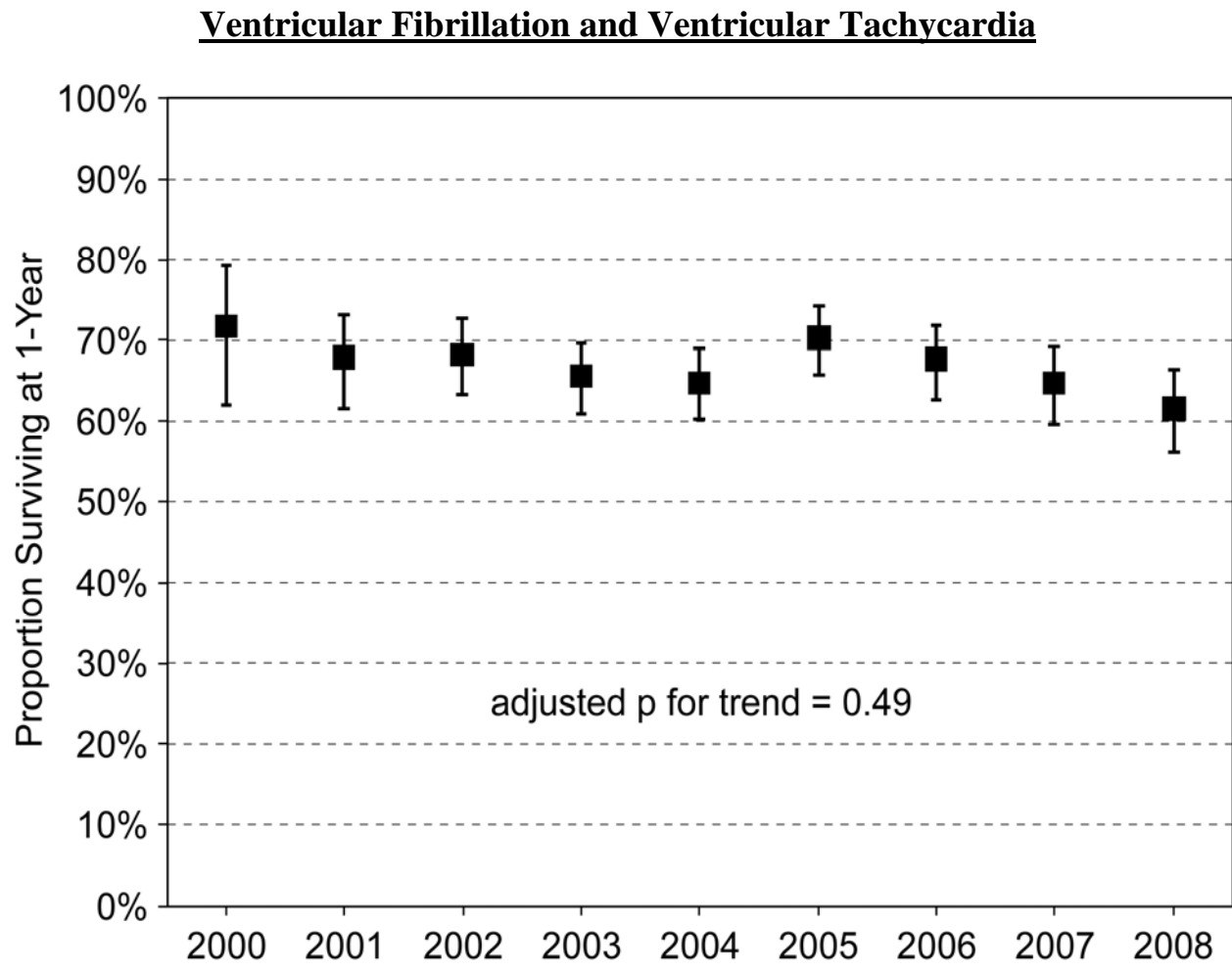
### Ventricular Fibrillation and Ventricular Tachycardia



\* Multivariable hierarchical model adjusted for hospital site and the variables listed in Table S1.

**Figure S3.** Kaplan-Meier Estimates of Freedom from Readmission Among Survivors of In-

Hospital Cardiac Arrest, Overall and by Discharge Neurological Status (CPC Score).
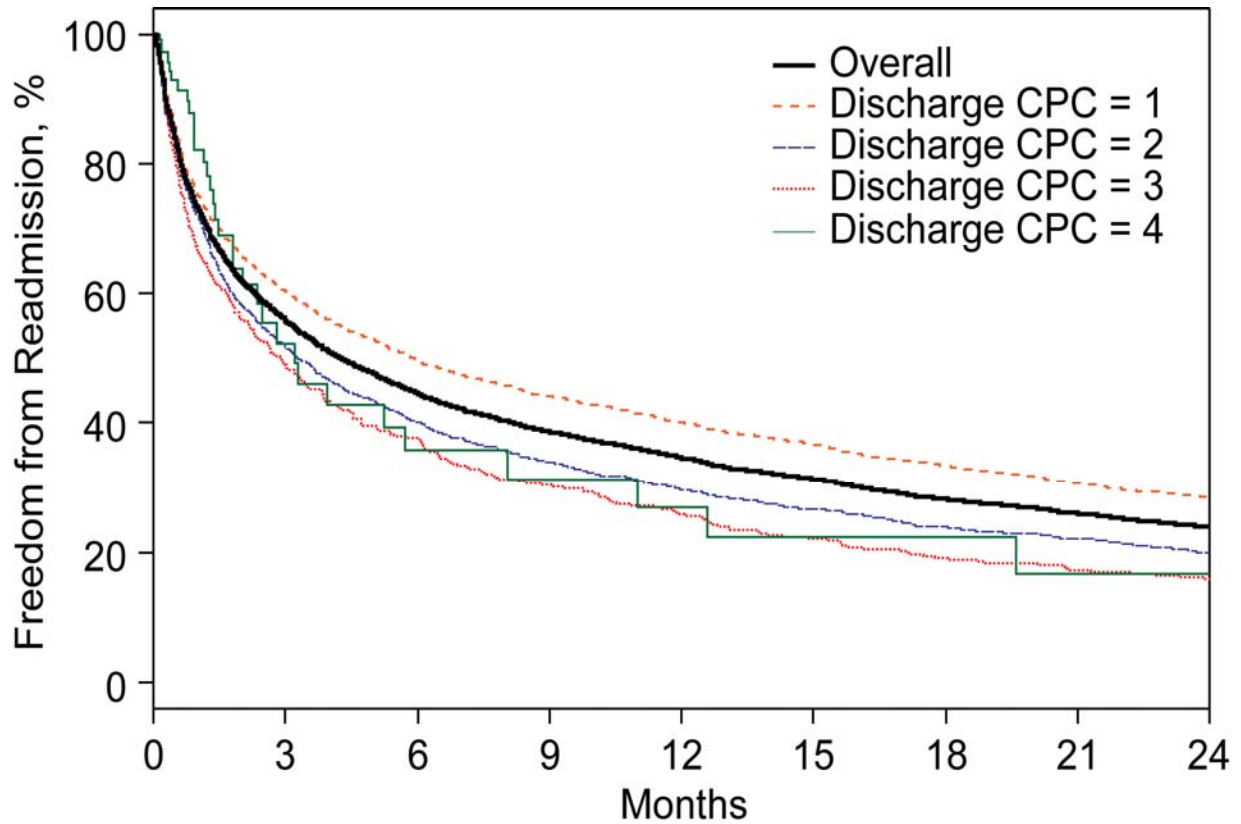


| Time (Months) | 1 | 3 | 6 | 12 | 18 | 24 |
|---|---|---|---|---|---|---|
| Overall, % | 73.3 | 55.6 | 44.4 | 34.4 | 28.1 | 23.8 |
| Discharge CPC = 1 | 75.2 | 60.0 | 49.4 | 39.9 | 33.2 | 28.4 |
| Discharge CPC = 2 | 72.0 | 51.4 | 39.9 | 29.5 | 23.7 | 19.8 |
| Discharge CPC = 3 | 66.6 | 48.5 | 36.9 | 25.7 | 18.9 | 15.7 |
| Discharge CPC = 4 | 82.3 | 52.4 | 35.7 | 26.8 | 22.3 | 16.8 |

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**Table S1**. Baseline Characteristics For Patients Matched and Not Matched to Medicare Files

| Characteristic | Patients Matched (n = 6972) | Patients Not Matched (n = 3236) | Standardized Difference* |
|---|---|---|---|
| Demographic characteristics | | | |
|   Age — yr | 75.8 ± 7.0 | 75.2 ± 7.0 | 9.1 |
|   Male sex, no. (%) | 3872 (55.5) | 1890 (58.4) | 5.8 |
|   Race, no. (%)† | | | |
|     White | 5634 (85.7) | 2396 (82.8) | Reference |
|     Black | 778 (11.8) | 365 (12.6) | 2.4 |
|     Other | 164 (2.5) | 132 (4.6) | 11.2 |
| Cardiac arrest characteristics, no. (%) | | | |
|   After hours (11:00 pm–6:59 am) | 1763 (25.3) | 837 (26.3) | 1.4 |
|   Weekend | 1908 (27.4) | 893 (27.6) | 0.5 |
|   Hospital-wide response activated | 5432 (77.9) | 2556 (79.0) | 2.6 |
|   Use of automated external defibrillator | 706 (10.1) | 340 (10.5) | 1.3 |
|   Initial cardiac arrest rhythm | | | |
|     Asystole | 1707 (24.5) | 865 (26.7) | Reference |
|     Pulseless electrical activity | 2031 (29.1) | 958 (29.6) | 1.0 |
|     Pulseless ventricular tachycardia | 1109 (15.9) | 521 (16.1) | 0.5 |
|     Ventricular fibrillation | 2125 (30.5) | 892 (27.6) | 6.4 |
| CPC score at discharge, no. (%)‡ | | | |
|   1 (mild to no neurological disability) | 2943 (48.1) | 1277 (46.5) | Reference |
|   2 (moderate neurological disability) | 2097 (34.3) | 902 (32.9) | 3.0 |
|   ≥3 (severe neurological disability or coma) | 1074 (17.6) | 565 (20.6) | 7.7 |
| Preexisting conditions, no. (%) | | | |
|   Acute stroke | 249 (3.6) | 115 (3.6) | 0.1 |
|   Baseline depression in CNS function | 736 (10.6) | 293 (9.1) | 5.1 |
|   Diabetes mellitus | 2262 (32.4) | 1043 (32.2) | 0.5 |
|   Heart failure during admission | 1625 (23.3) | 686 (21.2) | 5.1 |
|   Heart failure prior to admission | 1848 (26.5) | 800 (24.7) | 4.1 |
|   Hepatic insufficiency | 143 (2.1) | 78 (2.4) | 2.4 |
|   Hypotension | 1313 (18.8) | 588 (18.2) | 1.7 |
|   Major trauma | 113 (1.6) | 62 (1.9) | 2.2 |
|   Metabolic or electrolyte abnormality | 770 (11.0) | 364 (11.2) | 0.7 |
|   Metastatic or hematologic malignancy | 518 (7.4) | 222 (6.9) | 2.2 |
|   Myocardial infarction during admission | 1897 (27.2) | 842 (26.0) | 2.7 |
|   Myocardial infarction prior to admission | 1805 (25.9) | 742 (22.9) | 6.9 |
|   Pneumonia | 725 (10.4) | 291 (9.0) | 4.8 |
|   Renal insufficiency | 1836 (26.3) | 743 (23.0) | 7.8 |
|   Respiratory insufficiency | 2368 (34.0) | 1038 (32.1) | 4.0 |
|   Septicemia | 473 (6.8) | 213 (6.6) | 0.8 |
| Interventions in place, no. (%) | | | |
|   Mechanical ventilation | 1246 (17.9) | 564 (17.4) | 1.2 |
|   Dialysis | 136 (2.0) | 58 (1.8) | 1.3 |
|   Preexisting implantable cardioverter-defibrillator | 109 (1.6) | 51 (1.6) | 0.0 |

Abbreviations: CNS, central nervous system; and CPC, Cerebral Performance Category.

* Due to the large sample size, a standardized difference of >10 was used to denote significant differences between groups

† Race was missing for 396 patients who matched and 343 patients who did not match.
‡ CPC score was missing for 858 patients who matched and 492 patients who did not match.

**Table S2.** Discharge Destination by Patient Subgroups

| | | HOME | | INPATIENT | | | Hospice |
|---|---|---|---|---|---|---|---|
| | | **Self-care** | **Home Health** | **Skilled Nursing** | **Rehabilitation** | **Other** | **Hospice** |
| **Age** | 65 to 74 | 31.9% | 14.8% | 20.4% | 28.6% | 0.6% | 3.7% |
| | 75 to 84 | 21.7% | 14.0% | 32.3% | 26.6% | 0.4% | 5.0% |
| | ≥ 85 | 15.8% | 13.6% | 41.6% | 20.6% | 0.4% | 8.0% |
| **Sex** | Men | 28.3% | 14.3% | 25.3% | 27.2% | 0.6% | 4.4% |
| | Women | 22.4% | 14.4% | 31.4% | 26.3% | 0.3% | 5.3% |
| **Race** | White | 26.7% | 14.3% | 27.9% | 26.1% | 0.4% | 4.7% |
| | Black | 18.9% | 12.7% | 31.8% | 32.0% | 0.3% | 4.4% |
| | Other | 21.3% | 18.9% | 20.7% | 31.1% | 0.6% | 7.3% |
| **Initial cardiac arrest rhythm** | Asystole | 20.6% | 12.9% | 30.7% | 29.9% | 0.6% | 5.3% |
| | Pulseless Electrical Activity | 17.6% | 13.9% | 31.9% | 29.6% | 0.5% | 6.4% |
| | Ventricular Fibrillation | 35.0% | 14.7% | 23.6% | 23.6% | 0.4% | 2.8% |
| | Pulseless Ventricular Tachycardia | 30.3% | 16.5% | 25.1% | 22.9% | 0.5% | 4.8% |
| **CPC score at discharge** | 1 (mild to no neurological disability) | 39.0% | 19.8% | 19.3% | 20.3% | 0.4% | 1.2% |
| | 2 (moderate neurological disability) | 17.1% | 12.8% | 35.7% | 30.0% | 0.4% | 4.0% |
| | 3 (severe neurological disability) | 5.2% | 5.0% | 41.4% | 36.1% | 0.2% | 12.1% |
| | 4 (coma or vegetative state) | 6.7% | 2.1% | 21.0% | 33.3% | 1.0% | 35.9% |

**Table S3**. Adjusted Associations between Patient Characteristics and 1-Year Survival, Full Model Results

| Variable | Adjusted Rate Ratio (95% CI) | P Value |
|---|---|---|
| Age | | |
|    65 to 74 yr | 1.00 [Reference] | — |
|    75 to 84 yr | 0.92 (0.88-0.96) | <0.001 |
|    ≥85 yr | 0.78 (0.73-0.84) | <0.001 |
| Sex | | |
|    Female | 1.04 (1.00-1.08) | 0.03 |
|    Male | 1.00 [Reference] | |
| Race | | |
|    White | 1.00 [Reference] | — |
|    Black | 0.87 (0.81-0.95) | 0.001 |
|    Other | 1.04 (0.90-1.20) | 0.63 |
| Initial cardiac arrest rhythm | | |
|    Pulseless electrical activity | 1.00 [Reference] | — |
|    Asystole | 1.02 (0.96-1.09) | 0.44 |
|    Pulseless ventricular tachycardia | 1.02 (0.95-1.09) | 0.60 |
|    Ventricular fibrillation | 1.09 (1.04-1.15) | 0.001 |
| CPC score at discharge | | |
|    1 (mild to no neurological disability) | 1.00 [Reference] | — |
|    2 (moderate neurological disability) | 0.84 (0.80-0.88) | <0.001 |
|    3 (severe neurological disability) | 0.58 (0.52-0.65) | <0.001 |
|    4 (coma or vegetative state) | 0.14 (0.09-0.23) | <0.001 |
| Principal reason for index admission | | |
|    Acute respiratory failure | 0.86 (0.76-0.98) | 0.03 |
|    Cardiac arrest | 1.06 (0.94-1.20) | 0.36 |
|    Coronary artery disease | 1.08 (1.02-1.15) | 0.01 |
|    Heart failure | 0.86 (0.77-0.96) | 0.01 |
|    Malignant and metastatic cancer | 0.84 (0.72-0.97) | 0.02 |
|    Myocardial infarction or ischemia | 1.00 [Reference] | — |
|    Other cardiovascular diagnosis | 1.04 (0.98-1.10) | 0.17 |
|    Other pulmonary diagnosis | 0.79 (0.70-0.89) | <0.001 |
|    Renal disease | 0.82 (0.70-0.97) | 0.02 |
|    Other | 0.98 (0.92-1.05) | 0.57 |
| Preexisting conditions | | |
|    Acute stroke | 0.91 (0.80-1.04) | 0.18 |
|    Baseline depression in CNS function | 0.97 (0.89-1.05) | 0.43 |
|    Diabetes mellitus | 0.94 (0.90-0.98) | 0.003 |
|    Heart failure during admission | 0.92 (0.87-0.97) | 0.003 |
|    Heart failure prior to admission | 0.85 (0.80-0.90) | <0.001 |
|    Hepatic insufficiency | 1.01 (0.86-1.19) | 0.91 |
|    Hypotension | 1.03 (0.97-1.08) | 0.36 |
|    Major trauma | 1.06 (0.90-1.24) | 0.50 |
|    Metabolic or electrolyte abnormality | 0.91 (0.84-0.99) | 0.03 |
|    Metastatic or hematologic malignancy | 0.77 (0.69-0.86) | <0.001 |
|    Myocardial infarction during admission | 1.04 (1.00-1.09) | 0.07 |
|    Myocardial infarction prior to admission | 1.00 (0.96-1.04) | 0.90 |
|    Pneumonia | 0.86 (0.79-0.94) | 0.001 |
|    Respiratory insufficiency | 0.94 (0.90-0.98) | 0.01 |
|    Renal insufficiency | 0.84 (0.79-0.89) | <0.001 |
|    Septicemia | 0.79 (0.70-0.89) | <0.001 |

Abbreviations: CNS, central nervous system; and CPC, Cerebral Performance Category .

**Table S4.** Temporal Trends in 1-Year Unadjusted Survival, Stratified by Rhythm Type

|  | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| **Asystole / PEA\*** | | | | | | | | | |
| No. Alive at 1 Year | 34 | 93 | 170 | 245 | 283 | 293 | 236 | 257 | 316 |
| No. Discharged | 47 | 176 | 336 | 462 | 509 | 558 | 505 | 527 | 618 |
| Survival Rate | 72.3% | 52.8% | 50.6% | 53.0% | 55.6% | 52.5% | 46.7% | 48.8% | 51.1% |
| **VF / Pulseless VT\*\*** | | | | | | | | | |
| No. Alive at 1 Year | 76 | 167 | 258 | 296 | 306 | 320 | 272 | 248 | 210 |
| No. Discharged | 106 | 246 | 378 | 451 | 472 | 455 | 402 | 383 | 341 |
| Survival Rate | 71.7% | 67.9% | 68.3% | 65.6% | 64.8% | 70.3% | 67.7% | 64.8% | 61.6% |

Abbreviations: PEA, pulseless electrical activity; VF, ventricular fibrillation; and VT, ventricular tachycardia
\* $P$ for trend = 0.32
\*\* $P$ for trend = 0.49

**Table S5.** Risk-Adjusted Rates of 2-Year Survival for Pre-Specified Subgroups*

| Subgroup | Unadjusted Survival, % | Risk-Adjusted Survival, % | Adjusted Rate Ratio (95% CI) | *P* Value |
|---|---|---|---|---|
| Age | | | | |
| 65 to 74 yr | 55.8 | 55.8 | 1.00 [Reference] | — |
| 75 to 84 yr | 46.9 | 48.6 | 0.87 (0.83-0.91) | <0.001 |
| ≥85 yr | 35.7 | 40.2 | 0.72 (0.66-0.79) | <0.001 |
| Sex | | | | |
| Female | 49.7 | 52.5 | 1.06 (1.01-1.11) | 0.03 |
| Male | 49.5 | 49.5 | 1.00 [Reference] | — |
| Race | | | | |
| White | 51.2 | 51.2 | 1.00 [Reference] | — |
| Black | 36.1 | 45.6 | 0.89 (0.81-0.97) | 0.009 |
| Other | 44.5 | 51.7 | 1.01 (0.86-1.20) | 0.87 |
| Initial cardiac arrest rhythm | | | | |
| Pulseless electrical activity | 41.8 | 41.8 | 1.00 [Reference] | — |
| Asystole | 43.8 | 41.8 | 1.00 (0.94-1.07) | 0.94 |
| Pulseless ventricular tachycardia | 50.1 | 41.4 | 0.99 (0.91-1.07) | 0.75 |
| Ventricular fibrillation | 61.6 | 46.4 | 1.11 (1.04-1.18) | 0.001 |
| CPC score at discharge | | | | |
| 1 (mild to no neurological disability) | 63.6 | 63.6 | 1.00 [Reference] | — |
| 2 (moderate neurological disability) | 44.7 | 52.1 | 0.82 (0.77-0.86) | <0.001 |
| 3 (severe neurological disability) | 26.3 | 33.7 | 0.53 (0.46-0.60) | <0.001 |
| 4 (coma or vegetative state) | 7.7 | 9.5 | 0.15 (0.10-0.24) | <0.001 |

Abbreviations: CI, confidence interval; and CPC, Cerebral Performance Category.
* Models adjusted for the variables listed in Table S1.

**Table S6.** Adjusted Associations between Select Patient Characteristics and 2-Year Readmission*

| Variable | Adjusted Hazard Ratio (95% CI) | P Value |
|---|---|---|
| Age | | |
| 65 to 74 yr | 1.00 [Reference] | — |
| 75 to 84 yr | 1.05 (0.98-1.13) | 0.16 |
| ≥85 yr | 1.09 (0.97-1.21) | 0.13 |
| Sex | | |
| Female | 1.10 (1.03-1.17) | 0.006 |
| Male | 1.00 [Reference] | — |
| Race | | |
| White | 1.00 [Reference] | — |
| Black | 1.18 (1.05-1.32) | 0.006 |
| Other | 1.00 (0.79-1.26) | 0.99 |
| Initial cardiac arrest rhythm | | |
| Pulseless electrical activity | 1.00 [Reference] | — |
| Asystole | 0.97 (0.89-1.06) | 0.50 |
| Pulseless ventricular tachycardia | 1.02 (0.91-1.13) | 0.76 |
| Ventricular fibrillation | 0.92 (0.84-1.01) | 0.09 |
| CPC score at discharge | | |
| 1 (mild to no neurological disability) | 1.00 [Reference] | — |
| 2 (moderate neurological disability) | 1.21 (1.11-1.31) | <0.001 |
| 3 (severe neurological disability) | 1.28 (1.13-1.44) | 0.001 |
| 4 (coma or vegetative state) | 0.87 (0.59-1.28) | 0.48 |
| Preexisting conditions | | |
| Diabetes mellitus | 1.21 (1.13-1.30) | <0.001 |
| Heart failure prior to admission | 1.25 (1.15-1.35) | <0.001 |
| Metastatic or hematologic malignancy | 1.15 (1.00-1.32) | 0.05 |
| Renal insufficiency | 1.31 (1.21-1.43) | <0.001 |

Abbreviations: CI, confidence interval; and CPC, Cerebral Performance Category.
* Models adjusted for the variables listed in Table S1.