# Supplementary Online Content

Roth GA, Emmons-Bell S, Alger HM, et al. Trends in patient characteristics and COVID-19 in-hospital mortality in the United States during the COVID-19 pandemic. *JAMA Netw Open*. 2021;4(5):e218828. doi:10.1001/jamanetworkopen.2021.8828

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

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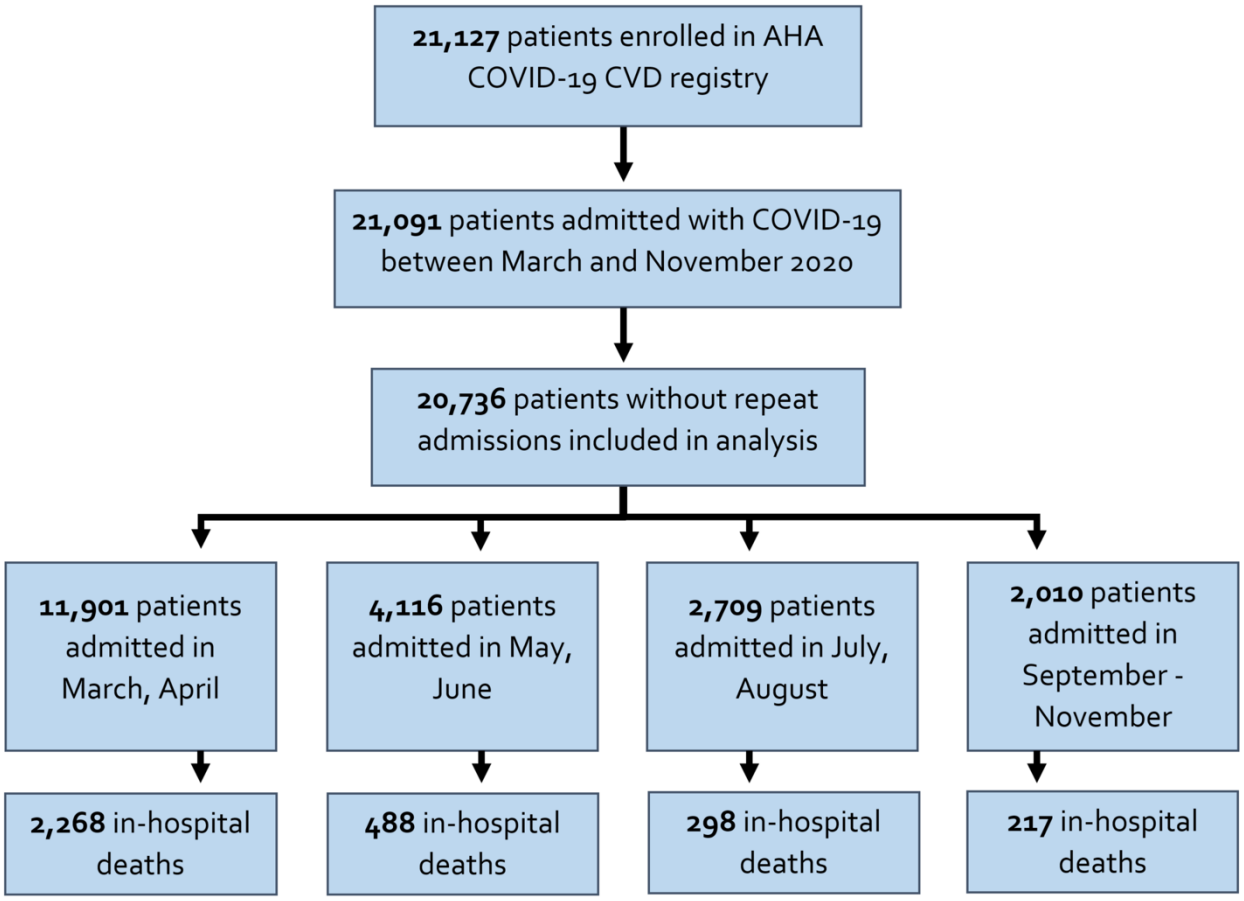
**eFigure. Study Flowchart of Patients With COVID-19 Enrolled in AHA GWTG Registry**

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**eTable 1. Missingness by Variable**

| | **March, April** (n=11,901) | **May, June** (n=4,116) | **July, August** (n=2,709) | **September, November** (n=2,010) | **Total** (n=20,736) |
|---|---|---|---|---|---|
| Women | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Age | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| **Survival status** | | | | | |
| In-hospital death | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| **Past medical history** | | | | | |
| CABG or PCI | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Cancer | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Cerebrovascular disease | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Chronic kidney disease | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Diabetes | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Heart failure | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Hypertension | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |

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| | | | | | |
|---|---|---|---|---|---|
| Pulmonary disease | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Smoking | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| **Admission Characteristics** | | | | | |
| BMI, kg/m$^2$ | 1,854 (15.6%) | 326 (7.9%) | 120 (4.4%) | 64 (3.2%) | 7,092 (11.4%) |
| O2 saturation, % | 1,239 (10.4%) | 182 (4.4%) | 37 (1.4%) | 16 (0.8%) | 4,422 (7.1%) |
| Supplemental O2 | 1,239 (10.4%) | 184 (4.5%) | 42 (1.6%) | 17 (0.8%) | 4,446 (7.1%) |
| Interstitial infiltrates | 1,028 (8.6%) | 376 (9.1%) | 453 (16.7%) | 212 (10.5%) | 6,207 (10%) |
| Respiratory rate | 770 (6.5%) | 70 (1.7%) | 32 (1.2%) | 25 (1.2%) | 2,691 (4.3%) |
| Heart rate | 698 (5.9%) | 62 (1.5%) | 28 (1%) | 8 (0.4%) | 2,388 (3.8%) |
| Systolic BP, mmHg | 724 (6.1%) | 134 (3.3%) | 170 (6.3%) | 44 (2.2%) | 3,216 (5.2%) |
| Creatinine, mg/dL | 868 (7.3%) | 135 (3.3%) | 75 (2.8%) | 55 (2.7%) | 3,399 (5.5%) |

Values represent number, and percent, of admissions with missing values for each covariate.

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**eTable 2. Length of Stay by Month and Age Group**

| Length of Stay (days) | March - April | May - June | July - August | September - November | Total |
|---|---|---|---|---|---|
| 18-50, mean (SD) | 8.7 (10.4) | 7.6 (10.1) | 7.3 (8.4) | 6.0 (6.1) | 8.0 (9.8) |
| 51-60, mean (SD) | 11.2 (12.9) | 10.1 (10.8) | 9.5 (11.0) | 7.6 (6.9) | 10.5 (11.9) |
| 61-70, mean (SD) | 12.4 (13.8) | 11.1 (11.3) | 11.0 (11.3) | 8.3 (7.7) | 11.5 (12.6) |
| 71-80, mean (SD) | 11.9 (12.8) | 11.2 (10.8) | 10.5 (10.1) | 8.3 (6.7) | 11.2 (11.7) |
| 81 plus, mean (SD) | 9.5 (9.2) | 9.7 (8.6) | 9.2 (7.6) | 7.6 (6.3) | 9.4 (8.7) |
| All ages, total days | 126,910 | 39,526 | 25,163 | 15,103 | 206,702 |

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## eTable 3. Univariate and Multivariate Association With In-Hospital Death

| | Univariate association with mortality | P-value, Univariate association with mortality | Multivariate association with mortality | P-value, multivariate association with mortality |
|---|---|---|---|---|
| Women | 0.72 (0.66 - 0.77) | <.001 | 0.74 (0.68 - 0.81) | <.001 |
| Age 18 - 25 | 0.16 (0.08 - 0.30) | <.001 | 0.26 (0.13 - 0.51) | <.001 |
| Age 26 - 30 | 0.31 (0.19 - 0.50) | <.001 | 0.45 (0.28 - 0.75) | <.01 |
| Age 31 - 35 | 0.34 (0.23 - 0.51) | <.001 | 0.43 (0.29 - 0.66) | <.001 |
| Age 36 - 40 | 0.46 (0.33 - 0.65) | <.001 | 0.54 (0.37 - 0.77) | <.001 |
| Age 41 - 45 | 0.44 (0.32 - 0.60) | <.001 | 0.44 (0.32 - 0.62) | <.001 |
| Age 46 - 50 | 0.81 (0.63 – 1.03) | .09 | 0.86 (0.66 - 1.12) | .26 |
| Age 51 - 55 | Reference category | N/A | Reference category | N/A |
| Age 56 - 60 | 1.24 (1.01 - 1.53) | .04 | 1.2 (0.96 - 1.51) | .11 |
| Age 61 - 65 | 1.43 (1.17 - 1.75) | <.01 | 1.35 (1.09 - 1.68) | <.01 |
| Age 66 - 70 | 2.19 (1.81 - 2.66) | <.001 | 1.99 (1.61 - 2.46) | <.001 |
| Age 71 - 75 | 2.82 (2.33 - 3.42) | <.001 | 2.71 (2.19 - 3.36) | <.001 |
| Age 76 - 80 | 3.38 (2.79 - 4.10) | <.001 | 3.41 (2.75 - 4.23) | <.001 |
| Age 81 - 85 | 3.73 (3.06 - 4.55) | <.001 | 4.21 (3.36 - 5.28) | <.001 |
| Age 86 - 90 | 4.62 (3.76 – 5.70) | <.001 | 5.16 (4.06 - 6.57) | <.001 |
| Age 91 - 95 | 4.95 (3.90 - 6.27) | <.001 | 5.65 (4.28 - 7.45) | <.001 |
| Age 96 - 110 | 4.70 (3.34 – 6.62) | <.001 | 5.07 (3.43 - 7.49) | <.001 |
| **Past medical history** | | | | |
| CABG or PCI | 1.83 (1.60 - 2.08) | <.001 | 1.08 (0.92 - 1.26) | .33 |
| Cancer | 1.63 (1.47 - 1.80) | <.001 | 1.25 (1.1 - 1.41) | <.001 |
| Cerebrovascular disease | 1.80 (1.63 – 1.99) | <.001 | 1.2 (1.05 - 1.37) | <.01 |
| Chronic kidney disease | 1.95 (1.77 - 2.15) | <.001 | 0.88 (0.77 - 1.01) | .06 |
| Diabetes | 1.46 (1.35 - 1.58) | <.001 | 1.1 (1 - 1.21) | .04 |
| Heart failure | 2.15 (1.94 - 2.34) | <.001 | 1.22 (1.07 - 1.38) | <.01 |
| Hypertension | 1.94 (1.79 - 2.10) | <.001 | 1.07 (0.96 - 1.19) | .24 |
| Pulmonary disease | 1.31 (1.20 - 1.44) | <.001 | 1.07 (0.96 - 1.2) | .22 |
| Smoking | 1.08 (0.93 - 1.25) | .32 | 1.11 (0.93 - 1.33) | .25 |
| **Admission characteristic** | | | | |
| BMI < 20, $kg/m^2$ | 1.03 (0.87 - 1.23) | .72 | 0.84 (0.69 - 1.03) | .09 |
| BMI 20 – 24.9, $kg/m^2$ | Reference category | N/A | Reference category | N/A |

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| | | | | |
|---|---|---|---|---|
| BMI 25 – 29.9, kg/m$^2$ | 0.84 (0.76 - 0.94) | <.01 | 1.01 (0.89 - 1.14) | .90 |
| BMI 30 – 34.9 , kg/m$^2$ | 0.70 (0.63 - 0.79) | <.001 | 1.08 (0.94 - 1.24) | .28 |
| BMI 35 – 39.9, kg/m$^2$ | 0.70 (0.61 - 0.80) | <.001 | 1.18 (1 - 1.4) | .05 |
| BMI 40 – 44.9, kg/m$^2$ | 0.67 (0.56 - 0.80) | <.001 | 1.18 (0.95 - 1.46) | .13 |
| BMI >= 45, kg/m$^2$ | 0.71 (0.59 - 0.84) | <.001 | 1.44 (1.16 - 1.79) | <.001 |
| O2 saturation <=70% | 7.79 (6.21 – 9.76) | <.001 | 6.91 (5.24 - 9.11) | <.001 |
| O2 saturation 71 - 85% | 3.45 (3.01 – 3.95) | <.001 | 3 (2.54 - 3.53) | <.001 |
| O2 saturation 86 - 93% | 1.65 (1.51 - 1.79) | <.001 | 1.5 (1.36 - 1.66) | <.001 |
| O2 saturation 94 – 100% | Reference category | N/A | Reference category | N/A |
| Supplemental O2, n (%) | 3.20 (2.97 - 3.46) | <.001 | 2.82 (2.56 - 3.1) | <.001 |
| Interstitial infiltrates | 2.22 (2.00 - 2.45) | <.001 | 1.58 (1.41 - 1.78) | <.001 |
| Respiratory rate <= 20 | Reference category | N/A | Reference category | N/A |
| Respiratory rate 21 - 25 | 1.69 (1.54 - 1.86) | <.001 | 1.37 (1.23 - 1.53) | <.001 |
| Respiratory rate 26 - 30 | 2.12 (1.89 - 2.38) | <.001 | 1.59 (1.39 - 1.82) | <.001 |
| Respiratory rate >30 | 3.44 (3.05 – 3.88) | <.001 | 2.08 (1.78 - 2.42) | <.001 |
| Heart rate <=100 | Reference category | N/A | Reference category | N/A |
| Heart rate 101 - 130 | 1.09 (1.00 - 1.18) | .04 | 1.3 (1.18 - 1.43) | <.001 |
| Heart rate >130 | 1.84 (1.55 - 2.20) | <.001 | 1.9 (1.52 - 2.36) | <.001 |
| Systolic BP <= 110 mmHg | 1.61 (1.42 - 1.81) | <.001 | 1.26 (1.09 - 1.45) | <.01 |
| Systolic BP 111 – 120 mmHg | Reference category | N/A | Reference category | N/A |
| Systolic BP 121 – 150 mmHg | 0.91 (0.82 – 1.02) | .12 | 0.9 (0.79 - 1.03) | .11 |
| Systolic BP > 150 mmHg | 0.97 (0.86 - 1.11) | .70 | 0.82 (0.71 - 0.96) | .01 |
| Creatinine <=1.5 mg/dL | Reference category | N/A | Reference category | N/A |
| Creatinine 1.6 - 2 mg/dL | 2.51 (2.23 – 2.83) | <.001 | 1.63 (1.42 - 1.88) | <.001 |
| Creatinine >2 mg/dl | 3.47 (3.18 - 3.80) | <.001 | 2.45 (2.17 - 2.76) | <.001 |

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Univariate association with mortality represents unadjusted odds ratios between each variable and inpatient mortality. Multivariate association represents adjusted odds ratios of our primary adjustment model reported in the paper.

**eTable 4. Counts of Inpatients and Deaths, and In-Hospital Mortality Rate, by Month**

| | Inpatients, number | Deaths, number | In-hospital mortality rate, percent |
|---|---|---|---|
| March | 5,039 | 1,077 | 21.4% |
| April | 6,862 | 1,191 | 17.4% |
| May | 2,574 | 312 | 12.1% |
| June | 1,542 | 176 | 11.4% |
| July | 1,549 | 175 | 11.3% |
| August | 1,160 | 123 | 10.6% |
| September | 739 | 95 | 12.9% |
| October | 910 | 99 | 10.9% |
| November | 361 | 23 | 6.4% |

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