

Table S1. Mortality Rates and Discharge Bias for Subgroup Analyses

| <b>Outcome measure</b>   | <b>Original cohort</b>       | <b>Mechanical ventilation subgroup</b> | <b>Severe sepsis subgroup</b> |
|--|------------------------------|--|-------------------------------|
| Observed in-hospital mortality %                                       | 9.6                          | 32.7                                   | 24.3                          |
| Observed 30-day mortality %  | 12.3                         | 32.6                                   | 27.3                          |
| Risk-adjusted hospital-specific in-hospital mortality %, mean $\pm$ SD | 9.6 $\pm$ 1.3                | 32.6 $\pm$ 0.9                         | 24.4 $\pm$ 2.5                |
| Risk-adjusted hospital-specific 30-day mortality %, mean $\pm$ SD      | 12.7 $\pm$ 1.5               | 32.8 $\pm$ 2.6                         | 27.9 $\pm$ 3.0                |
| Hospital-specific discharge bias %, mean $\pm$ SD (range)              | 3.2 $\pm$ 1.2<br>(-1.3, 6.6) | 0.2 $\pm$ 2.2<br>(-7.4, 5.4)           | 3.5 $\pm$ 2.3<br>(-4.6, 10.1) |

SD = standard deviation

Table S2. Discharge Bias by Hospital Characteristics (Univariable Associations) for Subgroup Analyses

| Hospital characteristic      | Mechanical ventilation subgroup |         | Severe sepsis subgroup      |         |
|------------------------------|---------------------------------|---------|-----------------------------|---------|
|                              | Mean bias <sup>a</sup> ± SD     | p-value | Mean bias <sup>a</sup> ± SD | p-value |
| Bed size                     |                                 |         |                             |         |
| <100 beds                    | 0.92 ± 2.86                     |         | 3.53 ± 1.56                 |         |
| 100-250 beds                 | 0.49 ± 1.86                     |         | 4.10 ± 1.99                 |         |
| >250 beds                    | -0.29 ± 2.44                    | 0.082   | 2.48 ± 2.58                 | 0.013   |
| Teaching status <sup>b</sup> |                                 |         |                             |         |
| Non-teaching                 | 0.47 ± 1.88                     |         | 3.87 ± 1.77                 |         |
| Small teaching               | 0.26 ± 1.96                     |         | 3.57 ± 1.98                 |         |
| Large teaching               | -0.10 ± 2.68                    | 0.34    | 2.87 ± 3.11                 | 0.098   |
| Ownership                    |                                 |         |                             |         |
| Non-profit                   | 0.35 ± 2.12                     |         | 3.53 ± 2.35                 |         |
| For profit                   | -1.09 ± 2.38                    | 0.075   | 3.25 ± 1.88                 | 0.69    |
| MSA size                     |                                 |         |                             |         |
| <100,000 or non-MSA          | 0.20 ± 1.60                     |         | 3.36 ± 1.28                 |         |
| 100,000 – 1 million          | -0.19 ± 1.94                    |         | 3.46 ± 1.71                 |         |
| >1 million                   | 0.43 ± 2.31                     | 0.30    | 3.52 ± 2.66                 | 0.85    |
| Medicaid penetration         |                                 |         |                             |         |
| Lowest tertile               | 0.77 ± 1.76                     |         | 3.53 ± 1.66                 |         |
| Middle tertile               | 0.30 ± 2.01                     |         | 3.72 ± 1.61                 |         |
| Highest tertile              | -0.45 ± 2.58                    | 0.034   | 3.23 ± 3.25                 | 0.60    |
| HMO penetration              |                                 |         |                             |         |
| Lowest tertile               | 0.33 ± 2.23                     |         | 3.71 ± 2.02                 |         |
| Middle tertile               | 0.33 ± 2.05                     |         | 3.94 ± 2.03                 |         |
| Highest tertile              | -0.03 ± 2.28                    | 0.53    | 2.78 ± 2.67                 | 0.111   |
| LTAC beds in HRR             |                                 |         |                             |         |
| 0                            | 1.02 ± 1.55                     |         | 4.57 ± 1.96                 |         |
| 1-200                        | -0.72 ± 1.75                    |         | 3.03 ± 1.26                 |         |
| >200                         | 0.52 ± 2.34                     | 0.61    | 3.56 ± 2.73                 | 0.65    |
| Hospice penetration in HRR   |                                 |         |                             |         |
| Lowest tertile               | -0.04 ± 1.45                    |         | 3.58 ± 1.57                 |         |
| Middle tertile               | 0.51 ± 2.16                     |         | 3.88 ± 1.79                 |         |
| Highest tertile              | -0.04 ± 2.39                    | 0.69    | 3.03 ± 2.88                 | 0.22    |

MSA = metropolitan statistical area size; HMO = health maintenance organization; LTAC = long-term acute care hospital; HRR = Dartmouth Atlas hospital referral region; SD = standard deviation

<sup>a</sup>Discharge bias is a percentage, defined as hospital-specific risk-adjusted 30-day minus in-hospital ICU mortality

<sup>b</sup>Teaching status categorized by resident-to-bed ratio (non-teaching 0, small teaching >0 to <0.25, large teaching ≥0.25)

Table S3. Mortality Rates and Discharge Bias for Sensitivity Analyses

| <b>Outcome measure</b>   | <b>Original cohort</b>       | <b>Sensitivity analysis 1<sup>a</sup></b> | <b>Sensitivity analysis 2<sup>b</sup></b> | <b>Sensitivity analysis 3<sup>c</sup></b> |
|--|------------------------------|---|---|---|
| Observed in-hospital mortality %                                       | 9.6                          | 9.6                                       | 9.4                                       | 9.0                                       |
| Observed 30-day mortality %  | 12.3                         | 12.3                                      | 11.9                                      | 12.3                                      |
| Risk-adjusted hospital-specific in-hospital mortality %, mean $\pm$ SD | 9.6 $\pm$ 1.3                | 9.4 $\pm$ 2.3                             | 9.1 $\pm$ 2.3                             | 9.1 $\pm$ 1.1                             |
| Risk-adjusted hospital-specific 30-day mortality %, mean $\pm$ SD      | 12.7 $\pm$ 1.5               | 12.7 $\pm$ 2.2                            | 12.2 $\pm$ 2.1                            | 12.7 $\pm$ 1.5                            |
| Hospital-specific discharge bias %, mean $\pm$ SD (range)              | 3.2 $\pm$ 1.2<br>(-1.3, 6.6) | 3.3 $\pm$ 1.6<br>(-3.4, 7.8)              | 3.2 $\pm$ 1.6<br>(-3.2, 7.8)              | 3.7 $\pm$ 1.1<br>(0.1, 6.7)               |

SD = standard deviation

<sup>a</sup>Sensitivity analysis 1 was done using the same cohort of patients as the primary analysis but without using predicted risk of death in risk-adjustment.

<sup>b</sup>Sensitivity analysis 2 was done using the primary cohort plus those patients excluded from the primary cohort because of missing MediQual Atlas predicted mortality risk scores.

<sup>c</sup>Sensitivity analysis 3 was done using the same cohort of patients as the primary analysis and with the same risk-adjustment variables, but only deaths that occurred in the hospital  $\leq$  30 days from admission were coded as in-hospital deaths

Table S4. Discharge Bias by Hospital Characteristics for Sensitivity Analyses

| Hospital characteristic      | Original cohort                |         | Sensitivity analysis 1 <sup>a</sup> |         | Sensitivity analysis 2 <sup>b</sup> |         | Sensitivity analysis 3 <sup>c</sup> |         |
|------------------------------|--------------------------------|---------|-------------------------------------|---------|-------------------------------------|---------|-------------------------------------|---------|
|                              | Mean bias <sup>d</sup><br>± SD | p-value | Mean bias <sup>d</sup><br>± SD      | p-value | Mean bias <sup>d</sup><br>± SD      | p-value | Mean bias <sup>d</sup><br>± SD      | p-value |
| Bed size <sup>e</sup>        |                                |         |                                     |         |                                     |         |                                     |         |
| <100 beds                    | 3.61 ± 1.15                    |         | 4.16 ± 1.44                         |         | 4.05 ± 1.46                         |         | 3.99 ± 1.12                         |         |
| 100-250 beds                 | 3.31 ± 1.03                    |         | 3.42 ± 1.33                         |         | 3.21 ± 1.29                         |         | 3.79 ± 0.90                         |         |
| >250 beds                    | 2.37 ± 1.33                    | <0.001  | 2.20 ± 1.77                         | <0.001  | 1.98 ± 1.59                         | <0.001  | 3.07 ± 1.06                         | <0.001  |
| Teaching status <sup>f</sup> |                                |         |                                     |         |                                     |         |                                     |         |
| Non-teaching                 | 3.40 ± 1.03                    |         | 3.75 ± 1.31                         |         | 3.64 ± 1.32                         |         | 3.81 ± 0.94                         |         |
| Small teaching               | 3.12 ± 1.06                    |         | 3.17 ± 1.45                         |         | 2.86 ± 1.43                         |         | 3.68 ± 0.99                         |         |
| Large teaching               | 2.63 ± 1.73                    | 0.006   | 2.51 ± 2.26                         | <0.001  | 2.33 ± 2.04                         | <0.001  | 3.29 ± 1.37                         | 0.038   |
| Ownership                    |                                |         |                                     |         |                                     |         |                                     |         |
| Non-profit                   | 3.19 ± 1.25                    |         | 3.35 ± 1.66                         |         | 3.15 ± 1.63                         |         | 3.67 ± 1.08                         |         |
| For profit                   | 3.05 ± 1.16                    | 0.67    | 3.24 ± 1.51                         | 0.80    | 3.25 ± 1.44                         | 0.80    | 3.67 ± 1.01                         | >0.99   |
| MSA size                     |                                |         |                                     |         |                                     |         |                                     |         |
| <100,000 or non-MSA          | 3.62 ± 1.14                    |         | 4.13 ± 1.48                         |         | 4.00 ± 1.55                         |         | 4.00 ± 1.12                         |         |
| 100,000 – 1 million          | 2.94 ± 0.86                    |         | 3.06 ± 1.16                         |         | 2.85 ± 1.13                         |         | 3.43 ± 0.79                         |         |
| >1 million                   | 3.14 ± 1.44                    | 0.197   | 3.20 ± 1.89                         | 0.039   | 3.02 ± 1.79                         | 0.027   | 3.70 ± 1.17                         | 0.48    |
| Medicaid penetration         |                                |         |                                     |         |                                     |         |                                     |         |
| Lowest tertile               | 3.08 ± 0.92                    |         | 3.34 ± 1.26                         |         | 3.35 ± 1.24                         |         | 3.52 ± 0.84                         |         |
| Middle tertile               | 3.47 ± 1.23                    |         | 3.72 ± 1.53                         |         | 3.12 ± 1.54                         |         | 3.88 ± 1.11                         |         |
| Highest tertile              | 2.95 ± 1.46                    | 0.60    | 2.96 ± 1.99                         | 0.27    | 3.01 ± 1.95                         | 0.31    | 3.62 ± 1.19                         | 0.68    |
| HMO penetration              |                                |         |                                     |         |                                     |         |                                     |         |
| Lowest tertile               | 3.47 ± 0.96                    |         | 3.85 ± 1.18                         |         | 3.74 ± 1.23                         |         | 3.82 ± 0.94                         |         |
| Middle tertile               | 3.22 ± 1.12                    |         | 3.28 ± 1.47                         |         | 3.04 ± 1.44                         |         | 3.78 ± 0.97                         |         |
| Highest tertile              | 2.81 ± 1.50                    | 0.011   | 2.87 ± 2.04                         | 0.005   | 2.70 ± 1.92                         | 0.002   | 3.41 ± 1.23                         | 0.066   |
| LTAC beds in HRR             |                                |         |                                     |         |                                     |         |                                     |         |
| 0                            | 3.57 ± 1.19                    |         | 3.97 ± 1.55                         |         | 3.80 ± 1.63                         |         | 4.03 ± 1.09                         |         |
| 1-200                        | 2.97 ± 0.83                    |         | 3.17 ± 1.16                         |         | 2.98 ± 1.18                         |         | 3.44 ± 0.78                         |         |
| >200                         | 3.21 ± 1.49                    | 0.61    | 3.29 ± 1.95                         | 0.26    | 3.11 ± 1.85                         | 0.25    | 3.76 ± 1.22                         | 0.88    |
| Hospice penetration in HRR   |                                |         |                                     |         |                                     |         |                                     |         |
| Lowest tertile               | 3.10 ± 0.98                    |         | 3.33 ± 1.32                         |         | 3.16 ± 1.40                         |         | 3.59 ± 0.94                         |         |
| Middle tertile               | 3.48 ± 1.12                    |         | 3.76 ± 1.42                         |         | 3.50 ± 1.42                         |         | 3.90 ± 1.04                         |         |
| Highest tertile              | 2.85 ± 1.44                    | 0.22    | 2.84 ± 1.94                         | 0.104   | 2.76 ± 1.85                         | 0.184   | 3.46 ± 1.13                         | 0.43    |

MSA = metropolitan statistical area size; HMO = health maintenance organization; LTAC = long-term acute care hospital; HRR = Dartmouth Atlas hospital referral region; SD = standard deviation

<sup>a</sup>Sensitivity analysis 1 was done using the same cohort of patients as the primary analysis but without using predicted risk of death in risk-adjustment

<sup>b</sup>Sensitivity analysis 2 was done using the primary cohort plus those patients excluded from the primary cohort because of missing MediQual Atlas predicted mortality risk scores

<sup>c</sup>Sensitivity analysis 3 was done using the same cohort of patients as the primary analysis and with the same risk-adjustment variables, but only deaths that occurred in the hospital ≤ 30 days from admission were coded as in-hospital deaths

<sup>d</sup>Discharge bias is a percentage, defined as hospital-specific risk-adjusted 30-day minus in-hospital ICU mortality

<sup>e</sup>Bed size was the only hospital characteristic significant in all multivariable analyses

<sup>f</sup>Teaching status categorized by resident-to-bed ratio (non-teaching 0, small teaching >0 to <0.25, large teaching ≥0.25)