**Readmissions Performance and Penalty Experience of Safety-Net Hospitals under Medicare’s Hospital Readmissions Reduction Program**

**Additional file 1**

**Table 1: Data collection and reporting dates for 30-day risk adjusted readmissions**

|  |  |  |
| --- | --- | --- |
| **Data collection period** | **Data reporting period** | **Analysis period** |
| 7/1/2005-6/30/2008 | 2009 | Pre-period |
| 7/1/2006-6/30/2009 | 2010 |
| 7/1/2007-6/30/2010 | 2011 | Washout period |
| 7/1/2008-6/30/2011 | 2012 |
| 7/1/2009-6/30/2012 | 2013 |
| 7/1/2010-6/30/2013 | 2014 | Post-period |
| 7/1/2011-6/30/2014 | 2015 |
| 7/1/2012-6/30/2015 | 2016 |

Note:

1) The post-period for the pneumonia cohort ends in 2015, since the criteria for identifying pneumonia admission changed in 2016.

**Table 2: Validity of difference-in-differences model estimates of change in 30-day readmissions associated with HRRP: Parallel trends test**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Acute myocardial infarction | Heart failure | Pneumonia |
| Safety-net hospitals | 0.55\*\*\* | 1.08\*\*\* | 0.63\*\*\* |
|  | (0.09) | (0.12) | (0.10) |
| Post 2010 | 0.05\* | 0.26\*\*\* | 0.20\*\*\* |
|  | (0.03) | (0.03) | (0.02) |
| Safety-net hospitals x Post 2010 | -0.01 | -0.10 | -0.09\* |
|  | (0.06) | (0.06) | (0.05) |
| Teaching hospital | 0.28\*\* | 0.30\* | 0.56\*\*\* |
|  | (0.12) | (0.16) | (0.12) |
| Government non-federal (ref: not-for-profit) | 0.19 | 0.52\*\*\* | 0.30\*\*\* |
|  | (0.12) | (0.14) | (0.11) |
| For-profit (ref: not-for-profit) | 0.12 | 0.63\*\*\* | 0.33\*\*\* |
|  | (0.09) | (0.13) | (0.10) |
| Bed size: 100-199 (ref: <100) | 0.08 | 0.24\* | 0.16 |
|  | (0.13) | (0.13) | (0.10) |
| Bed size: >=200 (ref: <100) | 0.01 | -0.09 | 0.16\* |
|  | (0.12) | (0.13) | (0.10) |
| Midwest (ref: Northeast) | -0.38\*\*\* | -0.76\*\*\* | -0.58\*\*\* |
|  | (0.11) | (0.14) | (0.12) |
| South (ref: Northeast) | -0.89\*\*\* | -1.22\*\*\* | -1.06\*\*\* |
|  | (0.10) | (0.13) | (0.11) |
| West (ref: Northeast) | -1.21\*\*\* | -1.65\*\*\* | -1.44\*\*\* |
|  | (0.11) | (0.15) | (0.12) |
| N | 2,890 | 3,748 | 3,790 |

Notes:

1) Safety-net hospitals: hospitals that fall in the top quartile of the Disproportionate Share Hospital (DSH) index; non-safety-net hospitals: hospitals in the bottom three quartiles of the DSH index.

2) Estimates from random effects model reported; heteroscedasticity-robust standard errors clustered at the hospital level; model includes year dummies.

3) \* p<0.10; \*\* p<0.05; \*\*\* p<0.01

4) Standard errors in parenthesis.

**Table 3: Difference-in-differences model estimates of change in 30-day readmissions associated with HRRP: Main model estimates**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Acute myocardial infarction | Heart failure | Pneumonia |
| Safety-net hospitals | 0.49\*\*\* | 1.01\*\*\* | 0.59\*\*\* |
|  | (0.09) | (0.11) | (0.09) |
| Post 2014 | -2.97\*\*\* | -2.42\*\*\* | -0.76\*\*\* |
|  | (0.04) | (0.06) | (0.04) |
| Safety-net hospitals x Post 2014 | -0.08 | -0.14 | -0.23\*\*\* |
|  | (0.09) | (0.10) | (0.09) |
| Teaching hospital | 0.24\*\*\* | 0.17 | 0.43\*\*\* |
|  | (0.08) | (0.11) | (0.09) |
| Government non-federal (ref: not-for-profit) | 0.13 | 0.30\*\*\* | 0.10 |
|  | (0.08) | (0.10) | (0.08) |
| For-profit (ref: not-for-profit) | 0.24\*\*\* | 0.54\*\*\* | 0.25\*\*\* |
|  | (0.06) | (0.09) | (0.07) |
| Bed size: 100-199 (ref: <100) | 0.18\*\* | 0.17\* | 0.14\*\* |
|  | (0.09) | (0.09) | (0.07) |
| Bed size: >=200 (ref: <100) | 0.15\* | -0.02 | 0.16\*\* |
|  | (0.09) | (0.09) | (0.07) |
| Midwest (ref: Northeast) | -0.29\*\*\* | -0.79\*\*\* | -0.39\*\*\* |
|  | (0.07) | (0.10) | (0.08) |
| South (ref: Northeast) | -0.51\*\*\* | -0.90\*\*\* | -0.69\*\*\* |
|  | (0.07) | (0.10) | (0.08) |
| West (ref: Northeast) | -0.80\*\*\* | -1.34\*\*\* | -1.04\*\*\* |
|  | (0.08) | (0.11) | (0.09) |
| N | 7225 | 9370 | 7580 |

Notes:

1) Safety-net hospitals: hospitals that fall in the top quartile of the Disproportionate Share Hospital (DSH) index; non-safety-net hospitals: hospitals in the bottom three quartiles of the DSH index.

2) Estimates from random effects model reported; heteroscedasticity-robust standard errors clustered at the hospital level; model includes year dummies.

3) \* p<0.10; \*\* p<0.05; \*\*\* p<0.01

4) Standard errors in parenthesis.

**Table 4: Sensitivity Analysis: Difference-in-difference model estimates of change in 30-day readmission rates using alternative definition of safety-net hospitals using Medicaid share inpatient days**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Acute myocardial infarction | Heart failure | Pneumonia |
| Safety-net hospitals | 0.23\*\*\* | 0.59\*\*\* | 0.26\*\*\* |
|  | (0.08) | (0.11) | (0.09) |
| Post 2014 | -2.97\*\*\* | -2.41\*\*\* | -1.19\*\*\* |
|  | (0.04) | (0.06) | (0.04) |
| Safety-net hospitals x Post 2014 | -0.08 | -0.15 | -0.20\*\* |
|  | (0.09) | (0.10) | (0.08) |
| Teaching hospital | 0.32\*\*\* | 0.33\*\*\* | 0.53\*\*\* |
|  | (0.08) | (0.11) | (0.09) |
| Government non-federal (ref: not-for-profit) | 0.15\* | 0.32\*\*\* | 0.14\* |
|  | (0.08) | (0.11) | (0.08) |
| For-profit (ref: not-for-profit) | 0.28\*\*\* | 0.66\*\*\* | 0.30\*\*\* |
|  | (0.06) | (0.09) | (0.07) |
| Bed size: 100-199 (ref: <100) | 0.20\*\* | 0.17\* | 0.15\*\* |
|  | (0.09) | (0.09) | (0.07) |
| Bed size: >=200 (ref: <100) | 0.21\*\* | 0.02 | 0.19\*\*\* |
|  | (0.09) | (0.09) | (0.07) |
| Midwest (ref: Northeast) | -0.32\*\*\* | -0.82\*\*\* | -0.40\*\*\* |
|  | (0.07) | (0.11) | (0.09) |
| South (ref: Northeast) | -0.49\*\*\* | -0.84\*\*\* | -0.66\*\*\* |
|  | (0.07) | (0.10) | (0.08) |
| West (ref: Northeast) | -0.75\*\*\* | -1.21\*\*\* | -0.96\*\*\* |
|  | (0.08) | (0.11) | (0.09) |
| N | 7225 | 9370 | 7580 |

Notes:

1) Safety-net hospitals: hospitals that fall in the top quartile of Medicaid share inpatient days; non-safety-net hospitals: hospitals in the bottom three quartiles of the Medicaid share inpatient days.

2) Models estimated are similar to that in Table 3. Estimates from random effects model reported; heteroscedasticity-robust standard errors clustered at the hospital level; model includes year dummies.

3) \* p<0.10; \*\* p<0.05; \*\*\* p<0.01

4) Standard errors in parenthesis.

**Table 5: Sensitivity Analysis: Difference-in-difference model estimates of change in 30-day readmission rates using hospital fixed effects specification**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Acute myocardial infarction | Heart failure | Pneumonia |
| Post 2014 | -2.99\*\*\* | -2.43\*\*\* | -1.18\*\*\* |
|  | (0.04) | (0.05) | (0.04) |
| Safety-net hospitals x Post 2014 | 0.003 | -0.08 | -0.21\*\* |
|  | (0.07) | (0.08) | (0.07) |
| N | 7225 | 9370 | 7580 |

Notes:

1) Models similar to that in Table 3 are estimated now with hospital-level fixed effects specification.

2) Note that hospital-level covariates (e.g., safety-net hospital status, teaching hospital, region) are excluded as they are time-invariant.

3) \* p<0.10; \*\* p<0.05; \*\*\* p<0.01

4) Standard errors in parenthesis.

**Figure 3: Distribution of number of years of penalty under HRRP by safety-net status, 2013-2016**



Notes:

1) Safety-net hospitals: hospitals that fall in the top quartile of the Disproportionate Share Hospital (DSH) index; non-safety-net hospitals: hospitals in the bottom three quartiles of the DSH index.

2) Mean number of years of penalty under HRRP for safety-net hospitals: 3.50 (CI: 3.45, 3.54); non-safety-net hospitals: 3.17 (CI: 3.14, 3.20); difference: 0.33 (p-value <0.001).