Appendix Table 1. Thirty-one comorbidities included as covariates in all regressions

- -Severe infection
- -Other infectious disease & pneumonias
- -Metastatic cancer/acute leukemia
- -Severe cancer
- -Other cancers
- -Diabetes mellitus
- -Protein-calorie malnutrition
- -End-stage liver disease
- -Severe hematological disorders
- -Alcohol abuse
- -Psychiatric comorbidity
- -Hemiplegia, paraplegia, paralysis
- -Seizure disorders
- -Congestive heart failure
- -Coronary atherosclerosis or angina
- -Specified arrhythmias
- -Chronic obstructive pulmonary disease
- -Other chronic lung disorders
- -Dialysis
- -Decubitus ulcer or chronic skin ulcer
- -Septicemia/shock
- -Disorders of fluid, electrolytes
- -Iron deficiency or other anemias
- -Cardiorespiratory failure or shock
- -Acute renal failure
- -Pancreatic disease
- -Rheumatoid arthritis
- -Respirator dependence/tracheostomy
- -Transplants
- -Coagulation /hematologic disorders
- -Hip fracture/dislocation

Appendix Table 2. For patients discharged to each PAC setting, characteristics of patients at hospitals and PACs that joined and did not join an ACO before and after the hospitals and PACs joined the ACOs.

| | Skilled nursing facility cohort | | | | Home health cohort | | | Inpatient rehabilitation cohort | | | | |
|--|---------------------------------|--|-------------------------------------|----------------|--------------------|--------------------------|-------------------------------------|---------------------------------|------|--------------------------|-------------------------------------|----------------|
| | Mean | Change in ACO hospital- PACs* | Change in non-ACO hospitals** | P- value*** | Mean | Change in ACO hospitals* | Change in non-ACO hospitals** | P- value*** | Mean | Change in ACO hospitals* | Change in non-ACO hospitals** | P- value*** |
| Age in years, mean | 82.1 | 0.2 | 0.1 | 0.35 | 78.7 | -0.1 | -0.1 | 0.57 | 79.2 | 0.3 | 0.1 | 0.44 |
| Female, % | 64.3 | -1.3 | -0.8 | 0.42 | 59.3 | -0.1 | -0.8 | 0.23 | 59.3 | -0.2 | -1.6 | 0.11 |
| Race, % | | | | | | | | | | | | |
| White | 86.7 | -0.6 | -0.5 | 0.85 | 86.1 | -0.7 | -0.3 | 0.42 | 87.2 | -1.6 | -0.3 | 0.07 |
| Black | 9.3 | 0.5 | 0.1 | 0.44 | 8.8 | 0.3 | 0.0 | 0.47 | 8.4 | 1.1 | 0.3 | 0.20 |
| Hispanic | 1.5 | -0.3 | 0.0 | 0.05 | 1.9 | 0.1 | -0.1 | 0.17 | 1.6 | 0.0 | -0.1 | 0.53 |
| Other | 2.3 | 0.4 | 0.3 | 0.88 | 2.9 | 0.0 | 0.2 | 0.19 | 2.6 | 0.3 | 0.1 | 0.37 |
| Dual eligible, % | 26.4 | -2.3 | -1.9 | 0.62 | 13.4 | -0.8 | -0.7 | 0.74 | 10.0 | -0.8 | -0.4 | 0.56 |
| Comorbidities, % | | | | | | | | | | | | |
| Diabetes | 34.7 | 5.1 | 6.3 | 0.04 | 32.5 | 3.5 | 4.5 | 0.08 | 33.7 | 6.2 | 7.2 | 0.15 |
| Cancer | 11.5 | 1.7 | 1.7 | 0.95 | 12.1 | 1.2 | 0.9 | 0.54 | 9.6 | 1.3 | 1.6 | 0.73 |
| Acute kidney disease | 25.7 | 2.1 | 3.5 | 0.02 | 16.6 | 1.4 | 2.2 | 0.12 | 16.3 | 3.2 | 3.9 | 0.35 |
| Congestive heart failure | 24.9 | 0.8 | 1.0 | 0.68 | 17.5 | -0.7 | 0.0 | 0.14 | 15.8 | 1.6 | 2.2 | 0.52 |
| Ischemic heart disease | 58.1 | 8.7 | 9.2 | 0.57 | 50.9 | 4.0 | 5.4 | 0.06 | 51.5 | 9.5 | 9.9 | 0.65 |
| Chronic obstructive pulmonary disease | 28.2 | 4.0 | 4.2 | 0.74 | 25.0 | 2.1 | 2.9 | 0.29 | 22.0 | 5.3 | 4.7 | 0.50 |

Reason for hospitalization, %

Appendix to "Effect of hospital and post-acute care provider participation in accountable care organizations on patient outcomes and Medicare spending" by Agarwal and Werner

| Total hip or | | | | | | | | | | | | |
|-----------------------------|-----|------|------|------|------|------|------|------|------|------|------|------|
| knee replacement | 8.4 | 0.3 | 0.2 | 0.85 | 13.2 | 2.5 | 1.1 | 0.06 | 13.9 | -1.9 | -2.5 | 0.50 |
| Sepsis | 6.3 | 1.4 | 1.8 | 0.33 | 3.4 | 1.0 | 1.3 | 0.20 | 2.1 | 0.7 | 1.0 | 0.38 |
| Congestive heart failure | 5.2 | 0.4 | 0.0 | 0.19 | 6.2 | -0.3 | 0.0 | 0.40 | 2.3 | 0.4 | 0.5 | 0.69 |
| Urinary tract infection | 4.4 | -0.4 | -0.4 | 0.87 | 2.5 | 0.0 | -0.1 | 0.79 | 1.3 | 0.3 | 0.2 | 0.65 |
| Hip fracture | 5.6 | 0.0 | -0.1 | 0.85 | 0.9 | 0.0 | -0.1 | 0.77 | 9.8 | -0.4 | -1.3 | 0.22 |
| Pneumonia | 4.4 | 0.4 | 0.3 | 0.64 | 4.1 | 0.4 | 0.5 | 0.84 | 1.5 | -0.2 | 0.5 | 0.02 |

^{*} Change from 2010 to 2013 among patients admitted to a hospital and PAC provider that participated in an ACO during the study period

^{**} Change from 2010 to 2013 among patients admitted to a hospital and PAC provider that did not participate in an ACO during the study period

^{***} P-value for difference in change over time between hospitals and PACs that participated in ACOs versus those that did not participate

Appendix Table 3. Differences in trends in outcomes between hospitals that ever join an ACO and hospitals that never join an ACO in pre-ACO period (2010-2011).

| | SNF cohort | | НН со | <u>hort</u> | IRF cohort | |
|------------------------------|------------------------|---------|------------------------|-------------|------------------------|---------|
| | Difference in trend | P-value | Difference in trend | P-value | Difference in trend | P-value |
| 30-day readmission or death | -0.0005 | 0.61 | -0.0003 | 0.76 | -0.003 | 0.29 |
| Medicare spending on episode | -58.1 | 0.12 | 18.1 | 0.56 | 118.7 | 0.22 |
| Length of stay of episode | -0.08 | 0.06 | -0.11 | 0.07 | 0.07 | 0.17 |

Differences in trends in outcomes between hospitals that ever join an ACO with each PAC provider and hospitals that never join an ACO with each PAC provider in pre-ACO period (2010-2011).

| | SNF cohort | | НН со | <u>hort</u> | IRF cohort | |
|------------------------------|------------------------|---------|------------------------|-------------|------------------------|---------|
| | Difference in trend | P-value | Difference in trend | P-value | Difference in trend | P-value |
| 30-day readmission or death | -0.005 | 0.39 | -0.003 | 0.09 | 0.000 | 0.99 |
| Medicare spending on episode | 124.2 | 0.86 | 12.5 | 0.88 | 123.3 | 0.36 |
| Length of stay of episode | -0.08 | 0.27 | -0.16 | 0.11 | 0.05 | 0.48 |

Appendix Table 4. Adjusted **c**hange in outcomes after a hospital or post-acute care provider joined an ACO, adjusting for PAC provider characteristics.*

| | Skilled nursing facility cohort (n=3,503,296) | | | | | |
|---|---|-------|-----------------------|-------|--|--|
| | Hospital in ACO Hospital and nursing facility | | | | | |
| | | | P- | | | |
| | Absolute change | value | Absolute change | value | | |
| 20 doursed mission or mortality (9/) | [95% CI] -0.5 | 0.01 | [95% CI] -0.8 | 0.30 | | |
| 30-day readmission or mortality (%) | -0.5 [-0.9 to -0.1] | 0.01 | -0.8 [-2.2 to 0.7] | 0.50 | | |
| 20 dour montality (0/) | -0.1 | 0.61 | [-2.2 to 0.7] -0.2 | 0.73 | | |
| 30-day mortality (%) | | 0.61 | | 0.73 | | |
| " " " " " " " " " " " " " " " " " " | [-0.4 to 0.2] | 0.00 | [-1.4 to 1.0] | 0.000 | | |
| Medicare spending on total episode (\$) | -145 | 0.03 | -903 | 0.003 | | |
| | [-279 to -11] | | [-1499 to -308] | | | |
| Medicare spending on hospitalization (\$) | -60 | 0.15 | -136 | 0.18 | | |
| | [-141 to 22] | | [-334 to 62] | | | |
| Medicare spending on PAC (\$) | 49 | 0.22 | -482 | 0.02 | | |
| | [-29 to 128] | | [-885 to -79] | | | |
| Length of stay in total episode (days) | 0.0 | 0.38 | -1.8 | <.001 | | |
| | [-0.1 to 0.3] | | [-2.6 to -0.9] | | | |
| Length of stay in hospital (days) | 0.0 | 0.70 | 0.2 | 0.19 | | |
| | [-0.0 to 0.1] | | [-0.1 to 0.4] | | | |
| Length of stay in PAC (days) | 0.2 | 0.07 | -1.7 | <.001 | | |
| - 6, (,-, | [-0.0 to 0.3] | | [-2.6 to -0.8] | | | |

Home health cohort

(n=1,597,751)

| | Hospital in A | СО | Hospital and h health agency ir | |
|-------------------------------------|-----------------|-------|------------------------------------|-------|
| | P- | | | P- |
| | Absolute change | value | Absolute change | value |
| | [95% CI] | | [95% CI] | |
| 30-day readmission or mortality (%) | -0.4 | 0.03 | -0.4 | 0.26 |

| | [-0.8 to -0.0] | | [-1.1 to 0.3] | |
|---|----------------|-------|----------------|------|
| 30-day mortality (%) | -0.1 | 0.27 | -0.1 | 0.62 |
| | [-0.3 to 0.0] | | [-0.5 to 0.3] | |
| Medicare spending on total episode (\$) | -60 | 0.33 | -137 | 0.24 |
| | [-183 to 61] | | [-366 to 93] | |
| Medicare spending on hospitalization (\$) | -44 | 0.38 | -86 | 0.41 |
| | [-142 to 55] | | [-291 to 119] | |
| Medicare spending on PAC (\$) | 41 | 0.004 | -30 | 0.08 |
| | [13 to 68] | | [-4 to 63] | |
| Length of stay for total episode (days) | -0.2 | 0.34 | -0.6 | 0.14 |
| | [-0.5 to 0.2] | | [-1.4 to 0.2] | |
| Length of stay in hospital (days) | 0.0 | 0.34 | 0.0 | 0.82 |
| | [-0.1 to 0.0] | | [-0.1 to 0.1] | |
| Length of stay in PAC (days) | -0.1 | 0.40 | -0.7 | 0.04 |
| | [-0.4 to 0.2] | | [-1.3 to -0.0] | |
| | | | | |

Inpatient rehabilitation cohort

(n=445,264)

| | Hospital in A | со | Hospital and inp rehabilitation fac ACO | |
|---|-----------------|-------|---|-------|
| | | P- | | P- |
| | Absolute change | value | Absolute change | value |
| | [95% CI] | | [95% CI] | |
| 30-day readmission or mortality (%) | -0.5 | 0.29 | 0.4 | 0.55 |
| | [-1.4 to 0.4] | | [-0.9 to 1.7] | |
| 30-day mortality (%) | -0.5 | 0.04 | 0.1 | 0.79 |
| | [-1.0 to -0.0] | | [-0.6 to 0.8] | |
| Medicare spending on total episode (\$) | 227 | 0.27 | -10 | 0.97 |
| | [-178 to 631] | | [-555 to 535] | |
| Medicare spending on hospitalization (\$) | 60 | 0.64 | -140 | 0.24 |
| | [-191 to 311] | | [-371 to 91] | |
| Medicare spending on PAC (\$) | 43 | 0.71 | 4 | 0.98 |
| | [-186 to 271] | | [-372 to 380] | |
| Length of stay in total episode (days) | 0.3 | 0.15 | 0.3 | 0.28 |
| | [-0.1 to 0.7] | | [-0.3 to 1.0] | |
| Length of stay in hospital (days) | -0.1 | 0.13 | -0.1 | 0.12 |

| | [-0.2 to 0.0] | | [-0.3 to 0.0] | |
|------------------------------|---------------|------|---------------|------|
| Length of stay in PAC (days) | 0.1 | 0.24 | 0.2 | 0.28 |
| | [-0.1 to 0.3] | | [-0.1 to 0.4] | |

^{*}SNF covariates include number of beds, hospital owned, profit status, and overall star rating; HH covariates include number of full-time equivalent staff, hospital owned, and profit status; IRF covariates include number of beds, hospital owned, and profit status.

Appendix Table 5. Characteristics of hospitals participating in ACOs and not in ACOs among a propensity-score matched cohort of hospitals, using 1:5 matching without replacement

| | participa | spitals ating in ACO without PAC | Hospitals not participating in a ACO | | |
|----------------------------|-----------|--|--------------------------------------|---------|--|
| Number of hospitals, n (%) | 293 | (16.7%) | 1,465 | (83.3%) | |
| Number of beds, n (%) | | | | | |
| <100 | 52 | (17.8%) | 260 | (17.8%) | |
| 100-250 | 99 | (33.9%) | 496 | (33.9%) | |
| 250+ | 142 | (48.4%) | 709 | (48.4%) | |
| Profit status, n (%) | | | | | |
| For profit | 23 | (7.9%) | 115 | (7.9%) | |
| Not for profit | 240 | (81.9%) | 1200 | (81.9%) | |
| Public | 30 | (10.2%) | 150 | (10.2%) | |
| Rural, n (%) | 41 | (14.0%) | 204 | (13.9%) | |
| Teaching status, n (%) | | | | | |
| Non-teaching | 169 | (57.7%) | 847 | (57.8%) | |
| Minor teaching | 69 | (23.6%) | 344 | (23.5%) | |
| Major teaching | 55 | (18.8%) | 274 | (18.7%) | |

Appendix Table 6. Adjusted **c**hange in outcomes after a hospital or post-acute care provider joined an ACO in cohort of propensity-score matched hospitals

| | Skilled nursing facility cohort (n=2,327,605) | | | | | |
|---|---|---------------------------------------|-----------------------------|-------|--|--|
| | Hospital in A | Hospital and sl nursing facility i | | | | |
| | | P- | | P- | | |
| | Absolute change [95% CI] | value | Absolute change [95% CI] | value | | |
| 30-day readmission or mortality (%) | -0.5 | 0.03 | -1.5 | 0.04 | | |
| | [86 to05] | | [-3.0 to06] | | | |
| 30-day mortality (%) | -0.1 | 0.60 | -0.61 | 0.35 | | |
| | [39 to .22] | | [-1.87 to .66] | | | |
| Medicare spending on total episode (\$) | -224 | 0.002 | -1624 | <.001 | | |
| | [-362 to -85] | | [-2379 to -869] | | | |
| Medicare spending on hospitalization (\$) | -82 | 0.06 | -174 | 0.09 | | |
| | [-166 to 2] | | [-371 to 24] | | | |
| Medicare spending on PAC (\$) | -10 | 0.82 | 919 | 0.002 | | |
| | [-91 to 72] | | [-1486 to -351] | | | |
| Length of stay in total episode (days) | 0.0 | 0.62 | -3.2 | <.001 | | |
| | [-0.2 to 0.1] | | [-4.4 to -2.1] | | | |
| Length of stay in hospital (days) | 0.0 | 0.72 | 0.1 | 0.29 | | |
| | [-0.1 to 0.1] | | [-0.1 to 0.4] | | | |
| Length of stay in PAC (days) | 0.0 | 0.87 | -3.0 | <.001 | | |
| | [-0.2 to 0.2] | | [-4.2 to -1.8] | | | |
| | | | | | | |

Home health cohort

(n=1,068,940)

| | Hospital in A | CO | Hospital and h health agency ir | |
|-------------------------------------|-----------------|-------|------------------------------------|-------|
| | P- | | | P- |
| | Absolute change | value | Absolute change | value |
| | [95% CI] | | [95% CI] | |
| 30-day readmission or mortality (%) | -0.4 | 0.04 | -0.4 | 0.24 |

| | [-0.85 to -0.02] | | [-1.11 to 0.3] | |
|---|---|----------------------|---|-----------------------|
| 30-day mortality (%) | -0.1 | 0.22 | -0.1 | 0.65 |
| | [35 to .07] | | [54 to .34] | |
| Medicare spending on total episode (\$) | -83 | 0.20 | -231 | 0.04 |
| | [-210 to 43] | | [-454 to -7] | |
| Medicare spending on hospitalization (\$) | -50 | 0.33 | -91 | 0.38 |
| | [-152 to 52] | | [-298 to 114] | |
| Medicare spending on PAC (\$) | 35 | 0.02 | -49 | 0.01 |
| | [7 to 63] | | [-87 to -11] | |
| Length of stay for total episode (days) | -0.2 | 0.25 | -1.7 | <.001 |
| | [-0.5 to 0.1] | | [-2.3 to -1.0] | |
| Length of stay in hospital (days) | 0.0 | 0.34 | 0.0 | 0.87 |
| | [-0.1 to 0.0] | | [-0.1 to 0.1] | |
| Length of stay in PAC (days) | -0.1 | 0.37 | -1.7 | <.001 |
| | [-0.5 to 0.2] | | [-2.2 to -1.2] | |
| Medicare spending on PAC (\$) Length of stay for total episode (days) Length of stay in hospital (days) | -50 [-152 to 52] 35 [7 to 63] -0.2 [-0.5 to 0.1] 0.0 [-0.1 to 0.0] -0.1 | 0.02 0.25 0.34 | -91 [-298 to 114] -49 [-87 to -11] -1.7 [-2.3 to -1.0] 0.0 [-0.1 to 0.1] -1.7 | 0.01 <.001 0.87 |

Inpatient rehabilitation cohort

| | inpatient rehabilitation cohort (n=445,264) | | | | |
|---|--|-----------|------------------|-------------|--|
| | | | | | |
| | Hospital in A | CO | Hospital and inp | | |
| | Hospital in ACO rehabilitation fa ACO | | | icility iii | |
| | | P- | | P- | |
| | Absolute change | value | Absolute change | value | |
| | [95% CI] | | [95% CI] | | |
| 30-day readmission or mortality (%) | -0.4 | 0.45 | 0.5 | 0.45 | |
| | [-1.2 to 0.6] | | [-0.8 to 1.9] | | |
| 30-day mortality (%) | -0.4 | 0.10 | 0.2 | 0.55 | |
| | [91 to .01] | | [47 to .88] | | |
| Medicare spending on total episode (\$) | 207 | 0.32 | -63 | 0.82 | |
| | [-204 to 617] | | [-613 to 487] | | |
| Medicare spending on hospitalization (\$) | 24 | 0.85 | -164 | 0.18 | |
| | [-227 to 276] | | [-402 to 73] | | |
| Medicare spending on PAC (\$) | 77 | 0.52 | -47 | 0.81 | |
| | [-157 to 310] | | [-436 to 342] | | |
| Length of stay in total episode (days) | 0.3 | 0.30 | 0.6 | 0.07 | |
| | [-0.2 to 0.7] | | [-0.0 to 1.3] | | |
| Length of stay in hospital (days) | -0.1 | 0.11 | -0.1 | 0.17 | |
| | [-0.2 to 0.0] | | [-0.3 to 0.0] | | |

| Appendix to "Effect of hospital and post-acute care provider participation in accountable care |
|--|
| organizations on patient outcomes and Medicare spending" by Agarwal and Werner |

Length of stay in PAC (days) 0.1 0.28 0.1 0.39 [-0.1 to 0.3] [-0.2 to 0.4]

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