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Original Study

The Effect of Hospice on Hospitalizations of Nursing Home Residents

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A B S T R A C T

Objectives: Hospice enrollment is known to reduce risk of hospitalizations for nursing home residents who use it. We examined whether residing in facilities with a higher hospice penetration: (1) reduces hospitalization risk for nonhospice residents; and (2) decreases hospice-enrolled residents' hospitalization risk relative to hospice-enrolled residents in facilities with a lower hospice penetration.

Methods: Medicare Beneficiary File, Inpatient and Hospice Claims, Minimum Data Set Version 2.0, Provider of Services File, and Area Resource File. Retrospective analysis of long-stay nursing home residents who died during 2005–2007. Overall, 505,851 nonhospice (67.66%) and 241,790 hospice-enrolled (32.34%) residents in 14,030 facilities nationwide were included. We fit models predicting the probability of hospitalization conditional on hospice penetration and resident and facility characteristics. We used instrumental variable method to address the potential endogeneity between hospice penetration and hospitalization. Distance between each nursing home and the closest hospice was the instrumental variable.

Results: In the last 30 days of life, 37.63% of nonhospice and 23.18% of hospice residents were hospitalized. Every 10% increase in hospice penetration leads to a reduction in hospitalization risk of 5.1% for nonhospice residents and 4.8% for hospice-enrolled residents.

Conclusions: Higher facility-level hospice penetration reduces hospitalization risk for both nonhospice and hospice-enrolled residents. The findings shed light on nursing home end-of-life care delivery, collaboration among providers, and cost benefit analysis of hospice care.

Nursing homes have increasingly become Americans' last site of care.[1–4] The quality of end-of-life care in nursing homes is often suboptimal, a matter of great concern to patients and their families.[5] Nursing home residents are often transferred to hospitals at the end of life,[6,7] although such transfers may result in adverse clinical outcomes[8–11] and disruption of care plans.[12] Many hospitalizations are potentially avoidable (ie, the conditions could be managed in the nursing homes) and, moreover, inconsistent with residents' wishes.[12,13]

Medicare hospice care reduces nursing home residents' risk of hospitalization at the end of life.[14] Miller et al[6] suggested that hospice's effect on reducing hospitalization risk of hospice residents "spills over" to nonhospice residents,[6] that is, nonhospice residents in nursing homes with moderate hospice penetration (proportion of residents in a nursing home receiving hospice care) may have a lower risk of end-of-life hospitalization compared with nonhospice residents in facilities with low or no hospice presence. Using an instrumental variable method, we examined whether residing in facilities with a higher hospice penetration: (1) reduces the risk of hospitalization for nonhospice residents (the spill-over effect); and (2) decreases hospice residents' risk of hospitalization relative to hospice residents in facilities with a lower hospice penetration (the expertise effect).

Methods

Data and Population

The Medicare beneficiary file was linked with the Minimum Data Set to identify nursing home residents who died in 2005–2007. We

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extracted resident-level characteristics from each resident's last Minimum Data Set assessment. Medicare inpatient and hospice claims were used to identify hospitalization events and hospice use at the end of life. The Provider of Services file was used to identify facility characteristics and the locations of nursing homes, hospices and hospitals. The Area Resource File provided county-level characteristics.

All Medicare and/or Medicaid certified US nursing homes were eligible for this study, except for facilities with fewer than 20 decedents during the study period. Long-stay residents (those who stayed in their last nursing home for more than 3 months) who died between 2005 and 2007 were included. Residents who enrolled in managed care plans or who were in a coma were excluded. Overall, 747,641 residents in 14,030 nursing homes (87.86% of the total) were included in the analytical sample.

Table 1
Facility Characteristics for the National Sample of Nursing Homes

Facility Characteristics	N = 14,030 %/Mean (SD)
Hospice penetration	28.31% (21.05%)
Distance to the closest hospice (miles)	7.15 (10.08)
Size (bed × occupancy rate)	94.15 (58.10)
For-profit	68.00%
Chain membership	54.40%
Hospital based	17.27%
Hospice ownership	0.18%
Distance to the closest hospital (miles)	3.01 (4.92)
Number of hospital beds per 100 people age 65+ in the county	4.07 (3.05)

SD, standard deviation.

Analytical Approach

The study outcome was any hospital admission in the last 30 days of life. The key independent variable was facility hospice penetration, defined as the proportion of decedents who received hospice care in the last 30 days of life. Other covariates were identified based on a review of the literature and consultation with clinical experts.[15] Staffing and proportion of Medicare and Medicaid residents were not used as covariates in the final models, despite the literature showing an association with risk of hospitalization,[15,16] because of potential endogeneity. We conducted a sensitivity analysis estimating the models with these variables, and the results from the sensitivity analysis did not change the study findings.

We used an instrumental variable (IV) approach to address endogeneity between hospice penetration and residents' risk of hospitalization.[17] Nursing homes with more expertise of palliative care may be less likely to hospitalize residents at the end of life and more likely to refer residents to hospice. Ignoring this possible endogeneity and attributing reduced hospitalization risk among nonhospice residents to hospice penetration may lead to erroneous conclusions, impacting policies and practice. An IV has to (1) be correlated with the endogenous "treatment" variable; and (2) not directly affect the outcome variable (ie, the IV can only influence the outcome through the "treatment" variable). Distance between each nursing home and the closest hospice satisfies these 2 conditions. First, it was shown that nursing home residents were more likely to use hospice when such were available within 15 miles of their nursing homes.[14] Hospice's location is not related to a nursing home's location. Overall, less than one-third of hospice enrollees are in a nursing home, and a very small group of hospices (about 8%) have two-thirds or more of their enrollees residing in nursing homes.[18] Second, distance from each nursing home to the closest hospice should not directly impact individual residents' risk of hospitalization.

To empirically test the appropriateness of distance as an IV, we followed Staiger and Stock[19] who argued that an incremental F-statistic greater than 10 supports the correlation between the instrument and the endogenous variable. We also applied Stock and Yogo's[20] suggested criterion for weak instruments: for a 5% Wald tests for a hypothesized β less than 0.1, Stock and Yogo indicated that the first-stage F-statistic for the instrumental variable should be greater than 22.3. For the sample of nonhospice residents, the distance was negatively related to hospice penetration ($\beta = -0.012$, $P < .001$), with an incremental F-statistic of 53.58. For the sample of hospice residents, the distance was also negatively associated with hospice penetration ($\beta = -0.017$, $P < .001$), with an incremental F-statistic of 46.92. Thus, the instrumental variable met both Staiger-Stock criterion and Stock-Yogo criterion.

We estimated probit models with an endogenous regressor—instrumented by the IV— and robust standard errors, separately for the nonhospice and hospice residents. In order to compare these results with those estimated without addressing endogeneity, we also fit probit regression models without the IV, but with facility random-effects and covariates. The study received exemption from the University of Rochester institutional review board.

Results

Sample Characteristics

The characteristics of the national sample of facilities are depicted in Table 1. In the average facility, 28.31% of residents received Medicare hospice care in the last 30 days of life. On average, a nursing home was located 7.15 miles from its closest hospice and 3.01 miles from the closest hospital. Individual characteristics, by hospice use status, are presented in Table 2. Almost 38% of nonhospice residents were hospitalized in the last 30 days of life. Among residents who used hospice during the last 30 days of life, 23.18% also had at least 1 hospitalization.

Hospice Effect on Hospitalization

Table 3 presents the coefficient estimates and marginal effects for hospice penetration from both the instrumental variable and the random-effects models (which did not address endogeneity and was for comparison).

Spill-over effect

The results for the nonhospice sample support the spill-over effect ($\beta = -0.136$; $P < .001$). The marginal effect suggests that when living in a facility with a 10% higher hospice penetration, a nonhospice resident's risk of hospitalization at the end-of-life was reduced by 5.1 percentage points, or 13.56% of the national average of hospitalization risk for nonhospice residents (37.63%, Table 2). The results from the random-effects model (which did not adjust for endogeneity of the hospice penetration) showed the opposite [ie, that higher hospice penetration was positively related to nonhospice residents' risk of hospitalization at the end-of-life ($\beta = 0.029$; $P \leq .001$)].

Expertise effect

In the hospice sample, both estimates from the IV model and the random-effects model showed a negative relationship between hospice penetration and risk of end-of-life hospitalization ($P < .001$ for both models), but the estimate from the random-effects model ($\beta = -0.039$) substantially underestimated the size of the effect compared to the IV model ($\beta = -0.164$). The marginal effect from the IV model indicated that for a 10% increase in the facility-level hospice penetration, hospice users' risk of hospitalization in the last 30 days of life was lower by 4.8 percentage points.