Regional Variation in Use of End-of-Life Care at Hospitals, Intensive Care Units, and Hospices Among Older Adults With Chronic Illness in the US, 2010 to 2016

Jason H. Maley, MD; Bruce E. Landon, MD, MBA, MSc; Jennifer P. Stevens, MD, MS

Introduction

Most older adults living with chronic illness prefer palliation of symptoms at home rather than invasive therapies or hospitalization at the end of life.1 In the United States, death occurring at home has become more common than death occurring in the hospital.2-3 However, national patterns may overlook important regional variation in end-of-life (EOL) care. Additionally, research is lacking on these patterns among the increasing population of older adults with chronic illness.1,3-5 Therefore, we sought to assess recent temporal patterns and regional variation in end-of-life health care use by Medicare beneficiaries with chronic illness.

Methods

This retrospective cohort study was deemed exempt by the Beth Israel Deaconess Medical Center Institutional Review Board, with a waiver of informed consent granted because the data were deidentified and publicly available. The cohort included decedents from 2010 through 2016 with a diagnosis of at least 1 of 9 chronic illnesses most commonly associated with death in the Medicare-eligible population: malignant cancer or leukemia, congestive heart failure, chronic pulmonary disease, dementia, diabetes with end-organ damage, peripheral vascular disease, chronic renal failure, severe chronic liver disease, and coronary artery disease.6 This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

We used data derived from Medicare fee-for-service claims6 in the 2 years prior to death to examine hospital referral region (HRR)-level variation and temporal patterns in the percentage of Medicare beneficiaries with chronic illnesses who died in 3 settings: hospital, hospital with intensive care unit (ICU) admission, and hospice. We examined all of the HRRs in the US. HRRs represent health care markets defined by sites of tertiary medical care.

Data were adjusted for age, sex, race, primary chronic condition, and the presence of multiple chronic conditions. A detailed description of the methods is available from the Dartmouth Atlas.6 For continuous variables, we computed means with standard deviations or medians with interquartile ranges. Categorical variables are described as numbers and percentages. Analyses were conducted from December 10, 2019, to January 20, 2020, using R, version 3.6.1 (R Project for Statistical Computing).

Results

We identified 7,425,913 Medicare beneficiaries diagnosed with at least 1 of 9 chronic illnesses most commonly associated with death in the Medicare-eligible population who died from 2010 through 2016. These illnesses included malignant cancer or leukemia, congestive heart failure, chronic pulmonary disease, dementia, diabetes with end-organ damage, peripheral vascular disease, chronic renal failure, severe chronic liver disease, and coronary artery disease. The mean (SD) patient age was 81 (8.4) years, and 4,119,749 (55%) Medicare beneficiaries were women. In 2010, Manhattan, New York, had the highest rate of EOL hospitalization (43.7%), followed by 3 other HRRs in New York...
state (Bronx, 37.7%; East Long Island, 37.4%; White Plains, 36.0%) (Table). These HRRs also had among the lowest rates of hospice enrollment among a total of 306 HRRs. In 2010, the rate of EOL hospitalization was lowest in Amarillo, Texas (13.3%), Greeley, Colorado (13.5%), and Ogden, Utah (13.9%); these HRRs had among the highest rates of hospice enrollment. In 2016, Manhattan, New York, again had the highest rate of hospitalization at the EOL (34.5%), whereas Cedar Rapids, Iowa, had the lowest rate (11.2%). Therefore, rates of EOL hospitalization and hospice use varied greater than 3-fold across all 306 HRRs. Even among the 20 largest HRRs, rates of hospitalization and hospice at the EOL varied greater than 2-fold between high and low-use regions (Figure). In 2016, among the 20 largest HRRs, rates of EOL hospitalization ranged from 14.7% to 34.5%. Rates of EOL hospice ranged from 33.6% to 68.2%.

<table>
<thead>
<tr>
<th>HRR</th>
<th>No. of decedents</th>
<th>Hospitalization, % a</th>
<th>Hospitalization with ICU admission, % b</th>
<th>Hospice enrollment, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>All HRRs, median (IQR)</td>
<td>1 107 702</td>
<td>23.9 (20.8-27.5)</td>
<td>20.1 (17.5-23.0)</td>
<td>15.8 (13.5-18.2)</td>
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<tr>
<td>HRRs with highest end-of-life hospitalization rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manhattan, New York</td>
<td>12 823</td>
<td>43.7</td>
<td>34.5</td>
<td>19.4</td>
</tr>
<tr>
<td>Bronx, New York</td>
<td>2392</td>
<td>37.7</td>
<td>28.4</td>
<td>19.5</td>
</tr>
<tr>
<td>East Long Island, New York</td>
<td>16 466</td>
<td>37.4</td>
<td>31.1</td>
<td>20.5</td>
</tr>
<tr>
<td>White Plains, New York</td>
<td>4502</td>
<td>36.0</td>
<td>31.9</td>
<td>21.9</td>
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<td>1868</td>
<td>34.2</td>
<td>27.9</td>
<td>17.3</td>
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<td>HRRs with lowest end-of-life hospitalization rate</td>
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<td></td>
<td></td>
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<tr>
<td>Amarillo, Texas</td>
<td>2022</td>
<td>13.3</td>
<td>12.0</td>
<td>8.2</td>
</tr>
<tr>
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<td>16.7</td>
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<tr>
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<td>16.1</td>
<td>11.3</td>
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<tr>
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<td>13.7</td>
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</tr>
<tr>
<td>Mason City, Iowa</td>
<td>973</td>
<td>10.0</td>
<td>13.9</td>
<td>7.2</td>
</tr>
</tbody>
</table>

Abbreviations: HRR, hospital referral regions; ICU, intensive care unit; IQR, interquartile range.

Table. Health Care Resource Use From 2010 to 2016 Among HRRs With the Highest and Lowest 2010 End-of-Life Hospitalization Rates

a Hospitalization was calculated as the number of patients hospitalized at the end of life (including all hospitalizations regardless of whether there was an ICU admission) divided by all decedents.

b Hospitalization with ICU admission was calculated as the number of patients hospitalized with an ICU admission at the end of life divided by all decedents.

Figure. Hospital Referral Region (HRR)–Level Rates of Hospitalization and Hospice Use at the End of Life in the US, 2016

Rates are shown for the 20 hospital referral regions with the largest populations of decedents. Point size is scaled by the total number of decedents in the hospital referral region in 2016.
From 2010 to 2016, the rate of EOL hospitalization decreased in 283 of 306 HRRs (92.5%) (mean change, −4.2% per HRR; range −13.9% to 5.8%), and hospice enrollment increased in 92.9% of HRRs (mean change, 6.9% per HRR; range, −6.7% to 21.4%). Most EOL hospitalizations included an ICU admission. For example, in 2016, 73.2% of EOL hospitalizations in Cedar Rapids, Iowa, and 58.5% in Manhattan, New York, included an ICU admission.

Discussion

From 2010 through 2016, the rates of hospitalization at the EOL decreased and hospice enrollment increased in nearly all regions in the US. Nonetheless, Medicare beneficiaries with chronic illnesses continue to experience marked regional variation in EOL hospitalization, ICU use, and hospice use—these rates varied more than 3-fold across all US regions. Despite a common preference to avoid EOL hospitalization and intensive therapies, the region of residence may remain an important determinant of the site of EOL care.1

This study has important limitations. Many factors may play a role in the observed temporal patterns and HRR-level variation, including changes to health policy and practice, the supply of hospital and hospice services, and health care spending. We did not assess these factors in the current study. We included fee-for-service claims only. Hospice rates include inpatient and home hospice. In addition, unmeasured patient-level covariates may contribute to hospitalization and hospice rates and confound observed HRR-level associations between these rates. Although overall patterns in EOL care are encouraging, future research should focus on identifying modifiable factors that contribute to persistent regional disparities in EOL care such that patients’ values, rather than region of residence, guide the dying experience.

ARTICLE INFORMATION

Accepted for Publication: May 6, 2020.


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Author Contributions: Dr Maley had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: All authors.

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Drafting of the manuscript: Maley.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Maley.

Obtained funding: Stevens.

Supervision: Landon, Stevens.

Conflict of Interest Disclosures: Dr Stevens reported receiving royalties from McGraw-Hill and UpToDate and grants from the Agency for Healthcare Research and Quality and the Doris Duke Charitable Foundation. No other disclosures were reported.

Funding/Support: Dr Maley received funding support from the Harvard combined pulmonary and critical care fellowship. The data used in this analysis were obtained from Dartmouth Atlas Data website, which was funded by
the Robert Wood Johnson Foundation, The Dartmouth Clinical and Translational Science Institute, under award number UL1TR001086 from the National Center for Advancing Translational Sciences of the National Institutes of Health, and in part, by the National Institute of Aging under award number U01 AG046830.

**Role of the Funder/Sponsor:** The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

**REFERENCES**


