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Association between physician age and patterns of end-of-life care among older Americans

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Abstract

Background: End-of-life (EOL) care patterns may differ by physician age given differences in how physicians are trained or changes associated with aging. We sought to compare patterns of EOL care delivered to older Americans according to physician age.

Methods: We conducted a cross-sectional study of a 20% sample of Medicare fee-for-service beneficiaries aged ≥66 years who died in 2016–2019 ($n = 487{,}293$). We attributed beneficiaries to the physician who had >50% of primary care visits during the last 6 months of life. We compared beneficiary-level outcomes by physician age (<40, 40–49, 50–59, or ≥60) in two areas: (1) advance care planning (ACP) and palliative care; and (2) high-intensity care at the EOL.

Results: Beneficiaries attributed to younger physicians had slightly higher proportions of billed ACP (adjusted proportions, 17.1%, 16.1%, 15.5%, and 14.0% for physicians aged <40, 40–49, 50–59, and ≥60, respectively; *p*-for-trend adjusted for multiple comparisons <0.001) and palliative care counseling or hospice use in the last 180 days of life (64.5%, 63.6%, 61.9%, and 60.8%; *p*-for-trend <0.001). Similarly, physicians' younger age was associated with slightly lower proportions of emergency department visits (57.4%, 57.0%, 57.4%, and

58.1%; *p*-for-trend <0.001), hospital admissions (51.2%, 51.1%, 51.4%, and 52.1%; *p*-for-trend <0.001), intensive care unit admissions (27.8%, 27.9%, 28.2%, and 28.3%; *p*-for-trend = 0.03), or mechanical ventilation or cardiopulmonary resuscitation (14.2, 14.9%, 15.2%, and 15.3%; *p*-for-trend <0.001) in the last 30 days of life, and in-hospital death (20.2%, 20.6%, 21.3%, and 21.5%; *p*-for-trend <0.001).

Conclusions: We found that differences in patterns of EOL care between beneficiaries cared for by younger and older physicians were small, and thus, not clinically meaningful. Future research is warranted to understand the factors that can influence patterns of EOL care provided by physicians, including initial and continuing medical education.

KEYWORDS

advance care planning, end-of-life care, palliative care, physician age

INTRODUCTION

Older adults in the U.S. often receive suboptimal end-of-life (EOL) care.[1–3] Many individuals experience burdensome transitions across care settings near the EOL (e.g., home to hospital), and receive high-intensity care at the EOL that may not align with their goals of care and preferences.[4–6]

Previous studies have shown that physicians are influential in the decision-making process of EOL care,[7,8] and there is wide variation in how physicians care for patients at the EOL,[9–15] with one potential physician factor being physician age. Differences in patterns of EOL care might arise from the differences in the state of knowledge when older and younger physicians were trained (i.e., cohort effects[16]). As physicians age, they may accumulate clinical skills[17–19] but may have less familiarity with the latest clinical guidelines or technology than younger physicians (i.e., age effects).[20–22] Physicians' views towards EOL care may change over time based on clinical experiences with critically ill patients.

However, little is known about whether physician age is associated with patterns of EOL care. Evidence suggests that younger physicians may be more likely to have EOL discussion with patients and refer patients to palliative care.[23,24] Studies also show that physicians' older age (or more years in practice in some studies) may be associated with lower-intensity care at the EOL, such as recommendations for withholding or withdrawal of life-sustaining treatment, although evidence is mixed.[25–28] While informative, these studies are limited in that they are all based on physician surveys and did not examine actual EOL care patients receive. Understanding the association between physician age and patterns of EOL care has important implications for physician training and continuing medical education (CME) to improve EOL care among the growing population of older adults.

To address this knowledge gap, using a nationally representative sample of Medicare beneficiaries, we examined the association between physician age and patterns of EOL care with a broad range of EOL care measures.

Key points

- Among Medicare beneficiaries who died in 2016–2019, beneficiaries attributed to younger physicians were slightly more likely to have billed advance care planning and palliative care, compared to those attributed to older physicians.
- Physicians' younger age was also associated with slightly lower proportions of high-intensity care at the end of life (e.g., emergency department visits and hospital admissions in the last 30 days of life).
- However, the observed differences across physician age groups were small, and thus, not clinically meaningful.

Why does this paper matter?

Our findings call for future research to understand the factors that can influence patterns of EOL care provided by physicians, including initial and continuing medical education.

METHODS

Data source

We linked two primary data sets: (1) a 20% random sample of Medicare claims data from 2016 to 2019 and (2) Medicare Data on Provider Practice and Specialty (MD-PPAS) data. Medicare claims data provide beneficiary characteristics, such as age, death dates (more than 99% of death dates are verified), monthly fee-for-service coverage status, comorbidities (based on the definitions by the Chronic Condition Data Warehouse[29]), and detailed information on healthcare utilization. We used a 20% sample Medicare data because we needed to use the Medicare Part B (Carrier) Files to attribute beneficiaries to a physician as described below and the maximum data the Centers for Medicare & Medicare Services (CMS) generally provides to researchers for the Carrier Files is a 20% sample. The MD-PPAS data provide physician characteristics, including birth date, gender, and specialty, which is based on self-reported specialty information in the Provider Enrollment and Chain/Ownership System (PECOS), the national enrollment system for Medicare clinicians and suppliers.[30] We were able to link more than 99% of Medicare beneficiaries to the MD-PPAS data.

Study participants

First, we identified Medicare beneficiaries aged 66 years and older who died in 2016–2019 and had fee-for-service coverage continuously during the last 6 months of life. Next, we attributed each beneficiary's outcomes to a physician with a primary care specialty (family practice, general practice, internal medicine, or geriatric medicine, based on the practitioner taxonomy codes in the MD-PPAS[31]) who filed more than 50% of evaluation-and-management (E&M) claims in the last 6 months of life (see Supplementary Table S1 for included billing codes). A similar approach has been used in the Medicare Accountable Care Organization program and prior research to attribute beneficiaries to a physician or an accountable care organization.[32–34]

We excluded beneficiaries (1) who died before July 1, 2016, because we used information during the last 6 months of life; (2) whose outcomes were unable to be attributed to a physician (i.e., a beneficiary did not receive any E&M services by a physician with a primary care specialty during the last 6 months of life or did not have a physician who provided more than 50% of E&M services); or (3) who had missing data on study variables. See Figure 1 for a flowchart of study participants.

Physician age

Our exposure variable was physician age, calculated based on physicians' birth date. We categorized physician age in 10-year increments (<40, 40–49, 50–59, and ≥60 years) to allow for a non-linear relationship between physician age and outcomes. Because we are interested in when they received medical training and the changes that occur as physicians age, in addition to accumulating clinical skills, we chose to use physician age, rather than years in practice, as our exposure variable (although physician age and years in clinical practice are known to be highly correlated[17]). To test the sensitivity of our findings to the choice of the exposure variable, we conducted a

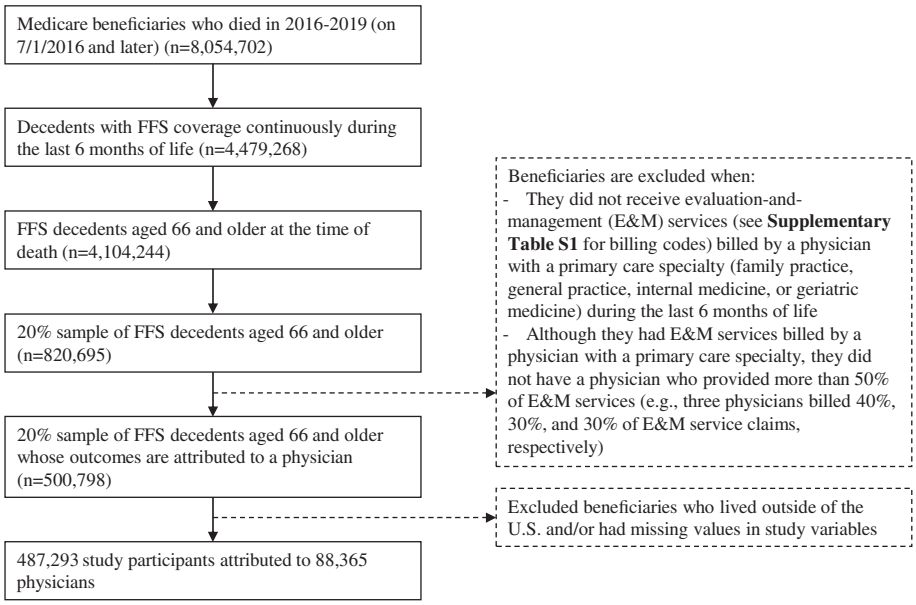

FIGURE 1 Flowchart of the study participants. FFS, fee-for-service.

sensitivity analysis using years in practice as an exposure variable.

Patterns of end-of-life care

We examined patterns of EOL care at the beneficiary level in two areas: (1) advance care planning (ACP) and palliative care, and (2) high-intensity care at the EOL, based on Medicare fee-for-service claims data (see Supplementary Table S2 for the Current Procedural Terminology codes and International Classification of Disease −10 codes used to define study outcomes). First, we examined ACP and palliative care using two measures: (i) billed ACP at any time before death, and (ii) palliative care counseling or hospice use during the last 180 days of life.[35,36] Second, we examined high-intensity care at the EOL by whether a beneficiary experienced each of the following five healthcare services in the last 30 days of life: (i) emergency department visit, (ii) hospital admission, (iii) intensive care unit (ICU) admission, (iv) mechanical ventilation or cardiopulmonary resuscitation (and/or defibrillation), or (v) placement of a feeding tube. We also examined (vi) in-hospital death as a measure of high-intensity care at the EOL.

Adjustment variables

We adjusted for the following beneficiary characteristics: age at the time of death (continuous), gender, race, and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, or Other), comorbidities (indicator variables for 26 Chronic Condition Data Warehouse chronic conditions—including "Alzheimer's disease and related disorders or Senile Dementia", but not including "Alzheimer's disease" because they overlap), median annual household income estimated at the residential zip code level (categorized into quintiles), Medicaid coverage, and long-term nursing home resident status. We used the Minimum Data Set (MDS) 3.0, a federally mandated clinical assessment of all residents in Medicare- or Medicaid-certified nursing homes, and defined long-term nursing home residents as those who had a comprehensive or quarterly MDS assessment within 90 days before death.[37] We also adjusted for fixed effects for the year of death (to account for secular trends) and Hospital Service Areas (HSAs) (to account for unmeasured geographic variation), effectively comparing physicians in different age categories in the same year and HSA.

Additionally, we adjusted for physician characteristics in the models: gender, geriatric training (because a previous study showed different patterns of EOL care by physicians' geriatric training status[38]), health system affiliation (because a previous study indicated different care patterns by physicians' health system affiliation status[39–42]), and the number of attributed beneficiaries (categorized into tertiles). We used physician-level data by Doximity, a professional networking platform for physicians in the U.S.[43,44] and defined physicians' geriatric training as (1) those with a self-reported specialty of geriatric medicine in the MD-PASS data and/or (2) those with board certification in geriatric medicine (both active and inactive) through the American Board of Internal Medicine (ABIM) in the Doximity data. We also used the RAND Health System, developed by the RAND Center of Excellence of Health System Performance, to determine whether a physician is affiliated with a health system (defined as "two or more health care organizations affiliated with each other through shared ownership or a contracting relationship for payment and service delivery").[45]

Statistical analysis

We examined the association between physician age and each measure for patterns of EOL care by fitting multivariable linear regression models adjusting for beneficiary and physician characteristics as well as year of death and HSA fixed effects. We used a categorical variable for physician age (<40, 40–49, 50–59, or ≥60 years) to estimate predicted probabilities of outcomes but used an ordinal variable to test the trend across physician age groups. We analyzed data at the beneficiary level and clustered standard errors at the physician level to account for potential correlation among beneficiaries attributed to the same physician. Although the study outcomes are binary, we used linear regression models for ease of interpretation of the regression coefficients (i.e., linear probability models).[46] We used the Holm-Bonferroni method to account for the multiple comparisons across outcomes, and report both unadjusted and adjusted *p*-values (an adjusted *p*-value of <0.05 was considered statistically significant).[47]

We conducted statistical analyses using SAS version 9.4 and Stata/MP 16.1. This study was reviewed and granted exempt by the University of California Los Angeles Institutional Review Board.

Secondary analyses

To further understand the association between physician age and patterns of EOL care, we conducted several secondary analyses. First, because patterns of EOL care

might differ by comorbidity, we conducted a subgroup analysis by the following three medical conditions based on the Chronic Condition Data Warehouse: (1) Alzheimer's disease and related disorders (ADRD), (2) cancer (breast, colorectal, endometrial, lung, and prostate cancer), and (3) chronic obstructive pulmonary disease (COPD). Second, we stratified the analysis according to whether a beneficiary was a nursing home resident because long-term nursing home status may be associated with patterns of EOL care. Third, we examined the association between years in practice (instead of physician age) and patterns of EOL care because physician age and years in practice capture slightly different concepts, although these two variables are highly correlated.[17] We estimated years in practice by subtracting 3 years (the duration of internal and family medicine residency programs) from years since medical school graduation, which were based on the Database and Doctors and Clinicians National Downloadable File.[48] Fourth, to test whether our decision to attribute beneficiaries to the physician who accounted for >50% of E&M claims in the last 6 months of life affected our findings, we reanalyzed the data using alternative approaches. Specifically, we attributed beneficiaries to the physician who filed the largest number, exceeding either 30% or 40% (instead of 50% used in the main analysis), of E&M claims in the last 6 months of life. Fifth, we conducted a sensitivity analysis using a more detailed categorization of age groups (<40, 40–49, 50–59, 60–69, 70–79, and ≥80 years) to test the sensitivity of our findings to the categorization of age groups. Last, to test the sensitivity of our findings to model specification, we conducted a sensitivity analysis using generalized estimating equations (GEE).

RESULTS

Physician and beneficiary characteristics

We included 487,293 Medicare fee-for-service beneficiaries who died in 2016–2019 (see Figure 1 for a flowchart of the study participants), who were attributed to 88,365 physicians (Table 1). Older physician groups were more likely to be male, have geriatric training, be unaffiliated with a health system, and have more attributed beneficiaries than younger physician groups, although most of the differences were small (Table 1). Beneficiaries under the care of older physicians were slightly older, more likely to be male, less likely to be non-Hispanic White, more likely to have Medicaid coverage, and more likely to live in zip codes with lower median household incomes, compared to those under the care of younger physicians (Table 1).

Physician age and patterns of EOL care

Beneficiaries under the care of younger physicians had slightly higher proportions of billed ACP (adjusted proportions, 17.1%, 16.1%, 15.5%, and 14.0% for physicians aged under 40, 40–49, 50–59, and 60 years or over, respectively; *p*-for-trend adjusted for multiple comparisons <0.001) and palliative care counseling or hospice use in the last 180 days of life (64.5%, 63.6%, 61.9%, and 60.8%; *p*-for-trend <0.001) (Figure 2 and Supplementary Table S3). We also found that physicians' younger age was associated with slightly lower proportions of high-intensity care at the EOL: emergency department visits (57.4%, 57.0%, 57.4%, and 58.1%; *p*-for-trend <0.001), hospital admissions (51.2%, 51.1%, 51.4%, and 52.1%; *p*-for-trend <0.001), ICU admissions (27.8%, 27.9%, 28.2%, and 28.3%; *p*-for-trend = 0.03), mechanical ventilation or cardiopulmonary resuscitation (14.2%, 14.9%, 15.2%, and 15.3%; *p*-for-trend <0.001) in the last 30 days of life, as well as in-hospital death (20.2%, 20.6%, 21.3%, and 21.5%; *p*-for-trend <0.001) (Figure 2 and Supplementary Table S3). There was no evidence that the proportion of feeding tube placement differed by physician age.

Secondary analyses

A subgroup analysis by beneficiary medical conditions (i.e., ADRD, cancer, and COPD) showed weak associations between physician age and EOL care outcomes across conditions, although beneficiaries with cancer or COPD were more likely to receive high-intensity care at the EOL than those with ADRD (Figure 3 and Supplementary Table S4). We also observed similar patterns regardless of whether beneficiaries were nursing home residents or not (Figure 4 and Supplementary Table S5). Sensitivity analyses using years of clinical experience (instead of physician age) as the exposure variable, alternative physician attribution rules, a more detailed categorization of age groups, or alternative model specification (i.e., GEE) yielded similar results to the main analysis (Supplementary Tables S6–10).

DISCUSSION

Using a nationally representative sample of Medicare fee-for-service beneficiaries who died in 2016–2019, we compared patterns of EOL care between beneficiaries cared for by younger and older physicians. We found that differences in billed ACP and palliative care counseling as well as high-intensity care at the EOL across physician age groups were small, and thus, not clinically

TABLE 1 Physician and beneficiary characteristics by physician age.

Characteristics	Overall	Physician age			
		<40	40–49	50–59	≥60
Physicians	***n* = 88,365**	***n* = 18,795**	***n* = 25,874**	***n* = 25,941**	***n* = 17,755**
Age, mean (SD), years	49.5 (11.0)	34.2 (3.3)	44.9 (2.8)	54.5 (2.9)	64.9 (4.5)
Female, %	34.6	52.0	41.1	29.3	14.5
Geriatric training, %	3.5	2.3	3.0	3.0	5.9
Health system affiliation, %	37.7	54.6	38.9	33.1	25.0
Number of attributed beneficiaries, mean (SD)	5.5 (8.2)	3.7 (5.7)	5.5 (8.6)	6.1 (8.6)	6.5 (8.8)
Beneficiaries	***n* = 487,293**	***n* = 51,014**	***n* = 125,177**	***n* = 160,238**	***n* = 150,864**
Age, mean, years	83.5 (8.6)	82.6 (8.7)	83.3 (8.6)	83.5 (8.6)	83.8 (8.6)
Female, %	55.7	56.1	56.4	55.8	54.9
Race and ethnicity, %					
Non-Hispanic white	85.5	85.9	85.7	85.4	85.3
Non-Hispanic black	7.3	7.4	7.2	7.3	7.4
Hispanic	3.9	3.5	3.8	4.1	4.0
Other	3.3	3.3	3.2	3.3	3.3
Medicaid coverage, %	21.4	19.0	20.6	21.5	22.9
Zip-code level annual household income, mean (SD), $	66,758 (27,319)	65,297 (26,152)	68,044 (27,750)	66,977 (27,326)	65,953 (27,286)
Nursing home resident	36.3	33.4	37.2	36.2	36.7
Selected coexisting conditions, %					
Congestive heart failure	54.5	54.0	54.4	54.5	54.7
Chronic obstructive pulmonary disease (COPD)	32.5	32.5	32.4	32.8	32.3
Chronic kidney disease	63.6	64.0	63.9	63.6	63.0
Alzheimer's disease and related disorders (ADRD)	54.8	51.8	55.2	54.7	55.5
Diabetes	41.6	40.3	41.5	41.9	41.7
Cancer	19.7	20.7	19.9	19.6	19.4

Note: Data is for decedents 66 years and older from 20% of Medicare claims data 2016–2019. Cancer included five cancer types (breast, colorectal, endometrial, lung, and prostate cancer).

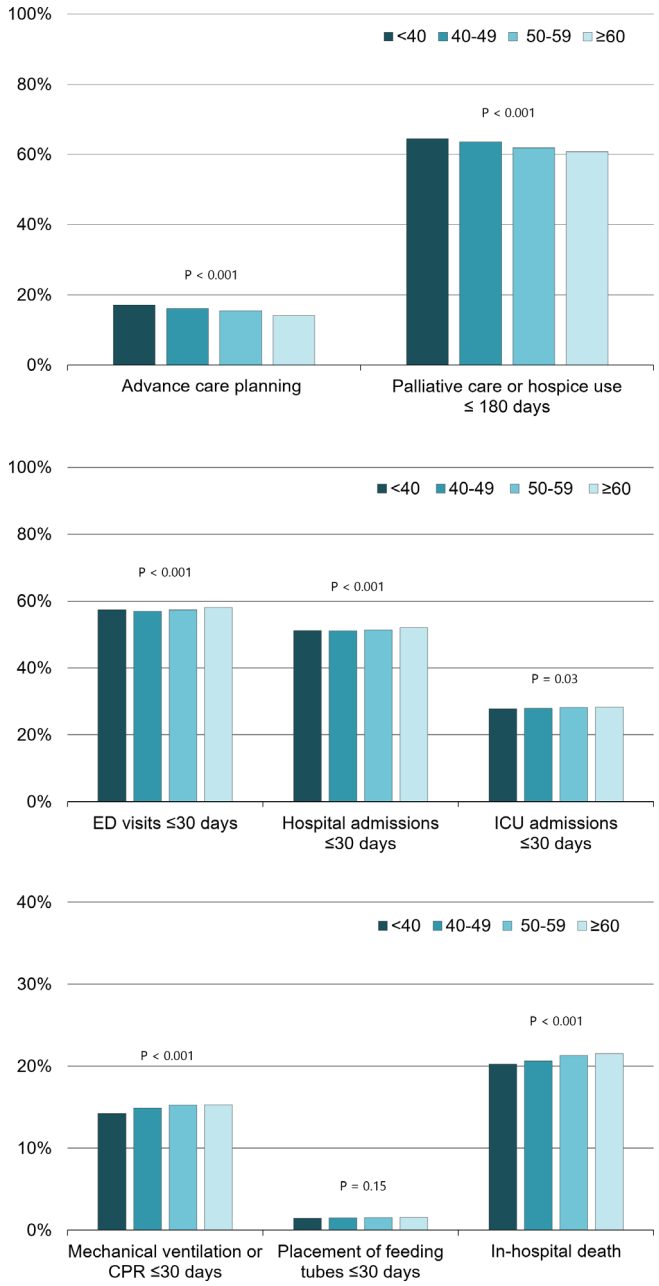

FIGURE 2 Association between physician age and patterns of end-of-life care. Using decedents 66 years and older from 20% of Medicare claims data 2016–2019, we fit linear regression models adjusted for beneficiaries' characteristics (age, gender, race, and ethnicity, comorbidities, zip-code level median annual household income, Medicaid coverage, and long-term nursing home resident status) and physician characteristics (gender, geriatric training, health system affiliation, and tertiles of the number of attributed beneficiaries). We also included fixed effects for the year of death and Hospital Service Areas in the models. See the main text for the algorithm to attribute each beneficiary's outcomes to physicians. *p*-values are adjusted with the Holm-Bonferroni method to account for the multiple comparisons across outcomes (an adjusted *p*-value of <0.05 is considered statistically significant). CPR, cardiopulmonary resuscitation; ED, emergency department; ICU, intensive care unit.

meaningful. These patterns did not vary by patients' comorbidities (ADRD, cancer, and COPD) or whether beneficiaries were nursing home residents or not.

There are several potential explanations for the observed similarities in patterns of EOL care between younger and older physicians. First, ongoing professional development opportunities, such as CME, may help align the practices of these two groups. Many medical schools only began to include palliative care training in their curricula after 2000, following the Liaison Committee on Medical Education (LCME) mandate for the inclusion of EOL care,[49,50] and most of the physicians older than 40 years in our study received medical education before this curriculum change (i.e., cohort effects[16]). Although older physicians might be less familiar with the rapidly evolving clinical guidelines, such as the expanded use of palliative care for non-cancer illness,[51] or the new technologies used for patient-physician communication (i.e., age effects),[20–22] the engagement of these physicians in opportunities to update their clinical knowledge and technical skills may compensate these differences. For example, a number of states have recognized the importance of palliative care and have implemented CME requirements on palliative care in recent years.[52] Second, an interdisciplinary approach may contribute to the standardization of EOL care. Medical care, including EOL care, is increasingly delivered by interdisciplinary teams that include physicians, nurses, social workers, and other specialists, ensuring care that transcends individual physician preferences and experiences.[53,54] Third, the growing emphasis on patient-centered care and shared decision-making may explain our findings. For example, the Centers for Medicare & Medicaid Services implemented the ACP billing codes in 2016,[55] recognizing the importance of aligning care with the values, preferences, and needs of patients and their families. Such approaches may reduce practice variability among physicians, centering care decisions around the patients' wishes. Future research is warranted to understand how these factors influence the patterns of EOL care provided by physicians to inform future interventions to improve EOL care.

In addition, the observed minor differences in billed ACP and palliative care counseling between younger and older physicians might reflect variations in billing practice, rather than actual differences in clinical care provided. Although we have no data to support or refute this hypothesis, it is possible that older physicians could be providing ACP and palliative care counseling as frequently as younger peers but may not bill for these services due to the following possible mechanisms. First, given the frequent updates, older physicians who have been practicing for a long period may face challenges

FIGURE 3 Association between physician age and patterns of end-of-life care by condition. We conducted a subgroup analysis by the following three medical conditions: (1) Alzheimer's disease-related disorders (ADRD), (2) cancer (breast, colorectal, endometrial, lung, and prostate cancer), and (3) chronic obstructive pulmonary disease (COPD). See the main text and notes for Figure 1 for more details. *p*-values (for trend) are adjusted with the Holm-Bonferroni method to account for the multiple comparisons across outcomes (an adjusted *p*-value of <0.05 is considered statistically significant). CPR, cardiopulmonary resuscitation; ED, emergency department; ICU, intensive care unit.

keeping up with the latest billing policies (e.g., the implementation of ACP billing codes in 2016). Second, older physicians may be more likely to be solo or small group practitioners, potentially having fewer resources available for billing submission. Third, patient-physician relationships are longer among older physicians, and ACP might have occurred before the implementation of ACP billing codes. Further, older physicians were more likely to care for non-white patients and patients with Medicaid insurance. These factors may be associated with unobserved variables such as patient preferences that may explain the differences in the outcomes.[56] Given the limited granularity of the Medicare claims data, further research is necessary to elucidate the exact mechanisms underlying our findings.

Our study builds upon previous work that examined the association between physician age (or clinical experience) and the quality of EOL care. A survey of 1050 Veteran Affairs physicians in 1993 showed that younger physician age was associated with reporting to have EOL discussions with patients.[23] Another study based on a survey among managed care physicians in Southern California in 2008 found that younger physicians were more likely to refer patients to home-based palliative care and hospice.[24] On the other hand, some studies suggest that physicians' older age (or more years in practice) may be associated with lower-intensity care at the EOL, although the evidence is mixed.[25–28] One study examining survey data of Canadian healthcare workers found that healthcare workers with more years in practice were more

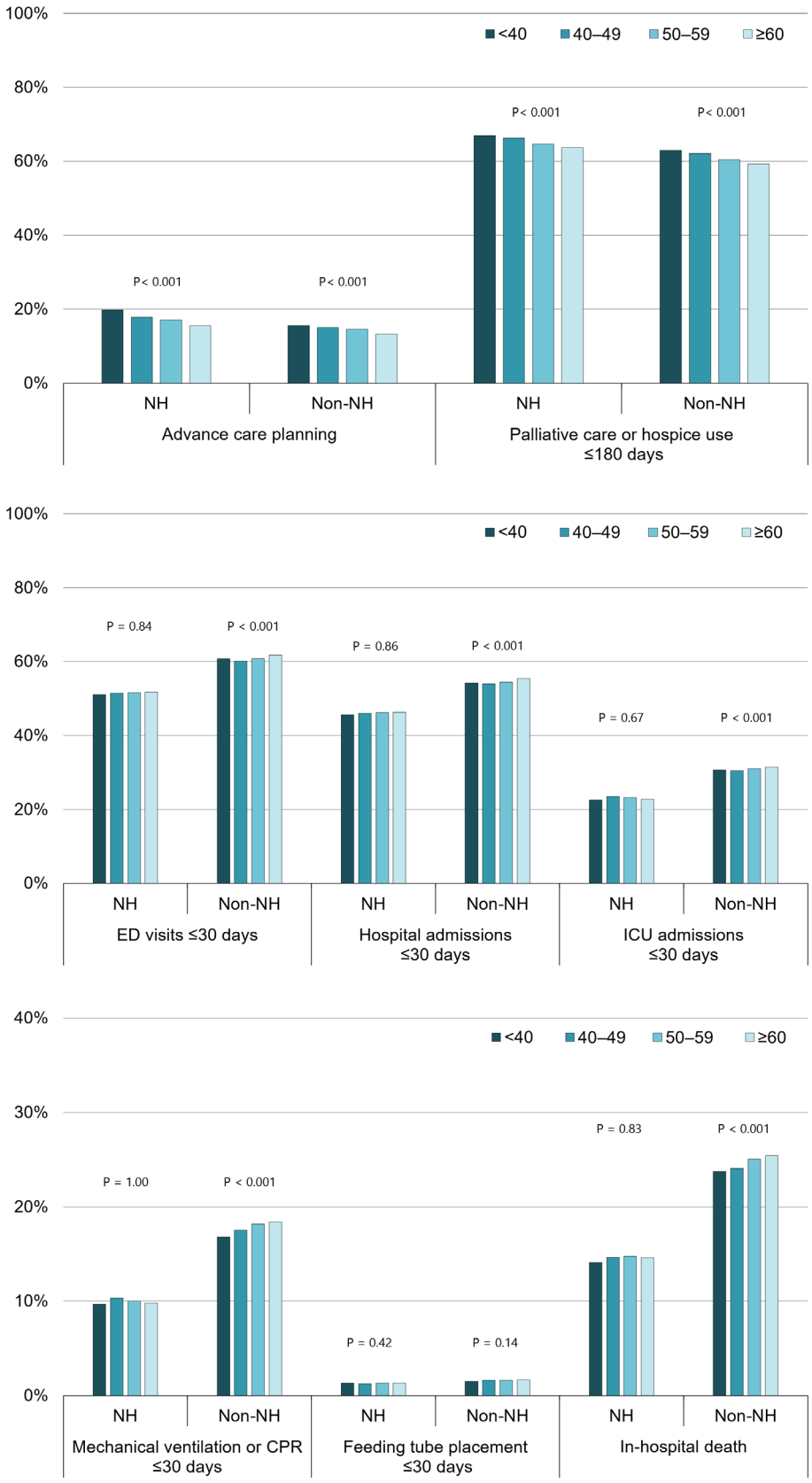

FIGURE 4 Association between physician age and patterns of end-of-life care by nursing home status. We conducted a stratified analysis by long-term nursing home resident status. See the main text and notes for Figure 1 for more details. *p*-values (for trend) are adjusted with the Holm-Bonferroni method to account for the multiple comparisons across outcomes (an adjusted *p*-value of <0.05 is considered statistically significant and an adjusted *p*-value >1.00 is winsorized at 1.00). CPR, cardiopulmonary resuscitation; ED, emergency department; ICU, intensive care unit; NH, nursing home.

likely to recommend withdrawal from life support.[25] In a study of physicians' opinions on discussing and recommending do-not-resuscitate (DNR) orders in clinical vignettes, physicians with more years in practice were more likely to recommend DNR than residents and fellows but not specialty physicians.[26] Another survey-based

study of European physicians showed that physician age was not associated with discussion of options to withhold or withdraw life-sustaining treatment or palliative care options.[27] However, these studies all used physician surveys and did not examine patient-level data. We provide new evidence on the association between physician age and billed EOL care using patient-level data from a U.S. nationally representative sample.

Our study has limitations. First, while we adjusted for important beneficiary- and physician-level characteristics, it is possible that unobserved patient factors (e.g., preference for lower-intensity care) may confound the association between physician age and the patterns of EOL care.[57] Second, our physician attribution algorithm may have resulted in incorrect attributions for some beneficiaries, leading to misclassification of physician age categories, while our findings were not sensitive to alternative physician attribution rules. Similarly, attributed physicians may not have control over inpatient care. Third, our study was not able to determine whether high-intensity care at the EOL was appropriate (e.g., in a patient without comorbidities) or concordant with patients' care preferences. However, a previous survey-based study conducted among Medicare beneficiaries has suggested that people tend to prefer treatments that focus on the palliation of symptoms rather than life extension.[57] Last, the generalizability of our findings to other populations, such as younger populations and Medicare Advantage enrollees, may be limited.

In summary, in a national analysis of Medicare beneficiaries, we found that differences in patterns of EOL care between beneficiaries attributed to younger and older physicians were small and not clinically meaningful. Further work is needed to understand the physician factors (e.g., medical education and training) that influence the patterns of EOL care.

AUTHOR CONTRIBUTIONS

Concept and design: Gotanda, Tsugawa. Acquisition, analysis, or interpretation of data: All authors. Drafting of the manuscript: Gotanda, Ikesu, Zhang, Tsugawa. Critical review of the manuscript for important intellectual content: All authors. Statistical analysis: Xu.

CONFLICT OF INTEREST STATEMENT

Dr. Jena reports receiving (in the last 36 months) consulting fees unrelated to this work from Bioverativ, Merck/Sharp/Dohme, Janssen, Edwards Life Sciences, Amgen, Eisai, Otsuka Pharmaceuticals, Vertex Pharmaceuticals, Sage Therapeutics, and Analysis Group. Dr. Jena also reports receiving (in the last 36 months) income unrelated to this work from hosting the podcast Freakonomics, M.D., from book rights to Doubleday Books, and from speaking fees from AAE and the Harry Walker Agency.

SPONSOR'S ROLE

The content is solely the responsibility of the authors and does not necessarily represent the official views of the funders.

FINANCIAL DISCLOSURE

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Supplementary Table S1. Primary care service billing codes included in the beneficiary attribution algorithm.
Supplementary Table S2. Current Procedural Terminology (CPT) codes and International Classification of Disease (ICD)-10 codes used to define study outcomes.
Supplementary Table S3. Association between physician age and patterns of end-of-life care.
Supplementary Table S4. Association between physician age and patterns of end-of-life care by condition.
Supplementary Table S5. Association between physician age and patterns of end-of-life care by nursing home status.
Supplementary Table S6. Association between physicians' years of clinical experience and patterns of end-of-life care.
Supplementary Table S7. Association between physician age and patterns of end-of-life care (using a 30% threshold for the physician attribution rule).
Supplementary Table S8. Association between physician age and patterns of end-of-life care (using a 40% threshold for the physician attribution rule).
Supplementary Table S9. Association between physician age and patterns of end-of-life care (using a more detailed categorization of age groups).
Supplementary Table S10. Association between physician age and patterns of end-of-life care (using generalized estimating equations [GEE]).

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