Impact of the Physician Orders for Life-Sustaining Treatment (POLST) Program Maturity Status on the Nursing Home Resident's Place of Death

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Abstract

Background: The Physician Orders for Life-Sustaining Treatment program was developed to enhance quality of care delivered at end-of-life. Although positive impacts of the Physician Orders for Life-Sustaining Treatment Program use have been identified, the association between a state's program maturity status and nursing home resident's likelihood of dying in their current care settings, nursing homes, remain unanswered.

Objective: Examine the impact of the Physician Orders for Life-Sustaining Program maturity status on nursing home residents' odds of dying in nursing homes.

Methods: Program maturity status data were linked with multiple datasets: Minimum Data Set, Vital Statistics Data, Master Beneficiary Summary File, Certification and Survey Provider Enhanced Reports, and Area Health Resource File. Stratifying residents on long-stay and short-stay, we used descriptive statistics and multivariable logistic regression models for total 595,152 individuals.

Results: Controlling for individual and contextual variables, long-stay nursing home residents living in states where the program was mature status had 20% increased odds of dying in nursing homes (OR: 1.20; CI 1.02-1.43) compared to those who resided in states with non-conforming status. Individuals residing in states with developing program status showed 11% increase in odds of dying in nursing homes (OR: 1.12; CI 1.02-1.24) compared to non-conforming status. No significant difference was noted for short-stay nursing home residents.

Conclusion: Mature and developing maturity status were associated with greater likelihood of dying in nursing homes among long-stay residents. Our findings inform that a well-structured advance care planning program such as Physician Orders for Life-Sustaining Program enhances care outcomes among older adults living in nursing homes.

Introduction

Over 16,000 U.S. nursing homes (NHs) serve nearly 1.5 million U.S. individuals at any time.(1) An estimated 1 in 4 Americans will die in NHs,(2, 3) and this number is projected to increase making end-of-life (EoL) care important in this setting.(2, 4, 5) Many experts have proposed domains of EoL care that can serve as quality indicators including: symptom management and care satisfaction,(6–8) advance care planning,(7–9) aggressiveness of care,(2, 10) and place of death for long-stay residents.(8, 11) Place of death for NH residents as an EoL quality care marker needs to be carefully considered because of the differing care needs of long-stay NH compared to short-stay residents.(12, 13) Contrary to the goals of care in short-stay residents, which often focuses on rehabilitation, the goals of care for long-stay residents align towards optimizing quality of life and relief of suffering due to irreversible cognitive impairments,(14–16) or progressively worsening physical impairments.(17, 18) For these residents, death in acute care facilities (e.g., emergency rooms or hospitals) is often deemed inappropriate, as hospital transfers are associated with physical and financial burdens,(19) adverse health outcomes,(20) and

aggressive or unwanted medical interventions.(11, 21–24) For long-stay NH residents, hospital deaths have been identified as a marker for poor quality of EoL care.(4, 13, 25–27)

The Physician Orders for Life-Sustaining Treatment (POLST) program is an advance care planning paradigm developed by medical experts in Oregon.(28) As a voluntary tool, acknowledged as a program to help achieve high quality EoL care, it aims to facilitate EoL care discussions between a healthcare provider and a dying patients.(29–33)

To standardize the program, the national POLST program task force established 4 levels of program maturity status: mature, endorsed, developing, and non-conforming.(28, 34) Mature status indicates the highest endorsement level, where the POLST program (e.g., California's POLST) is part of the standard of care for individuals living with serious illnesses.(34) Endorsed status indicates that the state POLST program (e.g., New York's MOLST; M stands for medical) met key elements (e.g., having a single form for a state-wide usage), and developed strategies for ongoing education and quality assurance.(28, 34) Developing status indicates the POLST program (e.g., Ohio's MOLST) is at an initial stage of development, and working towards statewide implementation. Lastly, non-conforming status (e.g., Nebraska's POLST) indicates the POLST program either does not exist, or the state program does not meet the national POLST program endorsement criteria (e.g., no agreement on single form use).

While the use of POLST program was positively associated with increased hospice referrals,(35, 36) and EoL care discussions,(37–40) an association between a state's POLST program maturity status and NH residents outcomes is unclear. The aim of this study is to examine the impact of POLST maturity status on the NH death among elderly residents. We hypothesized that the higher POLST maturity status was positively associated with a greater likelihood of dying in the NH for long-stay residents.

Method

This national study is a retrospective, cross sectional analysis.

Data sources

We used data collected from a previously published POLST program environmental scan,(41) linked with national-level administrative datasets: 2014 Vital Statistics File, 2012–2013 Minimum Data Set 3.0 (MDS), 2014 Certification and Survey Provider Enhanced Reporting (CASPER), Area Health Resources File (AHRF) and the 2013 Master Beneficiary Summary File (MBSF).(41) All data were linked by facility identification or location.

The environmental scan included data on: a) state's POLST maturity status; b) POLST adoption year, c) year of current maturity status, and d) number of years it took to advance to the current maturity status. These data were collected for each U.S. state's POLST program maturity status, as of 2013.

The Vital Statistics File was used to identify U.S. NH residents who died in 2013. Resident-level data were extracted from the MDS, federally mandated clinical assessments of NH residents residing in Centers of Medicare and Medicaid Services (CMS) certified nursing facilities.(42) Detailed health assessments are recorded upon admission, quarterly thereafter, and when any significant changes (i.e., transfer or death) occur; they contain demographic and health information (i.e., functional status).(43) We used the last available annual or the quarterly Omnibus Budget Reconciliation Act /Prospective Payment System (OBRA/PPS) assessment type prior to death for our long-stay group. For short-stay group, we utilized the PPS assessment type (i.e., 5-day, 14 day or 30 day scheduled assessment; whichever was the most recent). Resident characteristics extracted were: age at death, sex, race/ethnicity, and date of NH admission and discharge (when applicable); assessments on bed mobility, transfer, toilet use were extracted to compute the total activities of daily living (ADL) score for study sample.(44)

The CASPER dataset contains facility level information collected during the state annual inspections of NHs for CMS-required quality assurance.(45) Facility-level characteristics extracted included ownership, membership affiliation/ chain, bed size, occupancy rate, staffing and the presence of special units (i.e., Alzheimer's and/or hospice unit). Inclusion of presence of special units in NHs was guided by recent publications,(46, 47) which noted that having special units are associated with residents' health outcomes.

AHRF is a publicly available county-level dataset.(48) The following information were extracted: proportion elderly (> 65 years) population in county, and median household income. The MBSF data were used to identify Medicare beneficiaries with the following chronic conditions: Alzheimer's disease, dementia, chronic kidney disease (CKD), diabetes, cancer, and chronic obstructive pulmonary disease (COPD).(49)

Study Sample

We identified 1,009,372 unique individuals who died in 2013. The sampling process shown in Fig. 1. Exclusions were: individuals with no MDS in year 2012 or 2013, unable to merge with CASPER or AHRF data due to issues including inaccurate facility identifier or county code, no MBSF information, younger than 65 years of age, and living in the Virgin Islands. Our final study sample included 595,152 unique individuals. Guided by previous NH studies and based on our hypothesis,(50–52) we further classified our sample into long-stay (with consecutive length of stay equal or longer than 90 days) or short-stay.

Outcome variables

The primary outcome was place of death, dichotomized as NH death = 1, non-NH death = 0. NH death was defined on the last MDS assessment if a) resident's discharge placement indicated deceased, or b) MDS assessment type indicated death in facility. NH death was marked as no if a) MDS assessment type indicated discharge reporting and b) discharge to one of following settings: community; another NH facility; acute hospital; psychiatric hospital; inpatient rehab; Intellectual/ Development Disability (ID/DD) facility; hospice; long-term care hospital; or other.

Predictor variables

The main predictor of interest was the POLST program maturity status.(41) Guided by previous NH studies, individual and contextual characteristics associated with place of death in NHs were also examined. Individual characteristics included were: resident's age, sex, race/ ethnicity, marital status, chronic conditions, and the total ADL score.(27, 50, 53–55) Facility level predictors were: presence of special unit and bed size. Other contextual variables included: NH type, affiliation or chain status, occupancy rate, staffing, profit status, proportion of elderly population ≥ 65 , and median household income,(48, 56) setting, and geographic regions.(11, 25, 48, 53)

Analysis

Descriptive statistics were used to summarize the study sample. Bivariate analyses were conducted to investigate differences in the study population between long and short-stay residents using chi-square and t-test statistic stratified by individuals with long and short-stays. Multivariable logistic regressions were conducted. To account for the non-independence of observations derived from repeated measures of NH facilities within the same county, we estimated county-clustered robust standard errors. Odds ratio (OR) and 95% confidence intervals (CI) were calculated. All analyses were conducted using SAS 9.4.

Results

Resident level characteristics

Resident characteristics are presented in **Table 1**. The study sample included 595,152 unique elderly individuals, 48% long-stay ($n = 285,888$) and 52% short-stay residents ($n = 309,264$). These individuals resided in 6,241 NHs across the nation. Except for the presence of hospice unit within NH facilities, all other variables were significantly different across the long and short-stay groups ($p < .0001$). The residents were predominantly female (61%), non-Hispanic White (85%), and died between the ages of 86-90 (24%). The average age at death was 84 years ($SD \pm 8.35$). Nearly half (49%) were in oldest age group, age 86 and older. Little over half (52%) reported their marital status as widowed. The proportion of those widowed were higher among long-stay residents (58%) than in short-stay (46%) residents ($p < .0001$). The most common chronic conditions were CHF (50%) and CKD (48%). Although the total proportion of sample residents who suffered from Alzheimer's disease were 29%, the proportion was much higher among long-stay residents than short-stay residents (41% vs. 17%, respectively, $p < 0.001$). The proportion of cancer patients was higher among short-stay residents than long-stay residents (19% vs. 8%, respectively, $p < .0001$). Over half (57%) of all residents died in NH, and this was more common among long-stay residents than short-stay residents (76% vs 41% respectively, $p < .0001$).

State POLST program characteristics

The majority of states (59%) had a POLST program with *developing* maturity status, followed by *endorsed* (35%), *non-conforming* (5%) and *mature* (1%). Nearly all (95%) of sample residents (i.e., 95% of

all long-stay and 96% of all short-stay residents) were from the states where the POLST program had developing or higher maturity status.

Contextual characteristics

The contextual variables are presented in **Table 2**. Most NHs were for-profit status (72%) and chain affiliated (57%). More than half (59%) of NHs were equipped with 100-199 beds, with an average occupancy rate of 84% (± 13.60). The was on average 0.74 hours per resident day for registered nurses (SD ± 0.43), 0.84 hours per resident day for licensed practical nurses (SD ± 0.35), and 2.16 hours per resident day for certified nursing assistant (SD ± 0.65). Twenty two percent of all NHs were equipped with Alzheimer's unit; only 1% had a hospice unit (1%). NHs were mainly located in the South (36%) and in metropolitan areas (81%). The average proportion of elderly population per county was 10% (SD ± 3.27), and the median household income per county was \$53,334.54 (SD $\pm 13,957.46$)

Impact of POLST maturity status on NH death

Table 3 shows the result of multivariable logistic regression. The odds of dying in NHs were 20% higher in states that had *mature* POLST programs, compared to states where the POLST program was *non-conforming* (OR: 1.20, 95% CI 1.02-1.43). Residents in a state where the POLST program had *developing* status had 12% (OR: 1.12, 95% CI 1.02-1.24) increased odds of dying in NHs compared to residents in states where the POLST program was non-conforming. *Endorsed* POLST status showed 11% increase in NH death, but lacked significance (OR: 1.09, 95% CI 0.98-1.21). There was no difference for short-stay residents.

Predictors of NH death by Stay Type

In long-stay residents, older age groups had progressively higher likelihood of dying in NHs (ORs: 1.14-4.02). This association was similar in the short-stay group (ORs 1.04-2.88). Although odds of dying in NHs were not statistically different between the reference group (65-70 years) and the second youngest age group (71-75 years); all other age groups had progressively higher odds of dying in NHs (OR: 1.04, 1.19, 1.35, 1.63, 1.91, 2.23 for age group 76-80, 81-85, 86-90, 91-95, 96-100, 101-110, respectively).

In both long and short-stay residents, individuals who were never married, divorced, separated, or widowed had higher likelihood of dying in NHs than married individuals (ORs: 1.10-1.57). In a long-stay group, separated marital status was the strongest predictor of NH deaths (OR: 1.27, 95% CI 1.14-1.40) compared to the married status. For the short-stay residents, never been married was the strongest predictor of NH deaths (OR: 1.52, 95% CI 1.47-1.57).

In the long-stay residents, compared to White race, all other race groups (i.e., African American, American Indian, Asian, Hispanic, Native Hawaiian/ Pacific Islander, 2 or more race) had lower odds of dying in NHs (ORs: 0.66-0.71). In the short-stay residents, those who were Asian or multiple races had higher odds of dying in NHs (OR 1.22, 1.35, 95% CI 1.07-1.38, 1.15-1.58, respectively).

COPD increased likelihood of death in NHs compared to those who did not have COPD (OR: 1.49, 95% CI 1.45-1.53 long-stay; OR: 1.20, 95% CI 1.18-1.23 short-stay). Alzheimer's disease also increased likelihood of dying in NHs (OR: 1.49, 95% CI 1.44-1.54; OR: 1.45, 95% CI 1.42-1.48, respectively). An inverse relationship was noted in likelihood of dying in NHs for the NH residents suffering from cancer (OR 0.83, 95% CI: 0.81-0.86 for long stay; OR: 1.18, 95% CI 1.15-1.20 for short stay).

Facility characteristics associated with NH death were the presence of Alzheimer's unit (OR: 1.15, 95% CI 1.11-1.20 for long-stay; OR 1.16, 95% CI 1.08-1.21 for short-stay), and the smaller NH facilities with less than 50 beds (OR: 1.16, 95% CI: 1.09, 1.24 for long-stay; OR 1.12, 95% CI: 1.10-1.28 for short-stay), compared to NHs with 50-99 beds.

Discussion

Main Findings

This is the first study to examine the association between the POLST program maturity status and NH deaths. Controlling for individual and contextual characteristics, we found that mature (highest) and developing POLST maturity status were positively associated with greater odds of dying in NHs, among long-stay residents.

While the data used in this study do not allow for assessing individual preferences and completion of POLST forms, the significant relationship between the state's POLST maturity status and increased NH death in long-stay residents implies that the state-wide adoption of POLST can promote positive care outcomes. Spill-over is a term that explains the effects of an intervention on individuals who did not directly receive intervention, but who were connected to intervention recipients through social proximity. (57) It is often mentioned in NH studies where researchers witness an overall improvement of care outcome after initiating a new program that is designed for a target population (e.g., hospice program for dying patients). (50, 57–62) Miller and colleagues reported that when a NH facility had greater hospice program enrollees, indicating higher exposure to specialized EoL care, resident outcomes such as better management of pain,⁸¹ frequent pain assessments,^{79,81} and reduced number of burdensome transfers to hospitals were seen throughout all residents, regardless of their hospice enrollment status. (61, 63, 64) This spillover phenomenon is thought to be caused by diffusion of knowledge. (65) That is, a newly implemented program or protocol generates new knowledge, which then fuels changes in the practice pattern or culture of institution, influencing care outcomes in general population. The pattern we observed, higher POLST maturity status and greater odds of dying in NHs among long-stay residents, may be due to increased knowledge generated with the initiation of state-wide adoption of the POLST program.

While we observed significant associations between NH deaths and the state's POLST status (mature and developing), the positive association between endorsed status and NH deaths lacked significance. The previous research on POLST has only looked at care outcomes measured from those who completed the

POLST forms,(36, 39, 66–71) making it difficult to draw a comparison with our results. It is possible that there could be a plateau period, where relatively small efforts are made within the endorsed status to achieve mature status. It is also probable that NHs located in states with endorsed POLST status have an improved awareness on the importance of delivering specialized EoL care for dying patients, resulting in increased number of timely referrals to specialized EoL care facilities. Those NHs may also put more effort to identify dying patients' preferred place of death and allow them to be discharged near the time of death. Reasons behind the lack of significant association between the endorsed POLST status and NH deaths is an important question to be answered through future studies.

Predictors of NH deaths

Resident-level factors, specifically older age, White race, and living with chronic conditions (e.g., chronic obstructive pulmonary disease, Alzheimer's disease, and/ or dementia) were shown to increase the residents' odds of dying in NHs in both short and long-stay groups. Previous NH studies also reported similar findings: advanced age,(72–76) and chronic conditions as predictors of NH death for elderly residents living with serious illnesses.(73, 74, 76–78)

Although we noted a significant association between the race/ethnicity and dying in NHs in both stay groups, previous studies have mixed results. For example, in a recent study no significant associations were found between individual's race/ethnicity and the final place of death (e.g., hospital vs. non-hospital setting).(79) In another study, where authors examined the factors associated with in-hospital deaths among NH residents, it was noted that Black race was associated with a significantly higher risk of dying in hospitals when compared to their White counterparts.(80)

Men were at increased risk of NH death, in our short-stay group. While many studies have explored gender differences and the associated risk of mortality among NH residents,(74, 81–85) none reported specific location of death (e.g., NH vs. hospital). Moreover, the majority of available studies limited their study sample to disease-specific groups (e.g., Alzheimer's disease),(82, 83, 85) or by their cognitive function.(74, 81)

Future researchers should use different measures for the level of POLST development such as total length of time since the POLST program was first initiated, or a composite score generated with different elements relevant to the POLST program (e.g., research efforts, staff awareness, actual number of POLST form completed). Second, future studies should examine the impact of POLST program maturity status on different outcomes (e.g., receipt of concordant interventions, number of hospice enrollments). Lastly, future research should also explore if different levels of maturity status are associated with best practices in EoL care, such as timely EoL discussions, family meetings and/or bereavement support.

What this study adds

In the last few years, a significant research efforts have been made to provide scientific evidence on benefits of high quality EoL care provided to vulnerable population. And previous studies unanimously support that best practices in EoL are those that maximize quality of remaining life, while minimizing

avoidable care transfers. Results of this study call for the continued effort to adopt nationwide implementation of the POLST program that aims to deliver goal-concordant EoL care to elderly living with serious illnesses. It also calls for continued research efforts to identify best practices in EoL, and how best to deliver a type of care that aligns with dying patient's wishes, goals and values.

Limitations of the study

There are several limitations to this study. Rather than dichotomizing our outcome of interest as NH vs. non-NH death, examining other outcomes (i.e., death occurring in community) could have offered findings that were not discussed in our study. Plus, specifying place of death, beyond NH settings, could shed light to possible associations between the POLST maturity status and one's likelihood of dying at specific setting (e.g., home, NH, hospital). However, this was not feasible with the datasets we used. For instance, the current MDS 3.0 assessment includes an item that can help identify if the resident's last discharge (before the date of death) was to the community, or other facilities such as acute care hospital. The challenge that exists in using community as a measure of deaths that occurred at home is that the term community in MDS 3.0 includes other settings (i.e., assisted living care settings, or group homes).

A similar problem arose when the patient's discharge placement indicated a discharge to a hospice setting. Although it may seem more appropriate that dying patient should receive specialized care at hospice settings, it was unclear whether it captures discharges to a separate hospice care center, or a hospice unit within the same facility.

Another limitation of our study is that due to the nature of cross-sectional analysis, the relationship we examined between the POLST maturity status and NH death can only be interpreted as an association, and not causation.

Conclusion

Controlling for individual and contextual variables, higher POLST maturity status is positively associated with greater likelihood of dying in NHs, among long-stay residents. Findings from our study adds to the body of science that well-structured advance care planning programs, such as POLST, can promote best practices in EoL. State-wide implementation of the POLST program, and continued efforts to meet high standards of quality EoL care (evidenced by higher maturity status) can result in positive health outcomes for elderly patients suffering from serious illnesses. State, or national-wide initiatives focusing on quality improvement at EoL should therefore be widely disseminated and adopted to provide best care possible for the most vulnerable populations.

Declarations

- *Ethics approval and consent to participate*

Formal ethical approval was not required for this retrospective cohort study, as it did not affect the management of any human subjects.

- Consent for publication

Not applicable.

- Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

- Competing interests

The authors declare that they have no competing interests.

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Contribution / Author initials	AT	MA	AD	JS	PW
Substantial contribution to the concept or design of the work	X	X			X
Acquisition, analysis or interpretation of data	X	X	X	X	
Drafted the article	X				
Resaved it critically for important intellectual content		X	X		X
Approved the version to be published	X	X	X	X	X
Participated sufficiently in the work to take public responsibility for appropriate portions of the content	X	X	X	X	X

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Tables

Table 1. Description of Resident Level Characteristics and Bivariate Associations by Stay Type.

Characteristic	Long-stay residents (n = 285,888)	Short-stay residents (n = 309,264)	Total sample (n = 595,152)	P value ¹
Individual characteristics, n (%)				
Sex				<.0001
Female	194,161 (67.92)	167,473 (54.15)	361,634 (60.77)	
Race/ Ethnicity				<.0001
African American	28,775 (10.24)	25,838 (8.61)	54,613 (9.39)	
American Indian	659 (0.23)	653 (0.22)	1312 (0.23)	
Asian	3,891 (1.38)	4,204 (1.40)	8,095 (1.39)	
Hispanic	9,769 (3.47)	9,282 (3.09)	19,051 (3.28)	
Two or more race	577 (0.21)	598 (0.20)	1,175 (0.20)	
Native Hawaiian	272 (0.1)	344 (0.11)	616 (0.11)	
Non-Hispanic White	237,193 (84.37)	259,270 (86.37)	496,463 (85.40)	
Age at death				
65-70	17,237 (6.03)	31,332 (10.13)	48,569 (8.08)	<.0001
71-75	21,330 (7.46)	34,395 (11.12)	55,725 (9.29)	
76-80	33,574 (11.74)	46,933 (15.18)	80,507 (13.46)	
81-85	55,148 (19.29)	65,855 (21.29)	121,003 (20.29)	
86-90	71,612 (25.05)	71,140 (23.00)	142,752 (24.03)	
91-95	58,318 (20.40)	42,569 (14.64)	100,887 (17.52)	
96-100	23,824 (8.33)	12,765 (4.13)	36,589 (6.23)	
101-110	4,845 (1.69)	1,575 (0.51)	6,120 (1.10)	
Marital Status				
Divorced	25,933 (9.18)	24,509 (8.12)	50,442 (8.64)	<.0001
Married	62,637 (22.18)	111,973 (37.12)	174,610 (29.89)	
Never Married	27,671 (9.80)	22,751 (7.54)	50,422 (8.63)	
Separated	2,579 (0.91)	2,418 (0.80)	4,997 (0.86)	
Widowed	163,596 (57.93)	140,027 (46.42)	303,623 (51.98)	
Chronic Conditions				
Alzheimer	116,110 (40.61)	53,939 (17.44)	170,049 (28.57)	<.0001
Dementia	103,570 (36.23)	81,750 (26.43)	185,320 (31.14)	<.0001
CKD	122,948 (43.01)	162,208 (52.45)	285,156 (47.91)	<.0001
CHF	140,126 (49.01)	159,924 (51.71)	300,050 (50.42)	<.0001
Diabetes	109,363 (38.25)	109,918 (35.54)	219,281 (36.84)	<.0001
Cancer	23,294 (8.15)	58,484 (18.81)	81,478 (13.69)	<.0001
COPD	66,051 (23.10)	99,614 (32.21)	165,665 (27.84)	<.0001
Death in NH	216,182 (75.62)	125,542 (40.59)	341,724 (57.42)	<.0001

Note: ADL: activities of daily living; CKD: chronic kidney disease; COPD: chronic obstructive pulmonary disease; LPN: licensed practical nurse; NH: nursing home; SD: standard deviation;

¹: P value from chi-square tests for categorical variables, and t test for continuous variables

□ADL score range 4 to 18 (4 = independent, 18 = total dependency)

Table 2. Description of NH Sample and Bivariate Associations, by Stay Type.

Characteristic	Long-stay residents (n = 285,888)	Short-stay residents (n = 309,264)	Total sample (n = 595,152)	P value ¹
Independent variable, n (%)				
<u>POLST maturity status</u>				<.0001
Mature	3,377 (1.18)	4,829 (1.56)	8,206 (1.38)	
Endorsed	101,632 (35.55)	108,566 (35.10)	210,198 (35.32)	
Developing	167,370 (58.54)	182,356 (58.96)	349,726 (58.76)	
Non-conforming	13,509 (4.73)	13,513 (4.37)	27,022 (4.54)	
Facility characteristics, n (%)				
<u>Facility type</u>				<.0001
For-profit	198,680 (69.50)	230,622 (74.57)	429,302 (72.13)	
Non-profit	70,245 (24.57)	69,320 (22.41)	139,565 (23.45)	
Government	16,963 (5.93)	9,322 (3.01)	26,285 (4.42)	
<u>Affiliation/ Chain</u>	154,981 (54.21)	184,326 (59.60)	339,307 (57.01)	<.0001
<u>Bed size</u>				<.0001
< 50	8,779 (3.11)	10,844 (3.55)	19,623 (3.34)	
50-99	71,803 (25.44)	75,284 (24.63)	147,087 (25.02)	
100-199	161,173 (57.11)	184,343 (60.32)	345,516 (58.78)	
>200	40,462 (14.34)	35,135 (11.50)	75,597 (12.75)	
<u>Occupancy rate</u>	85.06 (12.89)	83.82 (14.19)	84.41 (13.60)	<.0001
<u>Staffing</u>				
RN	0.69 (0.34)	0.81 (0.49)	0.75 (0.43)	<.0001
LPN	0.82 (0.33)	0.86 (0.37)	0.84 (0.35)	<.0001
CNA	2.44 (0.60)	2.48 (0.69)	2.16 (0.65)	<.0001
<u>Occupancy rate</u>	85.06 (12.89)	83.82 (14.19)	84.41 (13.60)	<.0001
<u>Special unit</u>				
Alzheimer's unit	62,853 (21.99)	54,355 (17.58)	117,208 (19.69)	<.0001
Hospice unit	2,904 (1.02)	3,279 (1.06)	6,183 (1.04)	0.09
County level characteristics, mean (SD)				
Elderly proportion	10.11 (3.86)	9.95 (3.59)	10.03 (3.72)	<.0001
Median household income	52484.29 (13670.26)	54120.59 (14172.54)	53334.54 (13957.46)	<.0001
County level characteristics, n (%)				
<u>Setting</u>				<.0001
Metropolitan	221548 (77.50)	261631 (84.60)	483,179 (81.19)	
Urban	57740 (20.20)	43867 (14.19)	101,607 (17.07)	
Rural	6569 (2.30)	3750 (1.21)	10,319 (1.73)	
<u>Geographic region</u>				<.0001
Midwest	82,204 (28.75)	79,062 (25.57)	161,266 (27.10)	
Northeast	72,731 (25.44)	71,675 (23.18)	144,406 (24.27)	
South	102,059 (35.70)	110,709 (35.80)	212,768 (35.75)	
West	28,891 (10.11)	47,767 (15.45)	76,658 (12.88)	

Note: CNA: certified nursing assistance; LPN: licensed practical nurse; NH: nursing home; POLST: physician orders for life-sustaining treatment; SD: standard deviation;

*: measured in full-time equivalent hours per resident per day

¹: P value from chi-square tests for categorical variables, and t test for continuous variables

Table 3. Multivariable logistic regression model by NH stay type

Predictors	Long-Stay Residents		Short-Stay Residents	
	OR	(95% CI)	OR	(95% CI)
POLST maturity status				
Mature	1.20	(1.02-1.43)	0.90	(0.75-1.09)
Endorsed	1.09	(0.98-1.21)	1.12	(0.99-1.26)
Developing	1.12	(1.02-1.24)	0.97	(0.86-1.10)
Non-Conforming	Reference		Reference	
Age (in years)				
65-70	Reference		Reference	
71-75	1.14	(1.07-1.20)	1.008	(0.98-1.04)
76-80	1.27	(1.22-1.33)	1.09	(1.04-1.13)
81-85	1.46	(1.41-1.52)	1.23	(1.19-1.27)
86-90	1.71	(1.65-1.78)	1.41	(1.35-1.47)
91-95	2.12	(2.03-2.21)	1.70	(1.63-1.78)
96-10	2.74	(2.60-2.88)	2.02	(1.91-2.14)
101-110	4.02	(3.63-4.44)	2.54	(2.23-2.88)
Sex				
Female	Reference		Reference	
Male	0.995	(0.97-1.01)	1.07	(1.05-1.09)
Marital Status				
Married	Reference		Reference	
Never Married	1.14	(1.10-1.19)	1.52	(1.47-1.57)
Divorce	1.17	(1.13-1.22)	1.38	(1.33-1.43)
Separated	1.27	(1.14-1.40)	1.31	(1.18-1.45)
Widowed	1.12	(1.09-1.15)	1.21	(1.18-1.23)
Race/ Ethnicity				
Non-Hispanic White	Reference		Reference	
African American	0.69	(0.66-0.73)	0.85	(0.81-0.89)
American Indian	0.68	(0.55-0.82)	0.87	(0.72-1.05)
Asian	0.66	(0.62-0.71)	1.22	(1.07-1.38)
Hispanic	0.68	(0.64-0.73)	0.90	(0.84-0.95)
Native Hawaiian/ Pacific Islander	0.66	(0.50-0.87)	0.80	(0.64-0.99)
2 or more race	0.71	(0.59-0.86)	1.35	(1.15-1.58)
Chronic Conditions				
Cancer	0.83	(0.81-0.86)	1.18	(1.15-1.20)
COPD	1.49	(1.45-1.53)	1.20	(1.18-1.23)
CHF	0.72	(0.70-0.73)	0.80	(0.78-0.81)
Diabetes	0.92	(0.90-0.94)	0.97	(0.95-0.99)
CKD	0.49	(0.47-0.49)	0.75	(0.73-0.76)
Alzheimer's	1.49	(1.44-1.54)	1.45	(1.42-1.48)
Dementia	1.33	(1.30-1.37)	1.24	(1.21-1.26)
Alzheimer's Unit	1.15	(1.11-1.20)	1.14	(1.08-1.21)
Hospice Unit	1.05	(0.88-1.24)	1.15	(0.83-1.59)
Bed Size				
50-99	Reference		Reference	
<50	1.16	(1.09-1.24)	1.18	(1.10-1.28)
100-199	0.92	(0.90-0.95)	0.82	(0.79-0.86)
>200	0.81	(0.76-0.89)	0.72	(0.67-0.77)

Note: CI: confidence interval. CHF: congestive heart failure; CKD: chronic kidney disease; COPD: chronic obstructive pulmonary disease; NH: nursing home; OR: odds ratio

All models controlled for state-level clustering effects, state-level fixed effects, sociodemographic characteristics (i.e., total ADL

score), and facility level characteristics (i.e., staffing, occupancy rate, facility type, affiliation/chain status, setting, geographic region), county level characteristics (i.e., proportion of elderly, median household income)

Figures

Figure 1

Sampling Process. Note: AHRF area health resource file; CASPER: certification and survey provider enhanced reports; MBSF: medical beneficiary summary file; MDS: minimum dataset; NH: nursing home; POLST: physician orders for life-sustaining treatment; VI: virgin island