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Permalink

https://escholarship.org/uc/item/5fj1s9vk

Journal

Journal of the American Geriatrics Society, 61(11)

ISSN

0002-8614

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Publication Date

2013-11-01

DOI

10.1111/jgs.12517

Peer reviewed

Hospitalizations Among Nursing Home Residents in the Last Year of Life: Nursing Home Characteristics and Variation in Potentially Avoidable Hospitalizations

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Abstract

Objectives—1) To examine the incidence, variations, and costs in potentially avoidable hospitalizations (PAHs) among nursing home (NH) residents at the end-of-life. 2) To identify the association between NH characteristics and a facility-level quality measure (QM) for PAH.

Design—Retrospective study.

Setting—Hospitalizations originating from NHs.

Participants—Long-term care NH residents who died in 2007.

Measurements—We constructed a risk-adjusted QM for PAH. Poisson regression model was used to predict the count of PAH given residents' risk factors. For each facility, the QM was defined as the difference between the observed facility-specific rate (per 1,000 person-years) of PAH (O) and the expected risk-adjusted rate (E). We then fit a logistic regression model with state fixed-effects to examine the association between facility characteristics and the likelihood of having higher than expected rates of PAH (O-E>0). QM values higher than 0 indicate worse than average quality.

Results—Almost 50% of hospital admissions for NH residents in their last year of life were for potentially avoidable diagnoses, costing Medicare $1billion. Five conditions were responsible for over 80% of PAHs. PAH **QM** across facilities showed significant variation (mean=11.96; std dev=142.26; range: −399.48-398.09). Chain and hospital-based facilities were more likely to exhibit better performance (O-E<0). Facilities with higher nursing staffing were more likely to have better performance, as did facilities with higher skilled staff ratio, facilities with nurse practitioners/physician assistants, and those with on-site x-ray services.

Conclusion—Variations in facility-level PAHs suggest that a potential for reducing hospital admissions for these conditions may exist. Presence of modifiable facility characteristics associated with PAH performance provides insights into possible interventions for reducing PAHs at the end-of-life.

Keywords

Potentially avoidable hospitalizations; end-of-life; nursing homes

INTRODUCTION

Today, ~25% of all deaths in the United States occur in nursing homes (NHs),[1] and this proportion is expected to increase as Baby Boomers age[2]. While excellence in end-of-life care needs to become a major priority for NHs, research findings point to poor pain management[3], excessive reliance on hospitalizations[4], inadequate hospice use[5], and inattention to advance care planning[6], all indicating inadequate end-of-life quality of care.

Hospitalizations of NH residents are particularly frequent in the period preceding death; 25%–46% of residents are hospitalized within 6-to-12 months before death [4,7–9]. Research has demonstrated that such hospitalizations tend to increase the risk of iatrogenic illness, delirium, and functional decline[10–12], and are often inconsistent with residents' treatment preferences[13–14]. Moreover, some of these hospitalizations might have been avoided because the condition prompting admission was potentially preventable, if good quality care had been provided on-site, or because a resident could have been equally well treated in the NH.

Based on medical chart reviews, Saliba and colleagues[15] have concluded that close to 40% of hospitalizations may have been inappropriate. Using administrative data from New York State, Grabowski and colleagues reported that 31% of hospitalizations among NH residents were attributable to ambulatory care sensitive (ACS) conditions such as pneumonia, congestive heart failure (CHF) or urinary tract infections (UTI)[16]. Intrator and colleagues[17], based on data from 4 states, reported that 37% of hospitalizations occurring among long-term care NH residents were for the ACS conditions. A recent national study, focusing on Medicare and Medicaid eligible NH residents, found that 45% of hospitalizations, costing $2.7 billion per year, were for conditions identified as potentially avoidable[18–19]; i.e. those that could have been prevented through better care or managed on-site. Research has identified a number of resident and facility characteristics as predictors of such potentially avoidable hospitalizations (PAHs)[17,20–23]. Furthermore, wide variations in PAH rates have been reported, suggesting that rate reductions may be possible[18].

Recently, policy makers and researchers have begun to focus considerable attention on identifying factors affecting PAHs among long-stay NH residents to address important quality improvement objectives and to reduce Medicare cost[24–26]. For example, the Centers for Medicare and Medicaid Services (CMS) have launched a new $128 million initiative to ultimately effect reductions in PAHs among NH residents[27].

Despite these emerging public policy and research interests in hospitalizations of NH residents, there have been no studies specifically focusing on whether hospitalizations occurring at the end-of-life are potentially avoidable, or assessing the magnitude of spending associated with such hospitalizations. Therefore, the objectives of this study were twofold. First, we examined the incidence and variations in PAHs among NH residents in the last year of life. We also examined Medicare costs, and estimated potential cost savings associated with these admissions. Second, we identified NH characteristics associated with facility-level, risk-adjusted quality measure (QM) of PAHs.

METHODS

Study Design and Data Sources

This was a retrospective study using nation-wide administrative data from the Chronic Care Data Warehouse (CCW) established and supported by CMS. For this study, a customized CCW dataset was created to include CY2007 decedent Medicare beneficiaries who resided in Medicare and/or Medicaid certified NHs.

Using the Medicare denominator file, beneficiaries who died during CY2007 were first identified. The Minimum Data Set (MDS) was then used to select only those decedents who had a NH record of stay within 8 days prior to death, i.e. those who died in a NH or shortly after discharge or transfer to another care setting. The MDS is a federally mandated process for clinical assessment of residents in Medicare and/or Medicaid certified NHs. It contains information on each resident's health status collected at admission, quarterly and annually, or whenever significant changes in health status occur. The MDS discharge records were linked with Medicare inpatient file to identify hospital admissions, diagnoses and Medicare costs associated with each hospitalization. Hospitalizations were deemed as originating from a NH if they occurred within 3 days of NH discharge. The 3-day gap was used to ensure that hospitalizations were related to NH stays and to allow for recording inaccuracy[28–29].

In addition, we used the Provider of Service (POS) file and the Brown University's Long-Term Care Facts website (http://ltcfocus.org/about.aspx) to obtain facility-level characteristics, and the Area Resource File (ARF) to obtain county characteristics. The Medicare provider identifiers were used to merge all the databases.

Study Population

In total, we identified 340,212 decedent long-term care residents in 2007. We limited our analysis to older (age 65+) residents receiving custodial care because post-acute residents typically stay in NHs for a short period of time and have different care needs and discharge expectations. Long-term care residents were defined as those who stayed longer than 90 days (had quarterly or annual assessment), or whose care was not paid by Medicare.

A number of exclusions were made accounting for 19.2% of decedent residents. These exclusions were due to: incomplete MDS assessment records in the last year of life (3.0%); managed care enrollment in the last year of life (15.9%); and missing data for individual risk factors (0.3%). We removed managed care beneficiaries because their hospitalization information is not available in the Medicare inpatient claims. The final analytical sample used to predict the count of PAHs included 319,270 NH stays for 274,774 residents. The analytical sample for facility-level PAH performance included 11,999 NHs. Facilities were excluded (n=3,741) when: they could not be matched to the POS data (3.5%); had fewer than 10 decedent residents (20.0%); or had missing required data elements (0.2%).

Variables

Outcome Variable—PAH QM was constructed based on the count of the number of times a resident was hospitalized, for a potentially avoidable condition, during a NH stay (up to one year prior to death). In constructing this QM we employed the criteria for defining PAHs developed by a technical expert panel in a study funded by CMS[19]. The study identified 16 condition groups considered to be potentially preventable or manageable in NHs. The list of ICD-9 codes comprising these conditions is available at http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Reports/downloads/costdriverstask2.pdf.

Current definitions of PAH are largely driven by diagnoses alone[26], and this is clearly a limitation of existing studies, including ours. In order to at least partially account for the residents' co-morbidities and clinical complexities, we incorporated individual-level risk factors in constructing the PAH QM. To account for the availability of facility resources that may impact hospitalization decisions, we also included facility-level factors in the analysis.

Individual-level risk factors—Risk factors' selection was based on extensive literature review, followed by the examination of information available in the MDS and consultations with clinical experts, geriatricians and a NH medical director. **All** risk factors were based on the MDS assessment closest to the beginning of each resident's NH stay. MDS assessments can be categorized as full or partial assessment, depending on whether they include information on all risk factors. When an assessment closest to the start of the NH stay was a partial assessment, we imputed the missing risk factors based on a preceding full assessment. Only stable variables, such as chronic conditions, were imputed. Functional status was measured using the activity of daily living (ADL) score[30]. ADL score ranges from 0 to 28 depending on residents' ability to perform 7 activities (bed mobility, transfer, locomotion on unit, dressing, eating, toilet, and personal hygiene), with a higher score indicating increased dependence. Cognitive status was measured using the Cognitive Performance Scale[31], which ranges from 0 to 6, with 0 indicating intact cognition and 6 indicating most severe impairment. For each decedent we also included the length of stay (LOS) in NH during the last year of life to adjust for exposure time. LOS was calculated as the difference between admission and discharge dates. For residents with LOS longer than one year, only the days within last year of life were counted.

Facility-level characteristics—Several variables reflecting facility characteristics, which based on prior studies were found to be associated with PAH performance were included. We included: chain membership; ownership; number of beds; occupancy rate; and location (rural vs. urban). Ownership was dichotomized as for-profit or non-profit. NHs were dichotomized based on whether the facility was part of a chain. Location was defined using Rural-Urban Continuum Codes (RUCCs)[32]. To reflect the availability of NH resources, we included presence of nurse practitioners/physician assistants (NPs/PAs), total nurse staffing hours per resident per day, skilled care mix (ratio of high-skilled (registered nurse) to low-skilled staff (licensed practical nurse and certified nurse aide)), availability of on-site x-ray and clinical laboratory services, and hospital affiliation. Facility financial resources were further characterized by percentage of residents with Medicare or Medicaid as a primary payer. The number of hospital beds per 1000 population aged 65+ in the county where a NH was located was included as a signal for hospitalization capacity of the local health care system.

Statistical Analyses

The analyses were performed in three steps. First, the data were randomly split into development and validation datasets. The risk-adjustment model was developed on one dataset and tested on the other. The final model estimates (Table 1) were based on the full data. To predict the count of PAH, we fit a Poisson regression model to individual-level data with random facility effects, accounting for clustering of the residents. We examined the deviance as an approximate goodness of fit test and found the model to fit the data well[33]. The expected facility PAH rates were calculated as the sum of expected number of PAHs for all NH residents divided by the sum of lengths of NH stays. The observed facility PAH rates were calculated as the sum of observed number of PAHs for all NH residents in that NH divided by the sum of lengths of NH stays.

In the second step, we constructed PAH QM. This QM was defined as the difference between the observed facility-specific PAH rate and the expected, risk-adjusted rate. QM values greater than zero indicate rates that exceed the national average, and because PAH is undesirable, can be interpreted as indicating worse quality; with QM values less than zero indicating better than average quality.

In the third step, we fit a logistic regression model with state fixed effects to examine the association of facility characteristics with the likelihood of having worse than the average PAH performance. The unit of analysis was a NH. State fixed effects were used to account for the heterogeneity in state policies, practice patterns, and other state-level factors that may affect PAH performance.

RESULTS

Descriptive statistics and risk-adjusted regression estimates for PAH are presented in Table 1. In the last year of life, residents with cancer, dementia, and paraplegia/hemiplegia were less likely to experience hospitalizations for potentially avoidable conditions, while residents with CHF, COPD, diabetes, and renal failure, among others, were more likely to have PAHs. Adjusting for all risk factors, residents with DNH and DNR orders were considerably less likely to experience PAHs in the last year of life.

All hospitalizations and PAHs

More than 53% of residents who died in 2007 had at least one hospitalization during the last year of life (Table 2), costing Medicare almost $2.4 billion **(in 2007 dollars)**. Of the 295,929 hospitalizations, almost half or 143,058 may have been avoidable. Over one third (33.4%) of decedent NH residents had at least one PAH in the year prior to death. The total Medicare spending for these PAHs was $972 million, accounting for 41% of total Medicare hospital expenditures for this population. Recognizing that not all PAHs are truly avoidable, we estimated three previously suggested scenarios[19] assuming that 20%, 40%, or 60% may be prevented. Based on these assumptions Medicare hospitalization expenditures would be $194, $389, and $583 million, respectively.

Variation in PAHs across states

In Figure 1(a), we depicted state-specific variation in PAH rates among decedent residents. We observed a 4.4-fold difference in PAH rates across states (stddev:179/1,000 person-years), from the lowest in Utah (237/1,000 person-years) to the highest in Mississippi (1,046/1,000 person-years). In eighteen states, PAH rates exceeded the U.S. average rate of 601/1,000 person-years.

PAHs by condition

Five conditions (pneumonia, CHF, UTI, dehydration, and falls/trauma) were responsible for over 80% of all PAHs and 82% of Medicare spending. The leading cause was pneumonia accounting for 34.3% admissions and 38.6% of Medicare spending (Table 3). Almost 15% of PAH admissions were for CHF, with UTI and dehydration each accounting for 12.3% and 12.1% of admissions, respectively.

Nursing home performance in PAHs

Figure 1(b) shows the distribution of facility risk-adjusted QM for PAHs. NHs exhibited wide variability with regard to this QM with an average of 11.96 and a standard deviation of 142.26. Over 50% of NHs showed poorer than average PAH performance (QM>0).

Table 4 presents the results of the association between facility characteristics and the probability of having worse than average PAH performance. Poorer facility performance with regard to PAH was independently associated with: for-profit ownership (OR=1.20, 95% CI 1.09–1.32); rural location (OR=1.47, 95% CI 1.30–1.67); higher proportion of Medicare (OR=1.30, 95% CI 1.24–1.36) or Medicaid (OR=1.20, 95% CI, 1.16–1.23) residents. For every 10% increase in the proportion of Medicaid or Medicare residents, a facility experienced 20% and 30%, respectively, higher odds of worse than average performance. However, chain-affiliated and hospital-based facilities were more like to exhibit better than average performance in PAH (OR=0.90, 95% CI 0.83–0.97 and OR=0.59, 95% CI 0.47–0.73, respectively). Facilities with higher nursing staffing (total hours/resident) were less likely to have poor performance (OR=0.94, 95% CI 0.90–0.99), as did facilities with higher ratio of high-skilled staff (OR=0.92, 95% CI 0.88–0.97). Facilities with NPs/PAs had lower odds of poor performance (OR=0.91, 95% CI 0.84–0.99). On-site availability of x-ray services was associated with lower likelihood of poor performance (OR=0.86, 95% CI 0.76–0.97), but the availability of on-site laboratory service was not statistically significant. The availability of acute care hospital beds in the county had no impact on NH PAH performance.

DISCUSSION

NH residents, particularly at the end-of-life, are vulnerable to adverse consequences that often accompany hospital admissions[10–12]. Our findings demonstrate that in the last year of life more than half of the residents had at least one hospitalization, and almost 50% of these were for conditions identified as potentially avoidable, incurring a significant cost to Medicare.

While our findings should be cautiously interpreted as it is clear that not all PAHs can in reality be truly avoided[25], the high PAH rates and variations we observed in the study population suggest that some reductions may be possible. For example, three of the top five PAH conditions – CHF, dehydration, and UTI – account for almost 40% of all PAHs and $325 million in Medicare expenditures per year. Appropriate preventive interventions for these conditions are well established, available, and have been demonstrated as effective in preventing unnecessary hospitalizations in NH settings. With adequate disease management and careful medical monitoring (e.g., personalized treatment plans, daily weight, symptom monitoring) hospitalizations for CHF have been significantly reduced[34]. While frequent exacerbations of CHF occur even with good disease management, among long-term care NH patients these often signal poor prognosis and referral to palliative or hospice care should be considered a more appropriate option than hospitalization. Condition such as dehydration is also highly preventable, particularly in institutional care settings, with frequent monitoring and special attention to fluid intake. Measures to prevent infection in catheterized residents are known[35] and for the most part UTI can be safely managed in NHs without hospitalization[36]. Furthermore, some conditions may be treatable on-site without requiring a hospital stay, especially if they are identified early. Pneumonia alone accounted for over one-third of PAHs. Previous studies have found no significant difference in mortality rate due to pneumonia between residents treated on-site and those who were hospitalized [37–38]. However, although strategies for preventing hospitalizations for these conditions may have been successful in a NH environment, the extent to which admissions at the end-of-life are equally preventable is not clear because of the clinical complexity and severity that may arise at the end-of-life.

Our results demonstrated wide variations in PAH risk-adjusted QM across facilities. While some facility characteristics, e.g. for-profit ownership, higher percent of Medicaid or Medicare residents, and rural location were significantly associated with poorer PAH

performance, they are not likely to be modifiable. For-profit NHs, driven by profit maximization, may provide lower quality care compared with non-profit facilities[39–42], resulting in residents being at higher risk for developing conditions associated with PAHs. Alternatively, for-profit NHs may be more likely to send their acutely ill residents to hospitals because treating them on-site is more costly[39, 43–44]. We also found that as the proportion of Medicaid or Medicare patients increases, NHs' odds of poor PAH performance increased. Because Medicaid payment rates are considerably lower than private-pay price and Medicare payment rates, facilities with higher percentage of Medicaid patients may have fewer resources to invest in quality improvement activities that might reduce residents' risk for developing conditions leading to PAHs. Furthermore, research has demonstrated that almost one-fourth of Medicare beneficiaries discharged from hospital to skilled nursing facilities were re-hospitalized within 30 days[45] mostly for conditions that were potentially avoidable[46]. Thus, in NHs with high percentage of Medicare patients a practice of frequent admissions for potentially avoidable conditions among post-acute residents may suggest a spillover to custodial care residents. On the other hand, chain-affiliated and hospital-based NHs demonstrated better than average PAH QM. Perhaps as a result of the benefits of scale economics and resource sharing chain-affiliated NHs were able to increase productivity, thus positively influencing care quality. Hospital-based NHs, typically located within a hospital, may allow physicians to quickly assess a condition and manage some acute problems in the NHs. The availability of acute care hospital beds had no impact on NH PAH performance, suggesting that the capacity of the local healthcare system does not necessarily influence the propensity to hospitalize.

We also identified several potentially modifiable facility characteristics: presence of NPs/PAs; more nursing staff; higher skilled staff ratio; and on-site x-ray services, to be associated with above average performance. Our finding with regard to the presence of NPs/PAs is supported by evidence from the NH Evercare demonstration, showing that the use of NPs reduced preventable hospitalization rates by 65%[47]. Presence of NPs/PAs helps to improve primary care, to reduce hospitalizations, and to manage sick residents on-site. Our study demonstrated that facilities with more nursing staff or higher skilled staff ratio had fewer PAHs. This is consistent with prior research demonstrating that higher nursing staff intensity and skilled nursing staff mix were associated with better quality of care[48]. Both are important in recognition, assessment, and early management of conditions that may result in hospitalization. Facilities providing on-site x-ray services also had fewer PAHs. For some conditions, the availability of on-site x-ray provides access to imaging services thus facilitating timely diagnosis and treatment. On-site laboratory services had no impact on PAH. Perhaps rather than physical access to laboratory services, the timely availability of the results might be more helpful in reducing hospitalizations [49].

Although a number of modifiable NH characteristics appear to be associated with PAH rates, reductions in PAHs continue to be very challenging in this care setting, particularly as facilities have no clear incentives not to hospitalize. When residents are at the end-of-life, NHs may choose to hospitalize patients to avoid potential litigation[50], particularly when no clear treatment preferences are present in the medical record (only 3.3% of the residents had DNH orders). Thus, reducing PAH rates will require a concerted effort by policy makers and public payers to make substantial investments in facility infrastructure and/or reimbursement in order to incentivize NHs to improve care quality and better manage residents' acute care needs on-site[28]. One recent effort is the Nursing Home Value-based Purchasing Demonstration being implemented in 3 states, in which Medicare saving from decreased avoidable hospitalizations are used to reward NHs with good performance[28].

Several study limitations should be mentioned. In this study, PAHs were identified by conditions considered preventable or manageable within the NH setting. However, not all

hospitalizations for the conditions we identified by diagnoses are avoidable for everyone or in all circumstances, because diagnoses alone cannot account for the severity of disease or the many other factors that may contribute to the hospitalization decision[25]. Although we attempted to control for some of these factors, hospitalization decisions must be made based on clinical judgment and complete information about patients' clinical condition[26]. As in other studies using administrative data, the possibility of omitted variable bias should be considered. Although state fixed-effects were used to account for the heterogeneity in state policies, practice patterns, and other state-level factors that may affect PAH performance, some information, e.g. NH care practices, was not available. At the same time, the MDS and the Medicare hospital claims databases represent two of the richest administrative datasets currently available for this type of research.

In conclusion, to our knowledge this study is the first to document the extent of variations in PAH and the associated Medicare costs for decedent NH residents. Identifying facility characteristics associated with PAHs in this population is an important first step to formulating interventions and future policies for improving quality of end-of-life care.

Acknowledgments

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Figure 1 (a).
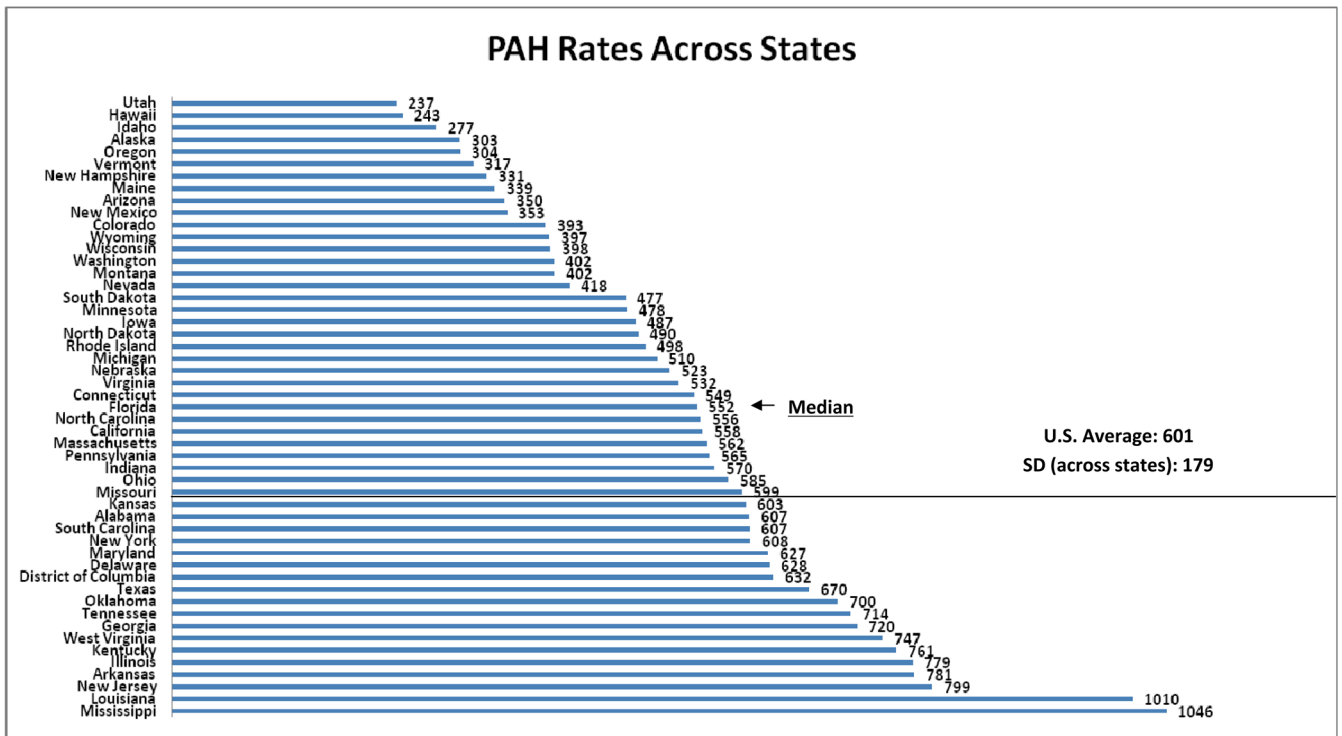
Figure 1 (b).
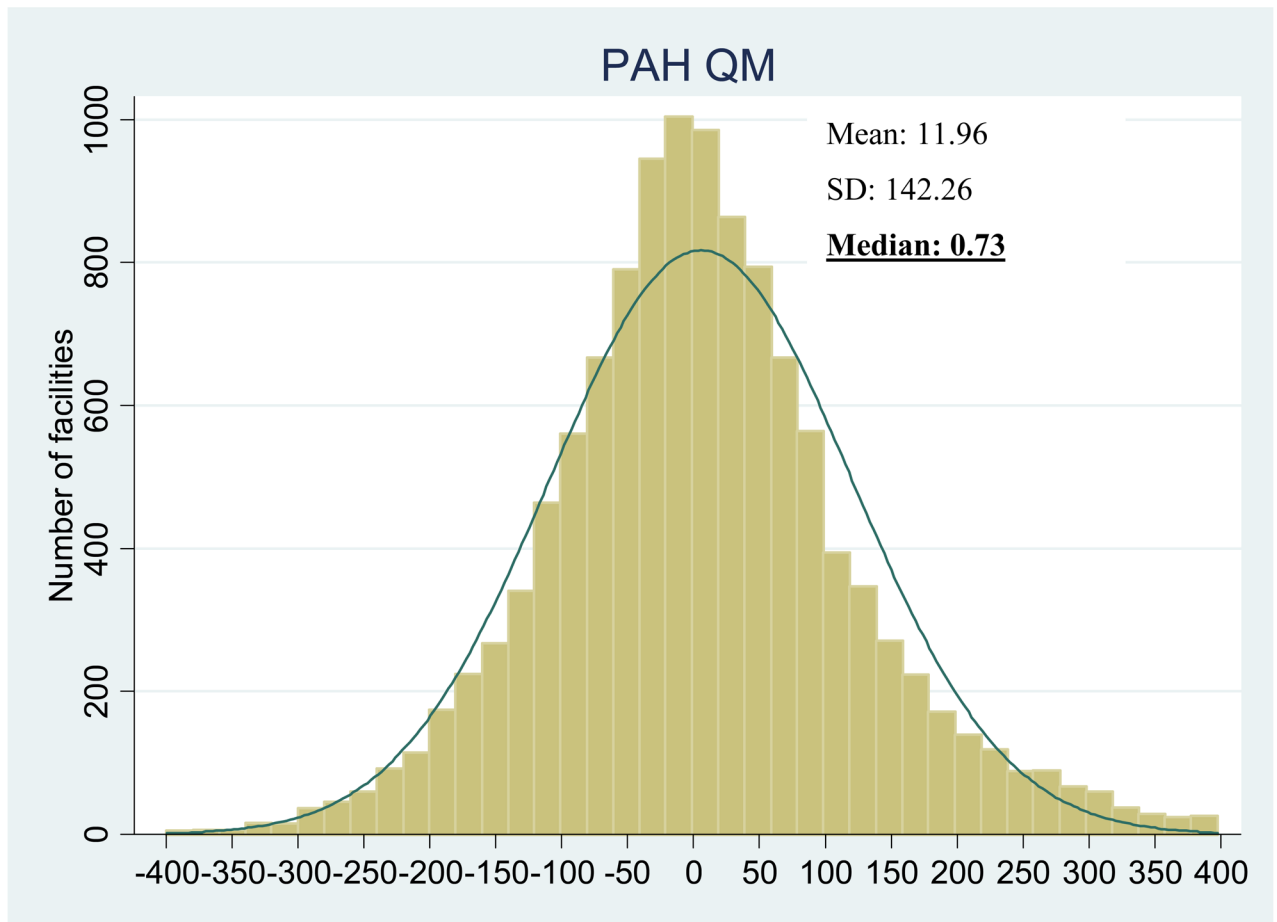
Figure 1.
(a) Potentially avoidable hospitalization (PAH) rates (per 1,000 person-years) among NH decedent residents in the last year of life: PAH rates in 50 states and District of Columbia (from the lowest to the highest); (b) Distribution of nursing home risk-adjusted quality measure (QM) for potentially avoidable hospitalizations (PAHs) in the last year of life: y-axis (0~1000): number of nursing facilities; x-axis (−400~400): risk-adjusted QM, which was defined as the difference between the observed facility-specific rate of PAH and the expected, risk-adjusted rate.

Table 1

Resident Characteristics and Results from Risk Adjustment Model Predicting the Count of Potentially Avoidable Hospitalizations in the Last Year of Life: 2007 Nursing Home Decedents

Resident Characteristic	Prevalence (%)or Mean ± SD	Risk Adjustment Model		
		Coefficient	95% CI	p-value
Demographics				
Age (years)	83.70 ± 9.70	−0.01[**]	−0.01, −0.01	<.001
Female	67.7	−0.13[**]	−0.14, −0.12	<.001
Length of stay (days)	262.73 ± 133.33			
Diagnoses				
Congestive heart failure	26.6	0.23[**]	0.21, 0.24	<.001
Emphysema/COPD	20.1	0.22[**]	0.21, 0.23	<.001
Diabetes	29.7	0.15[**]	0.14, 0.16	<.001
Dementia	50.0	−0.05[**]	−0.06, −0.04	<.001
Cerebrovascular accident/stroke	20.3	0.03[**]	0.01, 0.04	<.001
Arteriosclerotic heart disease	13.8	0.05[**]	0.03, 0.06	<.001
Cancer	10.9	−0.11[**]	−0.13, −0.09	<.001
Renal failure	8.6	0.15[**]	0.13, 0.17	<.001
Paraplegia/hemiplegia	8.7	−0.05[**]	−0.07, −0.03	<.001
Functional and cognitive status				
ADL score	17.79 ± 7.45	−0.01[**]	−0.01, −0.01	<.001
Cognitive performance score	2.88 ± 1.75	−0.08[**]	−0.09, −0.08	<.001
Resident conditions & treatments				
Urinary tract infection	14.7	0.17[**]	0.15, 0.19	<.001
Oral feeding tube	7.5	0.39[**]	0.37, 0.41	<.001
Pressure ulcer (Stage 2 or higher)	12.6	0.15[**]	0.13, 0.16	<.001
Pneumonia	6.7	0.30[**]	0.28, 0.32	<.001
Septicemia	1.2	0.03	−0.02, 0.08	0.23
Parenteral/IV nutrition	4.2	0.23[**]	0.20, 0.26	<.001
Indwelling catheter	13.2	0.14[**]	0.12, 0.16	<.001
Antibiotic resistant infection	2.6	0.14[**]	0.11, 0.18	<.001
Do-not-resuscitate orders (DNR)	56.1	−0.27[**]	−0.28, −0.26	<.001
Do-not-hospitalize orders (DNH)	3.3	−0.70[**]	−0.76, −0.65	<.001

[**]
p 0.01

SD = standard deviation; COPD = chronic obstructive pulmonary disease; ADL = activity of daily living.

Table 2

Hospitalizations, Potentially Avoidable Hospitalizations, and Estimated Medicare Cost Associated with Different Scenarios of PAH Reductions: For Nursing Home Residents in the Last Year of Life

| | All Hospitalizations | PAHs | Estimated %PAH reductions | | |
			20%	40%	60%
Total number	295,929	143,058	28,612	57,223	85,835
Proportion of residents having at least one hospitalization (%)	53.3	33.4			
Hospitalization rate (per 1,000 person-years)	1243	601			
Total Medicare expenditure ($**2007**, in millions)	2386	972	194	389	583
Average length of stay (days)	6.45	6.09			
Average Medicare expenditure per hospitalization ($**2007**)	8,064	6,793			

PAHs = potentially avoidable hospitalizations.

Table 3

Potentially Avoidable Hospitalizations, and Associated Medicare Expenditures, By Condition: In the Last Year of Life for 2007 Nursing Home Decedents

Rank	Condition	Number of Hospitalizations	% Total PAHs	Medicare Hospital Expenditure ($2007, in millions)	% Total Medicare Hospital Expenditure for PAHs	Mean Medicare Expenditure/ Hospitalization ($2007)
1	Pneumonia	49062	34.3	374.79	38.6	7639
2	Congestive heart failure	21214	14.8	130.65	13.4	6159
3	Urinary tract infection	17615	12.3	85.77	8.8	4869
4	Dehydration	17238	12.1	108.46	11.2	6292
5	Falls/trauma	11516	8.1	100.05	10.3	8688
6	COPD, asthma	6836	4.8	38.28	3.9	5599
7	Skin ulcers, cellulitis	5498	3.8	48.67	5.0	8853
8	Diarrhea, gastroenteritis, C. Difficile	3321	2.3	22.09	2.3	6652
9	Anemia	3007	2.1	13.88	1.4	4617
10	Seizures	2140	1.5	12.86	1.3	6009
11	Hypertension, hypotension	1698	1.2	10.75	1.1	6331
12	Constipation, impaction	1005	0.7	5.59	0.6	5564
13	Psychosis, agitation, organic brain syndrome	966	0.7	8.49	0.9	8784
14	Poor glycemic control	720	0.5	3.76	0.4	5227
15	Weight loss, Malnutrition	701	0.5	4.18	0.4	5969
16	Altered mental status, acute confusion, delirium	521	0.4	3.48	0.4	6680
	All	143,058	100	971.76	100	6793

PAHs = potentially avoidable hospitalizations; COPD = chronic obstructive pulmonary disease.

Table 4

Facility Characteristic and Logistic Regression (with State Fixed Effects) Predicting Poor PAH Performance in Resident's Last Year of Life

Facility Characteristic	Prevalence (%) or Mean ± SD	Logistic Regression Model		
		Odds Ratio	95% CI	p-value
For-profit	69.5	1.20[**]	1.09–1.32	<.001
Chain	55.8	0.90[**]	0.83–0.97	.01
Number of certified beds	119 ± 64	1.00	1.00–1.00	.72
Hospital-based	4.6	0.59[**]	0.47–0.73	<.001
Total staffing (hours per resident per day)	3.30 ± 1.01	0.94[*]	0.90–0.99	.02
RN to LPN + CNA ratio (per 10% increase)	0.11 ± 0.15	0.92[**]	0.88–0.97	0.001
Occupancy rate (per 10% increase)	0.86 ± 0.12	0.97	0.93–1.00	.08
Percent of Medicaid patients (per 10% increase)	0.61 ± 0.19	1.20[**]	1.16–1.23	<.001
Percent of Medicare patients (per 10% increase)	0.14 ± 0.12	1.30[**]	1.24–1.36	<.001
Rural	14.5	1.47[**]	1.30–1.67	<.001
X-ray onsite	76.5	0.86[*]	0.76–0.97	.02
Clinical lab onsite	76.2	1.11	1.00–1.24	.06
Nurse practitioners/physician assistants	31.2	0.91[*]	0.84–0.99	.03
Number of hospital beds per 1,000 population aged 65+	22.06 ± 16.34	1.00[**]	1.00–1.01	<.001

[*] p<0.05,

[**] p 0.01.

SD = standard deviation; PAH = potentially avoidable hospitalization; RN = registered nurse; LPN = licensed practical nurse; CNA = certified nurse aide.