Relationship between nursing home quality indicators and potentially preventable hospitalisation

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ABSTRACT

Background Hospitalisations are very common among nursing home residents and many of these are deemed inappropriate or preventable. Little is known about whether clinical care quality is related to hospitalisation, especially potentially preventable hospitalisations (PPHs). Among the few studies that have been conducted, the findings have been inconsistent. The objective of this study was to examine the relationship between quality indicators and overall and PPHs among Medicaid beneficiaries aged 65 years and older receiving care at nursing homes in Minnesota.

Methods 23 risk-adjusted quality indicators were used to assess nursing home quality of care. Quality indicators and other facility-level variables from the Minnesota Nursing Home Report Card were merged with resident-level variables from the Minimum Data Set. These merged data were linked with Medicaid claims to obtain hospitalisation rates during the 2011–2012 period. The sample consisted of a cohort of 20 518 Medicaid beneficiaries aged 65 years and older who resided in 345 Minnesota nursing homes. The analyses controlled for resident and facility characteristics using the generalised linear mixed model.

Results The results showed that about 44 % of hospitalisations were PPHs. Available quality indicators were not strongly or consistently associated with the risk of hospitalisation (neither overall nor PPH). Among these 23 quality indicators, five quality indicators (antipsychotics without a diagnosis of psychosis, unexplained weight loss, pressures sores, bladder continence and activities of daily living [ADL] dependence) were related significantly to hospitalisation and only four quality indicators (antipsychotics without a diagnosis of psychosis, unexplained weight loss, ADL dependence and urinary tract infections) were related to PPH.

Conclusion Although general quality indicators can be informative about overall nursing home performance, only selected quality indicators appear to tap dimensions of clinical quality directly related to hospitalisations.

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BACKGROUND

Hospitalisations are very common among nursing home residents and many of these are deemed inappropriate or preventable.[1] Besides generating excess healthcare cost, hospitalisations can be emotionally upsetting, and expose residents to additional risk factors, such as iatrogenic illness, deconditioning due to bed rest and disorientation, without always providing a substantial health benefit.[2] There is great variation in rates of potentially preventable hospitalisation (PPH) across nursing homes beyond what can be explained by resident heterogeneity.[3 4]

To reduce hospitalisations, on the hospital side, the Centres for Medicare and Medicaid Services (CMS) has initiated the Hospital Readmission Reduction Programme to reduce Medicare payments for hospitals with excess readmissions within 30 days.[5] This regulation is intended to reduce hospitalisations by encouraging hospitals to improve postdischarge management and use post-acute care effectively. On the nursing home side, CMS has also initiated the Skilled Nursing Facility Value-Based Purchasing Programme since 1 October 2018, which penalises nursing homes directly based on the 30-day all-cause readmission measure.[6] These policies intend to shift payments from volume to value based on the quality performance. Nursing homes are also being evaluated on other dimensions of care quality, termed quality measures.[7] More importantly, CMS has published rate of PPH readmission 30 days after discharge from a skilled nursing facility for short-stay resident and number of hospitalisations per 1000 long-stay resident days.[8] This information is designed to be used by consumers in choosing a nursing home and by providers in improving their care quality.

Few studies conducted on the association of clinical care quality and hospitalisation have found inconsistent results.[9–14] One study found two measures to be associated with readmission (quality deficiency rating and pressure ulcer rate).[13] Another study found little difference in PPH rates between 1-star and 5-star nursing facilities.[14] These prior studies

have limitations. They varied widely in deficiency calculations, measures of quality and even hospitalisation types—all-cause hospitalisation and PPH.

In order to effectively address inappropriate hospitalisations, we must have a better understanding of the relationship between nursing home care quality measures and hospitalisation. In our study, we used a rich set of Minnesota-specific quality indicators, measures of both all-cause hospitalisations and PPH, and a multilevel modelling approach that adjusted for risk of hospitalisation. Our study objectives were to investigate the following: (1) the relationships between available quality indicators and all-cause hospitalisation, (2) the relationships between available quality indicators and PPH and (3) quality indicators that were hypothesised to be related to specific conditions making up the PPH. We are not evaluating whether clinical care quality is related to outcomes. Instead, we are concerned with the way care quality is conceptualised and measured. We view quality as multidimensional, with each dimension having a potentially unique relationship to hospitalisation.

METHODS

Data sources

This study was approved by the University of Minnesota Institutional Review Board. We used facility-level nursing home data for the years 2011–2012 from the Minnesota Nursing Home Report Card, a data repository developed by the Minnesota Department of Health and the Department of Human Services to help people compare nursing homes on quality measures. The report card contains data on nursing home characteristics, quality indicators and other quality performance. Data on resident characteristics were obtained from the Minimum Data Set (MDS version 3.0). The MDS includes detailed clinical and functional status data on all residents in Medicare or Medicaid certified nursing homes. The facility-level nursing home data and resident-level MDS data sets were linked to the Medicaid claims data files of inpatient care for the Medicaid beneficiaries for 2011–2012. We had a very complete picture of hospitalisations for dual eligible nursing home residents. The Minnesota Medicaid claims files contain data on crossover claims for hospitalisations where Medicare is the primary payer. In addition, the Minnesota Medicaid programme receives hospitalisation encounter data on individuals who are covered by managed care plans.

Study sample

The initial sample consisted of a cohort of 24 530 Medicaid beneficiaries aged 65 years and older who resided in 368 Minnesota nursing homes between 1 January 2011 and 31 December 2012. We excluded the 23 facilities for which facility-level data were not present in all eight quarters and the 4012 residents for whom resident-level data were missing. Thus, 345 facilities with 20 518 residents were included in the final analysis.

Dependent variables

The first primary outcome was a composite end point of hospitalisation or death from any cause. To prevent inappropriate censoring of observations, death was included in the primary outcome. A secondary analysis using an end point of only hospitalisation was conducted for comparison. Another primary outcome was a PPH defined by a list of Ambulatory Care Sensitive conditions. The PPH hospitalisations were defined using the logic and diagnosis codes described by Walsh *et al* (2012) for use with nursing homes. The 16 conditions which were used to identify PPH were chronic obstructive pulmonary disease (COPD) or asthma, congestive heart failure (CHF), constipation, dehydration, hypertension, poor glycaemic control, seizures, urinary tract infection, weight loss/malnutrition, altered mental status, anaemia, diarrhoea, falls/trauma, pneumonia, psychosis/agitation and skin ulcers.

Independent variables

The key independent variables were 26 risk-adjusted quality indicators that served as indicators of the clinical quality of care provided to the residents. Three quality indicators ('incidence of healed pressure sores', 'prevalence of new or worsening pressure sores' and 'incidence of decrease in pain when admitted on a pain medication regimen') were dropped from our study because several facilities fell below the minimum number to report a reliable quality indicator. In all, 23 risk-adjusted quality indicators were used in the final analysis (see table 2; the definition of quality indicators can be found at http://nhreportcard.dhs.mn.gov/). A categorical summary rating based on deficiencies identified through site inspection surveys ranged from 1 to 5 stars, with more stars reflecting a better rating. Like federal quality measures, Minnesota quality indicator rates are the percentage of residents with a care process or outcome. All quality indicators are measured at the resident level from the MDS according to receipt or nonreceipt of a specific service; presence or absence of a condition at one point in time (prevalence) or a change in condition over time (incidence). The quality indicators are risk adjusted to account for differences between the types of residents served in nursing homes. Examples of the adjustors are as follows: age, gender, cognitive performance, Alzheimer's disease, stroke and activities of daily living (ADL) ability. Compared with the quality measures reported by Nursing Home Compare, the Minnesota quality indicators are more thoughtful about exclusions and more extensively risk adjusted. Online appendix table A provides a comparison between Minnesota report card quality indicators and CMS quality measures. For example, compared with CMS quality measure 'antipsychotic medication', the Minnesota quality indicator

excludes residents with end of life, bipolar disorder, psychotic disorder, hallucinations and other affective psychosis disorder, and is adjusted for age, gender and length of stay. Compared with CMS quality measure 'urinary tract infection', the Minnesota quality indicator excludes residents with end of life and is adjusted for age, gender, length of stay, cerebrovascular accident/stroke, paraplegia, quadriplegia, and locomotion on unit.

Moreover, we hypothesise that certain quality indicators may have direct relationships with specific medical conditions used to define PPH. These PPH diagnoses include falls and trauma, urinary tract infections, pneumonia, and skin ulcers and cellulitis (online appendix table B). For example, the several quality indicators associated with incontinence (such as incidence of worsening bladder incontinence, prevalence of indwelling catheter or prevalence of urinary tract infection) should be directly related to urinary tract infection, which is one of the hospital admission conditions (primary diagnosis). Nursing facilities with low incidence/prevalence of these incontinence indicators, which indicate good quality of care, are more likely to have low rate of PPH due to urinary tract infection.

Covariates

Other nursing home characteristics included ownership (for-profit, not-for-profit or government owned), hospital affiliation, location (urban or rural area), chain membership, facility size (total beds), facility acuity (calculated from the facility's Resource Utilisation Group average score per day), the percentage of residents covered by Medicare, Medicaid, private, and other insurance, proportion of single bedrooms, and staffing variables (direct care staff hours per resident day, direct care staff retention rate and the percentage of temporary/pool hours vs total staff hours). Besides the above facility-level variables, we obtained data on resident-level covariates from the MDS, including resident age, gender, race, marital status, cognitive impairment, end of life (life expectancy of less than 6 months), hospice care, mood score, length of stay in nursing home (≤30 days, 31–90 days or >90 days), admission sources to nursing home (hospital, community, other places) and the following conditions: acute onset mental status change, psychosis, anaemia, heart failure, hypertension, diabetes, hip fracture, Alzheimer's disease, cerebrovascular accident, transient ischaemic attack or stroke, non-Alzheimer's dementia, hemiplegia or hemiparesis, Parkinson's disease, seizure disorder or epilepsy, anxiety, manic depression, asthma, COPD or chronic lung disease, respiratory failure, and delirium.

Statistical analysis

Because facility-level quality indicators and residents' health status assessed each quarter could change during the 2-year period, the analyses were conducted at the resident-quarter level. The resident-level variables closest to the beginning of each quarter were used in the analysis. The outcomes of interest, measured at the resident level, were as follows: (1) the total number of hospitalisations and death in each quarter; (2) the total number of hospitalisations in each quarter and (3) the total number of PPHs in each quarter. To account for nested structure of residents in nursing homes, the generalised linear mixed models were used for analysis. We used the xtpoisson procedure available in Stata V.12.1, which takes into account the exposure time. Our measure of exposure was resident days in each quarter. For those residents who lived in more than one nursing home over this 2-year period, they were treated as independent resident stays in different nursing homes. The Huber Whites sandwich estimate of variance was used in the analysis to account for clustering of observations within a resident. In sensitivity analysis, we conducted a base model containing only 23 risk-adjusted quality indicators.

RESULTS

The mean age of the study sample was approximately 84 years of age and roughly three-fourths of residents were women. The majority of residents were white non-Hispanic and unmarried (widowed, separated, divorced or never married). Nearly 72% were long-stay residents (>90 days). Other resident characteristics are listed in table 1. Nursing home characteristics and incidence/prevalence of risk-adjusted quality indicators are shown in table 2.

The average hospitalisation rate for nursing homes was 302 per 1000 person years. The average PPH rate for nursing homes was 134 per 1000 person years (44% of hospitalisations). About one-third of Medicaid residents (33%) died during the 2-year period. Among all Medicaid residents, 19% were hospitalised. Among hospitalised residents, 76% had one hospitalisation. The most common primary diagnoses for hospitalisation were diseases of the respiratory system and circulatory system, which accounted for nearly 40% of hospitalisations. The most common conditions associated with PPH were pneumonia and bronchitis (33%), CHF (14%), falls and trauma (13%) and urinary tract infection (12%).

Table 3 shows the relationships between certain nursing home quality indicators and specific PPH diagnoses including pneumonia and bronchitis, falls and trauma, urinary tract infection, or skin ulcers and cellulitis. As hypothesised, certain quality indicators were directly related to hospitalisations. The quality indicator 'prevalence of infections' shows a consistently significant positive relationship with hospitalisations with primary diagnosis pneumonia and bronchitis. The two quality indicators, 'incidence of worsening or serious ADL dependence' and 'prevalence of falls with major injury', show a consistently significant positive relationship with hospitalisations with primary

Table 1 Resident characteristics

	Mean±SD or N (%)
Age (years)	84.1±9.4
65–69	2263 (9.2%)
70–74	2480 (10.1%)
75–79	2883 (11.8%)
80–84	3923 (16.0%)
≥85	12 981 (52.9%)
Gender	
Female	17 855 (72.8%)
Male	6675 (27.2%)
Race	
White non-Hispanic	22 137 (90.2%)
Black non-Hispanic	888 (3.6%)
Other	1505 (6.1%)
Marital status	
Married	4513 (18.8%)
Widowed, separated, divorced or never married	19 498 (81.2%)
Length of stay	
≤30 days	4392 (17.9%)
30–90 days	2491 (10.2%)
>90 days	17 647 (71.9%)
ADL score	2.5±0.9
Independent	198 (0.8%)
Supervision	2510 (10.7%)
Limited assistance	3158 (13.5%)
Extensive assistance	12 414 (52.9%)
Total dependence	5184 (22.1%)
Depression severity (over the last 2 weeks)	3.9±4.3
None	15 455 (66.8%)
Mild	5189 (22.4%)
Moderate	1703 (7.4%)
Moderately severe	629 (2.7%)
Severe	146 (0.6%)
Cognitive performance	10.0±4.6
Intact/borderline	7769 (42.5%)
Moderate impairment	4832 (26.4%)
Severe impairment	5700 (31.2%)
Pain or hurting (in the last 5 days)	11 032 (47.2%)
End of life (life expectancy of less than 6 months)	1160 (4.9%)
Hospice care	1330 (5.7%)
Diagnoses	
Hypertension	17 315 (73.5%)
Urinary incontinence	12 293 (54.9%)
Depression (other than bipolar)	11 832 (50.2%)
Dementia	11 384 (48.3%)
Bowel incontinence	8875 (38.2%)
Diabetes mellitus	7827 (33.2%)
Anaemia	7054 (29.9%)
Heart failure	6482 (27.5%)
Anxiety disorder	5624 (23.8%)
Asthma, COPD or chronic lung disease	5509 (23.4%)
Coronary artery disease	3664 (21.2%)
Cerebrovascular accident, transient ischaemic attack or stroke	3373 (14.3%)
Delirium	2422 (10.4%)
Urinary tract infection (last 30 days)	2026 (8.6%)
Hemiplegia or hemiparesis	1852 (7.8%)
Cancer	1250 (7.1%)
Psychosis	1543 (6.6%)
Seizure disorder or epilepsy	1447 (6.1%)
Parkinson's disease	1308 (5.5%)
Pneumonia	1123 (4.8%)
Malnutrition	783 (3.3%)
Manic depression (bipolar disease)	709 (3.0%)
Hip fracture	699 (3.0%)
Multidrug-resistant organism	382 (1.6%)
Respiratory failure	292 (1.2%)
Would infection (other than foot)	223 (0.9%)
Septicaemia	154 (0.7%)
Entered from (during the study period)	
In the nursing facility (on January 2011)	14 566 (59.4%)
Hospital	8200 (33.4%)
Community	1344 (5.5%)
Other places	420 (1.7%)

a. ADL score was the average score calculated based on 11 MDS 3.0 items: bed mobility, transfer, walk in room, walk in corridor, locomotion on unit, locomotion off unit, dressing, eating, toilet use, personal hygiene and bathing; range 0 to 4, with higher score indicating greater dependence. Based on the score, ADL self-performance was categorised into five groups: independent (=0), supervision (0–1), limited assistance (1–2), extensive assistance (2–3) and total dependence (3–4).
b. Depression severity was measured using nine-item Patient Health Questionnaire; range 0 to 27, with higher score indicating greater frequency bothered by these symptoms. Based on the score, depression severity was categorised into five groups: none (0–4), mild (5–9), moderate (10–14), moderately severe (15–19) and severe (20–27).
c. Cognitive performance was measured using the Brief Interview for Mental Status, which used MDS 3.0 items: repetition of three words, temporal orientation and recall items; range 0 to 15, with lower score indicating more severe cognitive impairment. Based on the score, residents were categorised into three groups: intact/borderline (13–15), moderate impairment (8–12) and severe impairment (<8).
d. Delirium was assessed using the Confusion Assessment Method, which is a standardised instrument that has been developed to facilitate the detection of delirium.
e. Urinary and bowel incontinence were defined as frequently or always incontinent (score 2 or 3 on MDS 4-point scale) and continence was defined as always continent or occasionally incontinent (score 0 or 1 on MDS 4-point scale).
ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; MDS, Minimum Data Set.

diagnosis falls and trauma. The two quality indicators, 'prevalence of urinary tract infections' and 'prevalence of indwelling catheters', show a consistently significant positive relationship with hospitalisations with primary diagnosis urinary tract infection.

Table 4 summarises the relationship between the quality indicators and the composite outcome measures

Table 2 Nursing home characteristics and incidence/prevalence of risk-adjusted quality indicators during the 2011–2012

	Mean±SD or N (%)	Median (IQR)
Ownership		
For-profit	100 (27.2)	
Not-for-profit	226 (61.4)	
Government	42 (11.4)	
Hospital based	54 (14.7)	
Urban	174 (47.3)	
Part of a chain	191 (51.9)	
Total beds	83±48	68 (51–100)
Proportion of single bedrooms	43.1±29.2	38.9 (18.8–65.0)
Staff		
Direct care staff hours per resident day	5.2±0.7	5.2 (4.8–5.6)
Direct care staff retention rate	73.2±10.6	73.4 (66.7–81.0)
Percentage of temporary/pool staff usage	0.3±0.1	0 (0–0)
Percentage of all residents covered by Medicaid	56.4±12.9	56.3 (48.6–64.1)
Percentage of all residents covered by Medicare	9.1±7.2	7.8 (5.4–11.0)
Facility inspection rating, stars		
1 (lowest)	3 (0.8)	
2	22 (6.0)	
3	94 (25.8)	
4	122 (33.5)	
5 (highest)	123 (33.8)	
Incidence of walking as well or better than previous assessment	77.0±9.3	77.1 (71.1–83.5)
Prevalence of occasional to full bowel incontinence without a toileting plan	75.1±23.0	83.9 (63.4–92.7)
Prevalence of occasional to full bladder incontinence without a toileting plan	59.1±26.0	62.2 (37.6–83.5)
Incidence of improved or maintained bowel continence	53.4±10.4	53.7 (46.7–59.7)
Incidence of improved or maintained ADL independence	30.8±8.9	30.5 (25.3–35.5)
Incidence of improved or maintained bladder continence	27.6±8.5	27.1 (22.0–33.0)
Incidence of worsening or serious mobility dependence	27.5±10.8	26.8 (20.8–33.2)
Incidence of worsening or serious bowel incontinence	27.1±8.7	26.9 (21.4–32.3)
Prevalence of residents who report moderate to severe pain (short stay)	26.8±9.8	27.0 (20.4–33.0)
Incidence of worsening or serious bladder incontinence	26.2±10.3	25.3 (18.6–32.4)
Incidence of worsening or serious ADL dependence	17.4±6.5	16.9 (13.1–21.4)
Prevalence of residents who report moderate to severe pain (long stay)	17.0±8.4	16.5 (10.9–21.9)
Incidence of worsening or serious resident behaviour problems	14.1±7.5	13.1 (9.0–17.8)
Incidence of worsening or serious range of motion limitation	12.7±8.4	11.3 (6.9–16.6)
Prevalence of antipsychotics without a diagnosis of psychosis	11.5±7.6	10.5 (6.0–15.6)
Prevalence of unexplained weight loss	5.9±3.4	5.4 (3.5–7.6)
Prevalence of urinary tract infections	5.8±3.6	5.2 (3.2–7.7)
Prevalence of infections	4.6±4.0	3.6 (2.0–6.0)
Prevalence of pressure sores in high-risk residents	4.1±2.3	4.0 (2.4–5.5)
Prevalence of falls with major injury	3.7±2.9	3.1 (1.4–5.2)
Prevalence of indwelling catheters	3.5±2.9	2.8 (1.2–4.8)
Prevalence of depressive symptoms	3.2±3.1	2.2 (0.9–4.4)
Prevalence of physical restraints	1.3±2.1	0.4 (0.2–1.7)

ADL, activities of daily living.

of hospitalisation and death, hospitalisation or PPH. Online appendix table C presents the incidence-rate ratios (IRRs), which are the exponentiated coefficients. Among 23 risk-adjusted quality indicators, only six quality indicators were associated with the risk of hospitalisation/death. Nursing facilities with better

Table 3 Relationship between certain quality indicators and specific PPH diagnoses

	Coefficient	P value
Outcome: pneumonia and bronchitis		
Prevalence of infections	**6.84**	**<0.001**
Outcome: falls and trauma		
Prevalence of falls with injury	**8.52**	**<0.001**
Incidence of worsening or serious ADL dependence	**3.33**	**0.001**
Incidence of worsening or serious mobility dependence	1.11	0.115
Incidence of improved or maintained ADL independence	−0.93	0.259
Incidence of walking as well or better than previous assessment	1.45	0.053
Outcome: urinary tract infection		
Prevalence of urinary tract infections	**6.68**	**<0.001**
Prevalence of indwelling catheters	**5.10**	**0.020**
Incidence of worsening or serious bowel incontinence	1.46	0.225
Incidence of worsening or serious bladder incontinence	0.01	0.994
Incidence of improving or maintained bowel continence	1.24	0.165
Incidence of improving or maintained bladder continence	0.70	0.437
Outcome: skin ulcers and cellulitis		
Prevalence of pressure sores in high-risk residents	3.25	0.415

ADL, activities of daily living; PPH, potentially preventable hospitalisation.

Table 4 Relationship between nursing home quality indicators and hospitalisation

	Hospitalisation/ death		Hospitalisation		PPH	
Quality indicators	**Coefficient**	**P value**	**Coefficient**	**P value**	**Coefficient**	**P value**
Prevalence of antipsychotics without a diagnosis of psychosis	−0.48	**0.021**	−1.20	**0.002**	−1.17	**0.020**
Prevalence of unexplained weight loss	1.50	**<0.001**	1.94	**0.002**	2.11	**0.012**
Prevalence of pressure sores in high-risk residents	1.25	**0.018**	1.95	**0.021**	1.18	0.320
Incidence of improving or maintained bladder continence	0.38	**0.041**	0.96	**0.003**	0.62	0.151
Incidence of worsening or serious ADL dependence	0.84	**<0.001**	0.82	**0.034**	0.74	0.160
Incidence of improved or maintained ADL independence	−0.42	**0.013**	−0.19	0.516	−0.93	**0.016**
Prevalence of urinary tract infections	0.70	0.066	1.15	0.068	1.75	**0.043**
Incidence of walking as well or better than previous assessment	−0.22	0.157	−0.18	0.514	−0.33	0.360
Incidence of worsening or serious mobility dependence	0.16	0.301	0.38	0.183	0.45	0.227
Incidence of worsening or serious ROM limitation	−0.09	0.643	−0.29	0.404	−0.51	0.252
Prevalence of falls with injury	0.23	0.577	0.61	0.362	0.49	0.603
Incidence of worsening or serious behaviour problems	−0.34	0.090	−0.03	0.937	−0.28	0.545
Prevalence of depressive symptoms	−0.48	0.286	0.55	0.480	−0.34	0.742
Prevalence of physical restraints	0.26	0.706	1.49	0.225	0.16	0.921
Prevalence of infections	0.07	0.844	0.78	0.208	0.83	0.314
Incidence of worsening or serious bowel incontinence	0.16	0.488	−0.24	0.534	0.15	0.785
Incidence of worsening or serious bladder incontinence	−0.20	0.277	0.32	0.306	0.66	0.117
Incidence of improving or maintained bowel continence	−0.01	0.939	−0.23	0.486	−0.03	0.945
Prevalence of occasional to full bladder incontinence	−0.04	0.595	−0.24	0.110	−0.11	0.585
Prevalence of occasional to full bowel incontinence	−0.07	0.458	−0.17	0.295	−0.36	0.086
Prevalence of indwelling catheters	0.10	0.838	0.69	0.436	0.94	0.418
Prevalence of moderate to severe pain (short stay)	0.26	0.076	0.08	0.727	−0.23	0.484
Prevalence of moderate to severe pain (long stay)	−0.09	0.620	0.52	0.102	0.73	0.085

ADL, activities of daily living; ROM, range of motion; PPH, potentially preventable hospitalisation.

performance on four quality indicators ('incidence of worsening or serious ADL dependence', 'incidence of improved or maintained ADL independence', 'prevalence of unexplained weight loss' and 'prevalence of pressure sores in high-risk residents') demonstrated a lower adjusted risk of hospitalisation and death; however, the relationship with hospitalisation and death seems counterintuitive in two quality indicators. 'Prevalence of antipsychotics without a diagnosis of psychosis' was associated with a lower adjusted risk of hospitalisation and death; and 'incidence of improved or maintained bladder continence' was associated with a higher adjusted risk of hospitalisation and death. The other 15 quality indicators were not significantly related to the composite outcome. When the outcome was just hospitalisation, the significance of quality indicators remained the same except that the quality indicator 'incidence of improved or maintained ADL independence' was no longer significant.

Among the 23 risk-adjusted quality indicators, only four quality indicators were associated with the risk of PPH. Three of these ('prevalence of antipsychotics without a diagnosis of psychosis', 'prevalence of unexplained weight loss', and 'incidence of improved or maintained ADL independence') had similar results with the composite outcome hospitalisation or death. We also found that the quality indicator 'prevalence of urinary tract infection' had a positive association with the risk of PPH. In addition, there was no significant association between 5-star quality deficiency rating and hospitalisation or PPH. The three measures with the highest IRRs were unexplained weight loss (IRR 4.46–8.22), pressure sores (IRR 3.26–7.02) and urinary tract infections (2.10–5.73), see online appendix table C. As a sensitivity test, we provide unadjusted results in online appendix table D. Among these 23 risk-adjusted quality indicators, seven quality indicators were related significantly to hospitalisation/death and only five quality indicators were related to PPH.

DISCUSSION

Among Medicaid beneficiaries aged 65 years and older who received care in a Minnesota nursing home during 2011–2012, better performance on most of the available 23 risk-adjusted quality indicators was neither strongly nor consistently associated with a lower adjusted risk of hospitalisation and death or PPH. Among 23 quality indicators, six quality indicators were associated with hospitalisation/death; five quality indicators were associated with hospitalisation; four quality indicators were associated with PPH and five quality indicators were significantly related to specific conditions making up the PPH. However, 13 quality indicators showed no significant association with any of the three outcomes or specific PPH conditions.

According to our expectations, we found that certain quality indicators had direct and strong relationships with specific PPHs. Nursing homes with better performance on quality indicator 'prevalence of infections' had lower rate of hospitalisation with primary diagnosis pneumonia and bronchitis. Nursing homes with better performance on quality indicators 'prevalence of falls with injury' and 'incidence of worsening or serious ADL dependence' had lower rate of hospitalisation with primary diagnosis falls and trauma. Nursing homes with better performance on quality indicators 'prevalence of urinary tract infections' and 'prevalence of indwelling catheters' had lower rate of hospitalisation with primary diagnosis urinary tract infections. These quality indicators appear to tap dimensions of nursing home quality directly related to hospitalisations.

Unintentional weight loss is a cardinal feature of frailty reflecting disease progression and it is an important prognostic indicator. Numerous studies have suggested that weight loss in older adults is associated with adverse health outcomes, such as pressure ulcer,[15] decline in ADL function and mobility,[16] hip bone loss and subsequent hip fracture,[17] hospitalisation[18] and death.[19 20] The current study confirms that prevalence of unexplained weight loss had a positive association with higher risk of the composite outcome (hospitalisation and death), hospitalisation and PPH. Our results were similar to a previous study that residents residing in facilities with a higher than expected incidence of unexplained weight loss or gain experienced increased risk of hospitalisation.[21]

The residents' ability to perform basic daily activities is important in maintaining health status and quality of life. Loss of independence in physical function has been recognised as an indicator of general decline and hence may be an important risk factor for hospitalisation among older adults. Among community-dwelling older adults, functional change was strongly related to future hospital use.[22] Among nursing home residents, the risk of hospitalisation increased as ADL dependence increased.[23 24] Worsening ADL trajectories increased the risk of mortality among long-stay nursing home residents.[25] As expected, we found that the quality indicator 'incidence of worsening or serious ADL dependence' had a positive association and the quality indicator 'incidence of improved or maintained ADL independence' had a negative association with the risk of the hospitalisation and death. We also found that the quality indicator 'incidence of improved or maintained ADL independence' was association with the lower risk of PPH.

Pressure ulcers have serious health consequences for residents in long-term care facilities.[26] There is a consensus that pressure ulcer development is related to the quality of care.[27] Unresolved ulcers may require hospitalisation. In the current study, the quality indicator 'prevalence of pressure sores in high-risk residents' was significantly related to the risk of hospitalisation. Our finding was consistent with prior studies.[21 23 28] We also found that the quality indicator 'prevalence of urinary tract infection' had a positive association with the risk of PPH. Indeed, urinary tract infection is used to define PPH and accounted for nearly 12% among all those conditions.

Our findings of the relationship between antipsychotic use and hospitalisation were unexpected. The inappropriate use of antipsychotics has resulted in adverse events including mortality with marginal clinical benefits.[29] Since high rates of antipsychotic drug prescribing may signal poor quality of nursing home care, we would expect the quality indicator 'prevalence of antipsychotics without a diagnosis of psychosis' may be associated with higher risk of hospitalisation or PPH. However, we found an opposite association. This may be explained by the clinical role of these chemical restraints. A frequent cause of hospitalisations is residents acting out or violence by residents due to dementia or behavioural health issues.[30] Although the practice is considered dangerous, the use of antipsychotics may reduce hospitalisations by making residents more tractable. Our findings were similar to previous research that found the number or rate of hospitalisations among users of conventional or atypical antipsychotics was lower than among nonusers.[31 32] Because of severe side effects of antipsychotics, effective interventions, such as higher staffing ratios, staff education, many and varied activities, and cognitive stimulation,[33 34] should be used as alternatives to antipsychotics when addressing behavioural symptoms in residents with dementia.

Another unexpected finding was the positive association between the quality indicator 'incidence of improving or maintained bladder continence' and the risk of hospitalisation and death. This unexpected positive relationship may in part be explained by the association between continence and dehydration.[35 36] Limiting fluid intake was used in nursing homes to manage urinary incontinence.[37] Fluid intake may be restricted in order to decrease the urinary output of incontinence and frequent requests for assistance.[38 39] Prior research found that dehydrated residents had a higher risk of hospitalisation.[40]

However, most quality indicators did not appear to capture the aspects of nursing home quality that relate to all-cause hospitalisation or PPH. The dimensions of care reflected in these quality indicators, although important for overall health, functioning and quality of life, may have only a very indirect relationship to hospital admission. Our results do not diminish the value of these quality indicators. Residents would undoubtedly prefer nursing facilities that were more effective at providing continence care, improving physical functioning or managing restraints and behaviours problems, depending on their specific needs.

A strength of our study is to be able to draw on 23 nursing home quality indicators from the Minnesota Nursing Home Report Card. The Nursing Home Compare website provides 5-star rating information about nursing home performance based on three domains: health inspection ratings, staffing measures, and performance on 16 clinical quality measures.[7] Although the 5-star performance rating provides an easy way to understand nursing home quality, making useful distinctions about overall performance, they may not be informative in rating facilities on specific resident outcomes, such as hospitalisations. The 5-star rating system places facilities into a few broad categories with considerable variation in quality scores within categories.[41] Moreover, a nursing facility may excel at some quality indicators and do poorly on other quality indicators.[42] Because of the multidimensional nature of nursing home quality, the individual performance measures can provide more meaningful and detailed information to find opportunities for quality improvement and to guide specific improvement activities.

The study has several limitations. First, our study only included Medicaid residents of nursing homes in Minnesota. The generalisability of these findings may be limited. More research is needed to test the relationship among non-Medicaid residents and in other states. Second, there were many Minnesota nursing home initiatives during this period to reduce avoidable hospitalisations, including implementation of the Interventions to Reduce Acute Care Transfers program[43] in many facilities. Third, we defined PPHs based on medical diagnoses. These are diagnoses where good primary care should reduce some, but not all, related hospitalisations. Clinically, some hospitalisations even those that are potentially preventable are appropriate in this high-risk population. In fact, higher quality nursing homes might be better at identifying residents who require hospitalisation and sending them to the hospital. A weak association between clinical quality indicators and hospitalisations may result from the difficulty of relying on a medical diagnosis alone as an indicator of appropriateness of a hospitalisation. Recent studies have called into question the use of diagnoses, such as the PPH conditions, as indicators of avoidability. The hospitalisation decision is complex; it may be influenced by a wide set of variables, such as communication between nursing home staff and medical providers, resident or family preferences, respect for advance directives,[44 45] that we were unable to capture in our study. Fourth, we used the risk-adjusted quality indicators, which may adjust away parts of nursing facility responsibility for quality. However, these risk-adjusted quality indicators have advantages to account for differences between the types of residents served in nursing homes. Fifth, poor quality nursing homes may under-report indicators they do poorly in. Superficial improvements in quality indicators may not represent true improvements in nursing home quality. This poor or inaccurate reporting by nursing homes may partly account for the lack of association between most quality indicators and hospitalisation.

Now that CMS has published hospitalisation rates and instituted financial penalties for nursing homes with excessive rates, providers should be more motivated to reduce hospitalisations of their residents. Future research should evaluate relationships between dimensions of clinical care quality and hospitalisation in the context of these Medicare policy changes.

CONCLUSION

Among Medicaid beneficiaries aged 65 years and older, better performance on selected quality indicators appears to tap dimensions of nursing home quality directly related to hospitalisations. Several other quality indicators were neither strongly nor consistently associated with hospitalisations, even though they may be very important to the nursing home resident's health, functioning and quality of life.

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