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Case-Mix and Quality Indicators in Chinese Elder Care Homes: Are There Differences between Government-owned and Private- sector Facilities?

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Royalties		X		X		X		
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Abstract

Objective—To assess the association between ownership of Chinese elder care facilities and their performance quality; and to compare the case-mix profile of residents and facility characteristics in government-owned and private-sector homes.

Design—Cross-sectional study.

Setting—Census of elder care homes surveyed in Nanjing (in 2009) and Tianjin (in 2010).

Population—140 (or 95% of all) elder care facilities located in urban Nanjing, and 157 (or 97% of all) facilities in urban Tianjin.

Main study outcome measures—We created a summary case-mix index based on activities of daily living (ADL) limitations and cognitive impairment to measure levels of care needs among residents in each facility. We selected structure, process, and outcome measures to assess facility-level quality of care. We also developed a structural quality measure, under-staffing relative to residents' levels of care needs, which indicates potentially inadequate staffing given the residents' case-mix.

Results—Government-owned homes have significantly higher occupancy rates, presumably reflecting popular demand for publicly subsidized beds, but they serve residents who, on average, have fewer ADL and cognitive functioning limitations than do private-sector facilities. Across a range of structure, process, and outcome measures of quality, there is no clear evidence suggesting advantages or disadvantages to either ownership type. However, when staffing to resident ratio is gauged relative to residents' case-mix, private-sector facilities were more likely to be under-staffed than government-owned facilities.

Conclusions—In Nanjing and Tianjin, private-sector homes were more likely to be understaffed, although their residents were sicker and frailer, on average, than those in government facilities. The case-mix differences are likely the result of selective admission policies that favor relatively healthier residents in government facilities than in private-sector homes.

Keywords

Long-term care; elder care facilities; ownership; disparities; China

INTRODUCTION

Traditionally, elder care in China has been confined to the familial sphere. Under the cultural mandate of filial piety,^{1–3} adult children are expected to take care of elderly parents financially, physically and emotionally. In recent years, however, demographic shifts and profound socioeconomic changes, such as rapid aging of China's population,^{3–5} rising old age dependency,^{6, 7} diminishing family size,^{8, 9} increasing population mobility,^{10, 11} and the surge of elderly “empty-nesters”,¹² are undermining the traditional family care system for the aged.^{1, 13, 14} In urban China, the elder care challenge is compounded by the emerging “4-2-1” family structure, which consists of four grandparents, two adult children both without siblings, and one grandchild—a consequence of China's one-child policy that has been in effect for more than 30 years.^{1, 4} As families are increasingly strained, residential

care facilities for the elderly have emerged and grown rapidly across major cities in China.^{15–17}

For decades, institutional elder care in China was rare and limited to the childless, the mentally ill, and developmentally disabled adults without families, who were housed in government-run social welfare institutions.^{3, 18} In recent years, soaring demands for formal elder care services and a limited bed supply have prompted the Chinese government to encourage the private sector to develop elder care homes using various policy incentives, ranging from tax exemption to financial inducements for new bed construction and operating subsidies for existing beds.^{4, 19} As a result, the private sector has dominated the recent growth of elder care homes in China.^{15, 20} Meanwhile, scandals in Chinese private elder care facilities have already begun to surface.^{21, 22}

Government-run facilities have also expanded. They enjoy a multitude of advantages over their private-sector counterparts, such as additional public financing, government employed personnel, subsidized rent, utilities and operating costs, and greater integration with local communities and professionals. In spite of these advantages, there have been numerous anecdotal reports of public concern that government-run elder care facilities were not taking care of elders most in need.^{23, 24, 25} However, no formal study has been conducted to assess the case-mix profile of residents or the quality of care in government-owned and private-sector homes.

Using survey data recently collected from a census of elder care facilities in two major Chinese cities, Nanjing and Tianjin, we examined the extent to which the case-mix of residents, in terms of cognitive impairment and limitations in activities of daily living (ADL), and measures of care quality differed between government and private-sector homes. Insights into these questions can inform older people in need of elder care, their family members, and policymakers in China in efforts to grow aged care services while insuring adequate quality as well as affordable and equitable access to such services.

METHODS

Data and Settings

We used primary data collected from two major cities in China, Nanjing and Tianjin, in 2009 and 2010, respectively. One of China's ancient capitals and now the capital city of Jiangsu Province, Nanjing is located in the Yangtze River Delta roughly 150 miles west of Shanghai. One of the four municipalities directly controlled by China's central government, Tianjin is a metropolis in northern China, about 69 miles southeast of Beijing. As of 2010, the total population of Nanjing and Tianjin were roughly 8 million and 13 million, respectively; in Nanjing, there were over 0.7 million people ages 65 years and older (or 9.2% of total population), and in Tianjin, 1.1 million people 65 years and older (or 8.5% of total).²⁶

Our target population consisted of all elder care homes located in the urban districts of each city as of June of the survey year (2009 in Nanjing, and 2010 in Tianjin). The operational definition of an elder care home is an institutional provider of elder care services licensed by

the local municipal government. We excluded homes located in remote suburban areas of the city due to their distinctly rural character. From the official listing of all registered elder care homes maintained by the Municipal Bureau of Civil Affairs (the government agency licensing social welfare and institutional elder care services) in each city, a total of 148 target facilities in Nanjing and 162 target facilities in Tianjin were identified.

After field testing, a survey questionnaire was administered to all target facilities through on-site, face-to-face interviews with administrators by a group of research assistants (graduate students recruited from Nanjing University in Nanjing and Nankai University in Tianjin) who had received training in survey protocols. The questionnaire was modeled after the Online Survey Certification and Reporting (OSCAR) survey instrument currently used in the US for annual inspection and certification of nursing homes, and adapted to fit the Chinese context. It gathered information at the facility level, including size, ownership, financing, staffing, and aggregated resident characteristics, which were based on all residents residing in each facility at the time of the survey. Data collection occurred between June-September, 2009 and 2010 in Nanjing and Tianjin, respectively. More details on the data collection process were described elsewhere.¹⁵ We obtained complete survey data from 140 (95% of total census) and 157 (97% of total census) elder care homes in the two cities.

Study Measures

Ownership—We classified elder care homes into two broad types of ownership: government vs. non-government. In our survey instrument, ownership was divided into 13 categories: “Provincial government”, “City government”, “District/county government”, “Street/community”, “Government owned, private run”, “Individual owned”, “Partnership”, “Corporation/enterprise”, “Work unit (non-profit) owned”, “Foreign investment”, “Church affiliated”, “Charity organization related”, and “Other”. Some facilities may belong to more than one category. We defined “government-owned” as those that fell in any of the first five categories; all other homes were classified as “non-government owned”, that is, private-sector facilities.

Residents’ Case-Mix—Based on selected ADL limitations and health conditions collected at the facility level, we created a standardized case-mix index. Specifically, this summary index included the following six variables: “percent of residents with dementia”, “percent of residents requiring assistance with eating”, “percent of residents requiring assistance with dressing”, “percent of residents requiring assistance with walking”, “percent of residents with bladder incontinence”, and “percent of residents with bowel incontinence”. Within each city, we first standardized each variable for each facility, as: (individual value–city mean)/standard deviation, which indicates how many standard deviations a facility is above or below the city-wide mean of a given variable. Then, we summed 6 individual standardized scores per facility to obtain a combined Z-score index as a summary case-mix measure. A higher index score indicates a sicker or frailer profile of residents in a facility.

Indicators of Care Quality—Following the Donabedian framework,²⁷ we selected various structure, process, and outcome measures to characterize the quality of care in Chinese elder care facilities. In this framework, structure refers to facility characteristics or

resources used to provide care (such as staffing); process pertains to treatment and action on the patient (such as use of restraints and feeding tubes); outcome measures assess the patient's health status.

Staffing (Structure Measures): We included direct-care staffing levels and mix, and clinical staff availability, measured by the “ratio of direct-care staff to residents” (number of direct-care staff per 100 residents), “percent of direct-care staff with middle school or more education”, “percent of direct-care staff who are rural migratory workers”, “whether a professional nurse is on-staff”, and “whether a physician is on-staff”.

Studies in the United States and other countries indicate that adequate staffing is a prerequisite to delivering good quality care in nursing homes.^{28–30} To profile homes that are most likely to have quality of care problems, in each city we also identified facilities with the *lowest* staffing level but the *highest* score on the case-mix index as under-staffed facilities relative to residents' care needs. In each city we ranked all facilities in quartiles, separately by staffing level (i.e., ratio of direct-care staff to residents) and by the summary case-mix index. Based on these two sets of quartile ranks, we divided all facilities in each city into 16 groups. We designated homes in the two *lower* quartiles of the staffing level distribution while in the two *upper* quartiles of the case-mix index distribution as susceptible to providing the *worst* quality of care.

Process and Outcome Measures: We selected three process/treatment measures as indicators of poor quality, including use of feeding tubes and the use of physical restraints and of psychoactive medications. We used the prevalence of pressure ulcers among residents as the outcome measure of low quality.

Other Variables—In addition, we included a number of variables on facility organizational characteristics (year of establishment, total number of beds, occupancy rate, whether currently under expansion, whether hospital-based, and chain membership), financing (sources of daily operating revenues and whether the facility received government subsidies), resident demographics (total number of residents, percent of residents age 60 and older, and percent of female residents), and payment status (percent of residents paying out of pocket, percent of residents who are welfare recipients, and percent of residents with pensions) in the analysis.

Statistical Analysis

We conducted bivariate analyses to examine the differences between government and non-government owned elder care homes in the characteristics of interest, as identified above. For continuous variables, we performed t-tests; for binary variables, we used Chi-square tests.

To assess the association between ownership and each process/outcome quality measure, we used negative binomial regression models to account for over-dispersion in the count of the outcome or process events, with the total number of residents per facility specified as the exposure variable (entered in natural logged form with coefficient constrained to 1). We report both crude (including ownership as the only predictor) and adjusted (further

controlling for resident demographics, the summary case-mix Z-score index, and payment status) model estimates in the form of incidence rate ratios (IRRs), which can be interpreted in a similar way to odds ratios.

Each process and outcome quality measure is expressed as the percentage (in bivariate, descriptive analysis) and count (in multivariate, negative binomial regression analysis) of residents having the specified adverse outcome event.

RESULTS

In both Nanjing and Tianjin, government-owned and private-sector facilities reported substantially different organizational and financing characteristics (Table 1). While the majority of private-sector facilities were established after 2000, only about one third of government owned facilities were built within the last ten years in Nanjing; in Tianjin, this percentage is even lower (7.7%). Government owned facilities on average were larger and had significantly higher occupancy rates than did private-sector homes. Governmental funds accounted for a significant share of daily operating revenues in government owned facilities in both cities (42% in Nanjing and 30% in Tianjin), while in private-sector homes the share of government funding is only about 2% and virtually all of their daily operating revenues came from private payment.

In Nanjing, the proportion of residents with functional limitations (requiring assistance with eating, dressing and walking) was about twice as great in private-sector homes than in government owned facilities (Table 1). The summary measure of case-mix Z-score revealed the difference in the health profile of residents between the two types of facilities in a more succinct manner. In both cities, government owned facilities on average had a lower case-mix Z-score than private-sector homes. In Nanjing, in particular, the mean case-mix Z-score index in government owned facilities is significantly lower than in private-sector homes (−1.8 and 1.4, respectively); there is a similar pattern in Tianjin, although the difference is not statistically significant.

In Nanjing, private-sector homes reported a higher direct-care staff to resident ratio than did government facilities (Table 1), but a lower proportion of direct-care staff with middle school or more education (42% vs. 62%) and a larger proportion of rural migratory workers (68% vs. 38%). In both cities, private-sector facilities were significantly more likely to fall into the “under-staffed” category. Table 2 and Table 3 show the proportion of facilities in Nanjing and Tianjin, respectively, that fall in each of the 16 groups formed by cross-tabulating the quartile ranks of all facilities within each city by their direct-care staffing ratio (rows) and the summary case-mix Z-score index (columns). The distribution is presented separately for government-owned (top panel of table) and private-sector (bottom panel) homes. Facilities located in the four shaded cells of each table were deemed understaffed to potentially compromise quality of care. In Nanjing, only five (or 8%) government-owned facilities were found in this category, compared with 16 (or 20%) of private-sector homes. In Tianjin, among the 35 understaffed facilities identified, only one was government owned (5%) and all the remaining 34 homes were in the private sector (25%).

The multivariate negative binomial regression results are summarized in Table 4. In Model 1, which includes the ownership variable alone (with private-sector homes as the reference group), only one of the four process and outcome measures, regarding feeding tube use, differ statistically (IRR=0.29; $p<.05$). However, in the full models (Model 2) adjusting for residents' average age, case-mix profile and payer mix, none of the coefficients for ownership were significant (at the 5% significance level).

DISCUSSION

We documented significant differences in the case-mix profile of residents in government-owned and private-sector elder care homes in Nanjing and Tianjin. In Nanjing, specifically, government-owned facilities house significantly healthier residents, on average, than do private-sector homes. We found no clear differences between government-owned and private-sector facilities in selected process and outcome aspects of quality. Nevertheless, private-sector homes were most likely to be understaffed, despite the fact that their residents were sicker than those in government facilities. These results suggested potential disparities in Chinese elder care facilities.

Government-owned facilities, by virtue of their public ownership, should tailor their services to elders most in need, especially those who are sicker and functionally more impaired. However, our finding of a greater number of healthier, and presumably low-need, residents in government-owned facilities as compared to private-sector homes indicates just the opposite. Private-sector facilities seem to be more willing to admit functionally impaired residents than do government-owned facilities. Since the occupancy rate is notably higher in government-owned facilities than in private-sector homes, we interpret this to suggest greater popular demand for publicly subsidized institutional care on one hand, and the challenges many private-sector facilities face in filling their empty beds on the other. It may also be the case that the “lighter” case-mix of residents in government-owned facilities relative to private-sector homes was partly driven by discriminatory admission policies that favor admitting more “profitable” light-care residents, particularly by government-owned homes. Indeed, one study reported that government owned care homes were more likely to be reserved for the upper class or wealthy families as well as retired government cadres, while the poor and less healthy elderly have fewer options and choices.²⁰

Our results also reveal that private-sector facilities were more likely to be relatively understaffed, meaning that they will find it more difficult to meet their residents' needs. While regulatory oversight in institutional long term care is quite limited in China, those facilities serving functionally compromised residents with limited staffing should be a priority for quality monitoring and targeted regulatory oversight. This is not to say that government owned facilities should be exempt from regulatory oversight because our results suggest little evidence of superior quality of care provided in government owned facilities, on average, than in private-sector facilities. Indeed, the lack of rigorous and effective regulations in China's booming sector of elder care facilities raises concerns about the quality of care provided in both private-sector and government owned facilities in general.¹⁹

Although nearly all private-sector homes in our study were registered as not-for-profit (thus entitled to tax exemption and other favorable policy treatments), in actual operation they tend to behave more like for-profit facilities. Thus, our findings are consistent with patterns reported in previous literatures in developed countries showing a negative association of for-profit ownership with nursing home quality.^{31, 32} Besides case-mix differences, other plausible explanations may include private-sector facilities' disadvantages in funding and staffing,^{20, 33} their profit-seeking motives,³⁴ and the fact that they were less successful in creating a social support network for residents who do not have regular visits from family and friends (because government owned facilities are far more likely to enjoy social interactions with students, community residents, volunteers, and the media).^{20, 35}

To our knowledge, this study is the first of its kind to empirically assess the association between ownership and quality of care in a rapidly expanding sector of elder care facilities in urban China. Additional strengths of our study include comprehensive quality measures covering structure, process, and outcome components, and a rich set of controls for residents' demographic characteristics, case-mix, and payer sources. Our results also contribute to the gerontological research literature, most of which has been based in developed countries.

Some limitations of the current study should be noted. First, we used a cross-sectional study design, which prohibits making causal inferences on the relationship between ownership and quality of care. Another potential limitation is that the data for this study were aggregated at the facility level, potentially masking substantial heterogeneity among residents within facilities. Although we controlled for aggregated information on residents' age, case-mix, and payment status, unobserved selection of residents by the facilities may still contribute to the observed differential outcomes. In particular, we do not have an adequate age distribution per facility (only using the proportion of residents 60 years or older). Our dementia measure excluded individuals who were not demented but who had congenital mental retardation due to one or more factors genetically or birth induced. Even if we included a fuller set of risk-adjustment variables, the observed associations might be explained by residual confounding. Moreover, we used regional data from two cities only, thereby limiting the generalizability of our findings.

In sum, our study of elder care homes surveyed in Nanjing and Tianjin suggests that government owned facilities need to reconsider their admission policies and to focus on serving frail elders with the most need for publically subsidized institutional care. It is also of concern that the shift from government to the private sector in Chinese elder care market might compromise quality of care in those facilities. Future studies on quality of care can ideally utilize patient-level longitudinal data to minimize residual confounding. Meanwhile, future research should consider gathering nationwide data and account for the complex interactions between facility characteristics (such as resident case-mix and payer mix) and market factors, such as competition among providers and the local political and social environment.

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Table 1

Organization, Financing, Resident Characteristics, and Quality Measures of Elder Care Homes in Nanjing (in 2009) and Tianjin (in 2010), by Ownership

	Nanjing			Tianjin		
	Nongovernment Owned (<i>n</i> =79)	Government Owned (<i>n</i> =61)	P-value	Nongovernment Owned (<i>n</i> =137)	Government Owned (<i>n</i> =20)	P-value
Organization						
Year of Establishment $\geq$ 2000 (%)	86.1	32.8	0.00	92.3	7.7	0.00
Total Number of Beds: Mean ($\pm$ SD)	74.6 ($\pm$ 76.3)	81.0 ($\pm$ 94.4)	0.66	104.0 ($\pm$ 80.4)	149.8 ($\pm$ 107.5)	0.02
Occupancy Rate: Mean ($\pm$ SD)	69.2 ($\pm$ 27.1)	83.1 ($\pm$ 20.5)	0.00	76.5 ($\pm$ 21.1)	91.0 ($\pm$ 14.4)	0.00
Under Expansion (%)	26.0	19.0	0.23	18.3	25.0	0.47
Hospital Based (%)	16.5	6.6	0.06	6.6	10.0	0.57
Owned or Leased by Multi-Facility Organization (%)	7.6	8.2	0.57	16.1	0.0	0.05
Financing						
Sources of daily operating revenues (%)						
Government: Mean ($\pm$ SD)	2.4 ($\pm$ 4.1)	42.2 ($\pm$ 43.8)	0.00	1.9 ($\pm$ 5.8)	30.2 ($\pm$ 36.2)	0.00
Private pay: Mean ($\pm$ SD)	96.2 ($\pm$ 7.2)	56.9 ($\pm$ 44.5)	0.00	95.8 ($\pm$ 10.2)	66.1 ($\pm$ 39.7)	0.00
Other sources: Mean ($\pm$ SD)	1.5 ($\pm$ 5.8)	0.8 ($\pm$ 4.2)	0.49	2.1 ($\pm$ 8.4)	3.2 ($\pm$ 10.1)	0.58
Have Government Subsidies (%)	84.8	n.a.		75.9	n.a.	
Resident Characteristics						
<i>Demographics</i>						
Total # residents ($\pm$ SD)	44.4 ($\pm$ 49.5)	58.9 ($\pm$ 53.2)	0.10	71.2 ($\pm$ 48.6)	121.1 ($\pm$ 94.7)	0.00
% Aged 60+: Mean ($\pm$ SD)	94.7 ($\pm$ 12.7)	94.2 ($\pm$ 7.5)	0.79	91.3 ($\pm$ 9.8)	93.1 ($\pm$ 6.7)	0.42
% Female: Mean ($\pm$ SD)	60.0 ($\pm$ 17.4)	48.4 ($\pm$ 24.4)	0.00	50.9 ($\pm$ 11.3)	52.7 ($\pm$ 13.7)	0.53
<i>Payer Mix</i>						
% Self-pay: Mean ($\pm$ SD)	43.2 ($\pm$ 41.0)	25.0 ($\pm$ 37.0)	0.01	20.6 ($\pm$ 21.3)	17.1 ($\pm$ 18.6)	0.49
% Welfare recipients: Mean ($\pm$ SD)	2.8 ($\pm$ 5.6)	33.6 ($\pm$ 42.2)	0.00	4.4 ($\pm$ 7.8)	13.5 ($\pm$ 23.7)	0.00
% Pensioners: Mean ($\pm$ SD)	69.6 ($\pm$ 32.2)	50.0 ($\pm$ 42.8)	0.00	74.1 ($\pm$ 22.7)	70.0 ($\pm$ 25.4)	0.47
<i>Case Mix</i>						
% With dementia: Mean ($\pm$ SD)	25.2 ($\pm$ 24.7)	20.7 ($\pm$ 28.7)	0.32	23.8 ($\pm$ 25.1)	21.6 ($\pm$ 24.6)	0.72
% Needing assistance with eating: Mean ($\pm$ SD)	22.9 ($\pm$ 22.9)	12.3 ($\pm$ 22.6)	0.00	26.9 ($\pm$ 22.8)	18.4 ($\pm$ 16.7)	0.11

	Nanjing			Tianjin		
	Nongovernment Owned (n=79)	Government Owned (n=61)	P-value	Nongovernment Owned (n=137)	Government Owned (n=20)	P-value
% Needing assistance with dressing: Mean ($\pm$ SD) *	52.8 ($\pm$ 31.5)	22.8 ($\pm$ 29.7)	0.00	58.3 ($\pm$ 25.3)	50.6 ($\pm$ 33.3)	0.23
% Needing assistance with walking: Mean ($\pm$ SD) *	52.0 ($\pm$ 31.5)	25.7 ($\pm$ 27.0)	0.00	58.9 ($\pm$ 24.9)	47.6 ($\pm$ 29.1)	0.06
% Incontinence (bladder): Mean ($\pm$ SD)	31.4 ($\pm$ 29.2)	22.2 ($\pm$ 30.6)	0.07	29.6 ($\pm$ 23.7)	25.8 ($\pm$ 23.7)	0.50
% Incontinence (bowel): Mean ($\pm$ SD)	25.9 ($\pm$ 27.1)	14.1 ($\pm$ 24.1)	0.01	29.2 ($\pm$ 24.1)	23.0 ($\pm$ 23.8)	0.28
Case-mix Z-score Index (6 item): Mean ($\pm$ SD) **	1.4 ($\pm$ 4.6)	-1.8 ($\pm$ 5.0)	0.00	0.2 ($\pm$ 4.8)	-1.4 ($\pm$ 5.1)	0.16
Structure Measures: Staffing						
<i>Direct-Care Staff</i>						
# Staff per 100 residents *100: Mean ($\pm$ SD)	20.6 ($\pm$ 11.2)	14.8 ($\pm$ 8.5)	0.00	16.2 ($\pm$ 5.7)	18.7 ($\pm$ 7.0)	0.08
% Middle school or higher education: Mean ($\pm$ SD)	42.3 ($\pm$ 36.9)	61.8 ($\pm$ 38.3)	0.00	93.8 ($\pm$ 8.9)	96.2 ($\pm$ 8.9)	0.63
% Migratory workers: Mean ($\pm$ SD)	68.4 ($\pm$ 38.9)	37.7 ($\pm$ 42.5)	0.00	12.6 ($\pm$ 22.8)	4.0 ($\pm$ 9.8)	0.10
Under-staffed relative to levels of care needs (case-mix Z-score) (%)	20.3	8.2	0.00	24.8	5.0	0.00
<i>Nurses and MDs</i>						
Any professional nurse (%)	30.4	27.9	0.75	31.4	45.0	0.23
Any physician (%)	34.2	26.2	0.31	35.8	50.0	0.22
Process and Outcome Measures						
% Physically restrained: Mean ($\pm$ SD)	8.5 ($\pm$ 18.2)	6.2 ($\pm$ 17.2)	0.44	4.7 ($\pm$ 9.2)	9.4 ($\pm$ 19.6)	0.08
% Tube fed: Mean ($\pm$ SD)	2.4 ($\pm$ 8.1)	1.4 ($\pm$ 4.9)	0.41	3.2 ($\pm$ 5.8)	0.9 ($\pm$ 2.2)	0.08
% Receiving tranquilizers: Mean ($\pm$ SD)	2.6 ($\pm$ 5.7)	1.7 ($\pm$ 4.0)	0.26	2.4 ($\pm$ 5.0)	1.9 ($\pm$ 3.1)	0.32
% With pressure ulcers: Mean ($\pm$ SD)	1.3 ($\pm$ 3.6)	0.6 ($\pm$ 2.1)	0.19	0.4 ($\pm$ 1.1)	0.1 ($\pm$ 0.3)	0.34

* Includes partially dependent (semi-independent) and totally dependent residents.

** This index is a sum of standard scores of 6 case-mix characteristics. A standard score is calculated by (individual value – mean)/standard deviation, indicating how many standard deviations an observation or datum is above or below the mean. The higher Z-score index of a facility means the worse health condition of residents in that facility. (For detailed description, please refer to the main measures/variables section.)

SD = Standard Deviation.

Notes: For continuous measures, p-value comes from T-test; for binary measures, p-value comes from Chi-square test.

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Table 2

Staffing to Resident Ratio vs. Case-mix Index, Nanjing

Government Owned (n=61)		Case-mix Z-score Index (quartile)				
		0%–25%	25%–50%	50%–75%	75%–100%	
Staffing level (quartile)	75%–100%	3	0	3	3	
	50%–75%	1	5	3	2	
	25%–50%	2	6	1	2	
	0%–25%	19	4	2	0	

Non-Government Owned (n=79)		Case-mix Z-score Index (quartile)				
		0%–25%	25%–50%	50%–75%	75%–100%	
Staffing level (quartile)	75%–100%	4	5	5	11	
	50%–75%	1	7	9	8	
	25%–50%	3	3	7	5	
	0%–25%	2	3	2	2	

Notes: We ranked all facilities in quartiles, separately by staffing level (i.e., ratio of direct-care staff to residents) and by the summary case-mix index. Based on these two sets of quartile ranks, we divided all facilities in each city into 16 groups. We designated homes in the two lower quartiles of the staffing level distribution while in the two upper quartiles of the case-mix Z-score distribution as susceptible to providing the worst quality of care.

Table 3

Staffing to Resident Ratio vs. Case-mix Index, Tianjin

Government Owned (n=20)		Case-mix Z-score Index (quartile)				
		0%–25%	25%–50%	50%–75%	75%–100%	
Staffing level (quartile)	75%–100%	2	1	1	3	
	50%–75%	2	1	3	0	
	25%–50%	0	1	1	0	
	0%–25%	5	0	0	0	

Non-Government Owned (n=137)		Case-mix Z-score Index (quartile)				
		0%–25%	25%–50%	50%–75%	75%–100%	
Staffing level (quartile)	75%–100%	4	10	7	8	
	50%–75%	5	10	11	10	
	25%–50%	10	8	7	9	
	0%–25%	11	9	8	10	

Notes: We ranked all facilities in quartiles, separately by staffing level (i.e., ratio of direct-care staff to residents) and by the summary case-mix index. Based on these two sets of quartile ranks, we divided all facilities in each city into 16 groups. We designated homes in the two lower quartiles of the staffing level distribution while in the two upper quartiles of the case-mix Z-score distribution as susceptible to providing the worst quality of care.

Table 4

Negative Binomial Regression Results: Process and Outcome Quality Measures in Nanjing and Tianjin, by Ownership (Reference Group: Nongovernment Owned)

	Nanjing				Tianjin			
	Model 1		Model 2		Model 1		Model 2	
	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI
Pressure Ulcers	0.49	0.19 1.23	0.70	0.29 1.70	0.36	0.07 1.93	0.25	0.04 1.60
Tube Feeding Placement	0.57	0.22 1.48	0.76	0.28 2.05	0.29**	0.12 0.73	0.46 ⁺	0.19 1.12
Physical Restraints Use	0.72	0.31 1.65	1.17	0.52 2.64	1.97	0.64 6.02	1.92	0.61 5.93
Psychoactive Drug Use	0.61	0.31 1.21	0.73	0.35 1.52	0.83	0.31 2.24	0.91	0.34 2.46

Notes: Model 1 is the unadjusted regression model including ownership as the only variable; Model 2 further adjusts for age, case-mix Z-score index, and payment status (including “% of residents who get reimbursement from previous work unit”, “% of residents paying out of pocket”, and “% of residents who are welfare recipients”).

⁺ P<0.10;

* P<0.05;

** P<0.01.