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Extent of and factors associated with pain among older residents in nursing homes in South Korea: A nationwide survey study

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Introduction

Pain, often called the fifth vital sign, is an indicator of quality of care and quality of life.1–3 Pain among older nursing home residents is prevalent, but it is often underreported and untreated.3–5 This is because pain is a subjective experience, and older nursing home residents are likely to have challenges in reporting their pain to caregivers properly due to decreases in cognitive and/or communication function.4 Besides individual factors, organizational factors, such as a lack of care workers with the relevant skill levels and skill-mix, can be barriers for appropriate pain management in nursing homes.6,7 Uncontrolled pain has negative impacts on older residents’ daily activities and participation in social activities.5

The prevalence of pain and its management among nursing home residents have been actively studied in North American and European countries with longer histories of formal institutional long-term care. Although the prevalence of pain among nursing home residents varies across studies, a recent large European study reported that approximately half of residents in nursing homes experienced pain, and one-quarter of those with pain did not have any pain medication.2,8 Another study also reported that approximately 48% of residents suffered from pain, and many suffered from high pain intensities.9 In the USA and Canada, the proportion of residents with pain is used as a quality indicator of nursing homes, and is monitored regularly using standardized resident assessment tools.10

Korea, an East Asian country, is one of the most rapidly aging countries in the world. It took just 18 years for the population aged ≥65 years to transition from 7% to 14% in Korea compared with 69 years in the USA and 115 years in France.11 The introduction of a public long-term care insurance (LTCl) in July 2008 was a major policy reform to respond to rapid population aging;
this reform has opened a new era in the provision of formal long-term care services in the country. Approximately one-tenth of older people are currently eligible for the public LTCI, which is expected to increase. Nursing homes in Korea are characterized by the provision of a room and board, and 24-h ADL support for the physically and cognitively impaired, with limited medical or rehabilitation services. Details on the long-term care systems in Korea have been written about elsewhere. The number of nursing homes in Korea rapidly increased from 693 in 2008 to 5304 in 2017, and 34.6% of LTCI beneficiaries with relatively high care needs resided in nursing homes in 2017. Although the expansion of access to institutional long-term care was a focus of the early stages of the LTCI policy implementation, the quality of care provided and quality of life of older residents received more attention. Facility-level quality monitoring programs operated by the National Health Insurance System, the single public insurer, were introduced in 2009 and use a wide range of quality indicators, although pain is not an officially monitored indicator yet.

The purpose of the present study was to examine the prevalence and characteristics of pain, and also the resident and organizational factors associated with pain among nursing home residents in Korea using a nationwide survey including standardized functional assessment tools used in other studies. In particular, the relationship between nursing staffing and pain is the key interest of this study, as we have not found any published studies that have examined this relationship with a nationally representative nursing home sample in Korea, although the important role of nursing staff in pain management has been reported in existing studies in other countries.

Methods

Databases and study population

The present study was a secondary analysis of a large national survey in Korea in 2013. A nationally representative sample of nursing homes was selected by a two-stage stratified random sampling method using geographic region and facility size as strata. Random sampling of 20% of older residents in each nursing home was then carried out using the resident roster. Nursing homes that were newly opened within 1 year and/or had a number of beds of up to nine were excluded. The final sample consisted of 1444 residents aged ≥65 years in 91 nursing homes; residents who had stayed at the nursing home <30 days or who had not answered regarding their pain were excluded. This study was approved by the institutional review board of the institution with which the corresponding author is affiliated.

Instruments and procedure

The interRAI long-term care facility (LTCF), a comprehensive geriatric assessment system, was used in the present study. The interRAI LTCF can measure the multidimensional functional status of older adults, including activities of daily living (ADL), comorbidities and services provided. The Korean version of the interRAI LTCF was developed through a translation and back-translation procedure, and a psychometric test was carried out. The function of older residents including pain was assessed by staff nurses who provided care to these residents after attending a training session provided by the research team. For pain assessment, the assessors were told to review residents’ records, and/or consult relevant other staff, as well as to interview and observe residents directly based on standardized assessment protocols. Institutional-level variables including the number of beds and staffing level were collected from nursing home administrators.

Variables

Pain of nursing home residents

The pain of the residents was assessed in several different ways, including frequency, intensity, severity and consistency of pain. These pain characteristics were measured on a 4-point scale, as shown in Table 1, and residents were identified as having pain if they answered, at a minimum, the pain was “present but not in last 3 days” in the pain frequency question. Pain intensity was measured and categorized into four groups, with higher scores meaning greater pain. Pain severity was measured with the pain severity scale in the interRAI LTCF, which combines pain frequency and intensity to assess severity, categorized into four groups: (i) no pain; (ii) less than daily pain; (iii) daily pain, but not severe; and (iv) daily severe pain. Consistency of pain was measured and categorized into four groups: (i) no pain; (ii) single episode; (iii) intermittent; and (iv) constant pain.

Characteristics of nursing home residents

The general characteristics of nursing homes in our analysis included size, sex, being a Medical Aid beneficiary (yes/no) and marital status (yes/no). The care needs of the residents were assessed using the interRAI scales for depressive symptoms, cognitive function and ADL. The score for depressive symptoms, measured with the depressive rating scale, ranges from 0 to 14, with higher numbers meaning more depressive symptoms. Cognitive function also ranges from 0 to 6, with higher scores meaning more severe impairment. The score for the ADL hierarchy scale ranges from 0, which means no limitations, to 6, which means total dependence. The case-mix for the residents was assessed with resource utilization groups (RUG); originally, residents were divided into seven groups according to their RUG, and we re-categorized six groups into four groups for the stability of the analytic model.

Nursing home characteristics

The general characteristics of nursing homes in our analysis included size (small 10–29 beds, medium 30–99 beds, large ≥100 beds), ownership (private or public), year of foundation (before July 2008, which means it was established before the LTCI was introduced, or after July 2008) and location of the nursing homes (rural or urban). Regarding nursing staffing, we included skill-mix and nursing staffing levels. The Korean Elderly Welfare Act 22 requires nursing homes to hire one nursing staff per 25 residents (although nursing homes with <30 beds are permitted to have only 1 nursing staff total), and one personal care assistant (PCA) per 2.5 residents. The act allows nursing homes to hire either a registered nurse (RN) or nurse aid (NA) to meet the nursing staffing standard. Based on the standards, two binary variables for staffing standard – meeting the nursing staffing standard and meeting the PCA staffing standard – were calculated. The nursing skill-mix variable was calculated by dividing the number of RN and NA by the total number of staff (RN, NA and PCA).

Statistical analysis

Descriptive analysis was carried out using χ²-tests and analysis of variance to summarize the pain characteristics, as well as the resident and nursing home characteristics of the sample. Multivariate
Table 1  Characteristics of residents and nursing homes

| Resident characteristics | n (mean) | % (SD) |
|--------------------------|---------|-------|
| **Total**                | 1444    | 100   |
| **Sex**                  |         |       |
| Male                     | 324     | 22.44 |
| Female                   | 1120    | 77.56 |
| **Age (years)**          |         |       |
| 65–74                    | 220     | 15.24 |
| 75–84                    | 612     | 42.38 |
| ≥85                      | 612     | 42.38 |
| **Medical Aid beneficiary** | 1068  | 73.96 |
| Yes                      | 376     | 26.04 |
| **Marital status**       |         |       |
| Married                  | 272     | 18.84 |
| No partner               | 1172    | 81.16 |
| **CHF**                  |         |       |
| Yes                      | 46      | 3.19  |
| **Stroke**               |         |       |
| Yes                      | 411     | 28.46 |
| **Diabetes**             |         |       |
| Yes                      | 235     | 16.27 |
| **Dementia**             |         |       |
| Yes                      | 869     | 60.18 |
| **RUG**                  |         |       |
| 1 Rehabilitation        | 288     | 19.94 |
| 2 Extensive care         | 19      | 1.32  |
| 3 Special care           | 43      | 2.98  |
| 4 Clinically complex     | 164     | 11.36 |
| 5 Cognitive impairment   | 137     | 9.49  |
| 6 Behavior problems      | 67      | 4.64  |
| 7 Reduced physical function | 726  | 50.28 |
| **Depressive symptoms**  |         |       |
| 0–14 range               | 2.64    | 2.84  |
| **Cognitive function**   |         |       |
| 0–6 range                | 3.08    | 1.7   |
| **Activities of daily living** | 3.65 | 1.91 |
| **Pain**                 |         |       |
| Frequency of pain        |         |       |
| 0 – No pain              | 912     | 63.16 |
| 1 – Pain present, but not in the past 3 days | 245 | 16.97 |
| 2 – Pain present on 1–2 of the past 3 days | 167 | 11.57 |
| 3 – Pain present daily in the past 3 days | 120 | 8.31 |
| Intensity of pain        |         |       |
| 0 – No pain              | 922     | 63.85 |
| 1 – Mild pain            | 296     | 20.5  |
| 2 – Moderate pain        | 186     | 12.88 |
| 3 – Horrible or excruciating | 40   | 2.77  |
| Severity of pain (pain scale) |       |       |
| 0 – No pain              | 912     | 63.16 |
| 1 – Less than daily pain | 412     | 28.53 |
| 2 – Daily pain but not severe | 93   | 6.44  |
| 3 – Daily severe pain    | 27      | 1.87  |
| Consistency of pain      |         |       |
| 0 – No pain              | 936     | 64.64 |
| 1 – Single episode (in last 3 days) | 81 | 5.59  |
| 2 – Intermittent         | 340     | 23.55 |
| 3 – Constant             | 87      | 6.02  |

| Nursing home characteristics | n (mean) | % (SD) |
|------------------------------|---------|-------|
| **Total**                    | 91      | 100   |
| Size                         |         |       |
| Small                        | 35      | 38.46 |
| Medium                       | 43      | 47.25 |
| Large                        | 13      | 14.29 |
| Type of foundation           |         |       |
| Public                       | 6       | 6.59  |
| Private                      | 85      | 93.41 |
| Year of foundation           |         |       |
| Before 1 July 2008           | 42      | 46.15 |
| After 2008.07.01             | 49      | 53.85 |
| Region                       |         |       |
| Urban                        | 47      | 51.65 |
| Rural                        | 44      | 48.35 |
| Nursing staff ratio          |         |       |
| RN + NA/RN + NA + PCA        | 11.4    | 4.24  |
| Meeting nursing staffing standard | 77    | 84.62 |

(Continued)
multilevel analysis was carried out to examine the resident and nursing home factors associated with severity and consistency of pain among older residents. All statistical analyses were carried out using SAS version 9.4 (SAS Institute, Cary, NC, USA).

Results

General characteristics of residents and nursing homes
General characteristics of the residents and the nursing homes are shown in Table 1. The majority of residents were women (77.6%) and aged ≥75 years (84.8%). Approximately 26.0% of the residents were Medical Aid beneficiaries. Dementia was the most prevalent chronic condition (60.2%). In terms of the RUG, approximately half (50.3%) of the residents were in the “reduced physical function” group, and those belonging to “extensive care” or “special care” were <5%. The mean depression score of the residents was 2.64, where a score of <2 indicates a low risk of depression, and >3 indicates a high risk of depression. They had moderate or severe cognitive impairment (score 3.08), and required extensive assistance for daily living (score 3.65). As for pain prevalence, approximately 36.8% of the residents had pain in the past 3 days. For pain severity and consistency, approximately 8.31% of the residents had daily pain, either not severe or severe, and 6.02% had constant pain.

As for nursing home characteristics, the majority were medium sized (47.3%), followed by small homes (38.5%). Most of the nursing homes were private (93.4%), and approximately half (53.9%) of the homes were established after 2008, when the LTCI was introduced. The average nursing staffing mix (RN and NA vs total ratio) was 11.4. The majority of nursing homes (84.6%) met the nursing (RN and NA) staffing standard level, and 37.4% of homes met the PCA standard level.

Presence of pain by general characteristics of residents and nursing homes
Pain prevalence by resident and nursing home characteristic is presented in Table 2. Pain experience was significantly higher for those who were female, older, married or had Medical Aid. There was no significant difference in pain experience according to comorbid diseases, except for dementia; those with dementia had less pain ($P = 0.0025$) than those without dementia. Pain experience was positively associated with depressive symptoms and negatively associated with cognitive function ($P < 0.0001$). Pain experience was also significantly different by nursing home size and location. Residents in large nursing homes ($P = 0.006$) and those in homes located in an urban area ($P < 0.0001$) were more likely to have pain. Residents in nursing homes that met the PCA staffing standard were more likely to have pain ($P = 0.0057$).

Multivariate, multilevel logistic regressions
Finally, we examined the factors associated with residents’ experience of the severity and consistency of pain using multivariate, multilevel analyses (Table 3). Regarding pain severity, the cognitively impaired and behavioral problems groups (RUG 5 & 6) were less likely to experience daily or daily severe pain ($O R = 0.432, P = 0.045$). Depressive symptoms ($O R = 1.233, P < 0.0001$) and limitations in ADL ($O R = 1.161, P = 0.037$) were positively associated with the likelihood of having severe pain. Among institutional factors, meeting the nursing staffing standard was significantly negatively associated with the residents’ likelihood of having severe pain ($O R = 0.514, P = 0.049$).

In terms of pain consistency, depressive symptoms and cognitive function were contributing resident factors. People with depressive symptoms tended to have constant pain ($O R = 1.206, P = 0.0001$), and residents with impaired cognitive function were less likely to experience constant pain ($O R = 0.732, P = 0.001$). As for nursing home factors, residents in the nursing homes that were more recently established (after the introduction of the LTCI) had a higher possibility of having constant pain ($O R = 2.228, P = 0.011$). In contrast, meeting the nursing staffing standard was negatively associated with consistency of pain ($O R = 0.420, P = 0.024$).

Discussion
This is the most comprehensive study on pain assessment in long-term care facilities in Korea using a representative sample so far. Pain is one of the most important quality of life indicators, and more than one-third (36.7%) of nursing home residents in Korea experienced pain to some degree.9 This study found the prevalence of pain among nursing home residents in Korea to be 36.8% ($P = 0.049$) higher than those in other European countries was 48.4% (ranging from 19.8% [Israel] to 73% [Finland]) using the same interRAI LTCF instrument.8 The somewhat lower prevalence of pain in Korean nursing homes could be because nursing homes under the LTCI law 13 are social welfare institutions with limited healthcare services, unlike nursing homes in other countries, such as the USA and Japan.15,16 Thus, older people with higher medical needs who are more likely to have frequent and severe pain would not reside in nursing homes.

Regarding individual factors, depressive symptoms, cognitive function, and ADL had significant relationships with the severity and consistency of pain. Residents with greater depressive symptoms reported a greater severity and consistency of pain. Similar results were found in a previous study.9 This finding supports the idea that residents with depressive symptoms are a high-risk group for pain assessment and management. The relationship between depression and pain should be examined further. The reverse relationship between cognitive function and severity of pain was also consistent with the results of existing studies.8 This finding suggests potential under-assessment and reporting issues in pain management among the cognitively impaired group, for which...
further studies are necessary. Severe pain can reduce daily activities and quality of life.23,24 This finding provides specific characteristics of residents who are vulnerable to pain. To avoid reducing ADL and quality of life for these vulnerable groups, better staff training and policies promoting pain management are important and required in nursing homes in Korea.

Regarding institutional factors, meeting the nursing staffing standard was related to a lower likelihood of both the severity and consistency of pain. Unlike nursing homes in many Western countries, nursing homes in Korea are mainly social care organizations whose main service is to provide daily living assistance.16 Korean dependent older patients with medical need are cared for in either acute care hospitals or long-term care hospitals.16 For this reason, the staffing requirements of nursing homes by law are different from those of other countries. The workforce of nursing homes mainly consists of personal care assistants.14 Specifically,

Table 2  Presence of pain by general characteristics of residents and nursing homes

| Resident characteristics | Total |
|--------------------------|-------|
|                          | n (mean) | % (SD) | n (mean) | % (SD) | n (mean) | % (SD) | P-value |
| Sex | Male | 324 | 22.44 | 231 | 71.3 | 93 | 28.7 | 0.0006 |
|      | Female | 1120 | 77.56 | 681 | 60.8 | 439 | 39.2 |
| Age (years) | 65–74 | 220 | 15.24 | 161 | 73.18 | 59 | 26.82 | 0.0005 |
|      | 75–84 | 612 | 42.38 | 392 | 64.05 | 220 | 35.95 |
|      | ≥85 | 612 | 42.38 | 359 | 58.66 | 253 | 41.34 |
| Medical Aid beneficiary | No | 1068 | 73.96 | 697 | 65.26 | 371 | 34.74 | 0.0052 |
|      | Yes | 376 | 26.04 | 215 | 57.18 | 161 | 42.82 |
| Marital status | Married | 272 | 18.84 | 715 | 61.01 | 457 | 38.99 | 0.0004 |
|      | No partner | 1172 | 81.16 | 197 | 72.43 | 75 | 27.57 |
| CHF | No | 1398 | 96.81 | 889 | 65.39 | 509 | 36.41 | 0.0601 |
|      | Yes | 46 | 3.19 | 23 | 50.0 | 23 | 50.0 |
| Stroke | No | 1033 | 71.54 | 662 | 64.09 | 371 | 35.91 | 0.2468 |
|      | Yes | 164 | 11.36 | 250 | 60.83 | 161 | 39.17 |
| Diabetes | No | 1209 | 83.73 | 766 | 63.36 | 443 | 36.64 | 0.7205 |
|      | Yes | 235 | 16.27 | 146 | 62.13 | 89 | 37.87 |
| Dementia | No | 575 | 39.82 | 336 | 58.43 | 239 | 41.57 | 0.0025 |
|      | Yes | 869 | 60.18 | 576 | 68.28 | 293 | 32.72 |
| RUG 1† | 11.4 | 2.84 | 2.3 | 2.58 | 2.5 | 2.94 | <0.0001 |
| RUG 2, 3, 4 | 3.08 | 1.70 | 3.25 | 1.73 | 2.80 | 1.61 | <0.0001 |
| RUG 5, 6 | 3.65 | 1.91 | 3.64 | 1.93 | 3.62 | 1.88 | 0.6613 |
| RUG 7 | 91 | 100 | 912 | 63.16 | 532 | 36.85 |
| Depressive symptoms 0–6 range | 2.64 | 2.84 | 2.03 | 2.58 | 2.94 | <0.0001 |
| Cognitive function 0–5 range | 3.08 | 1.70 | 3.25 | 1.73 | 2.80 | 1.61 | <0.0001 |
| Activities of daily living 0–5 range | 3.72 | 1.92 | 3.63 | 1.93 | 3.62 | 1.88 | 0.6613 |
| Nursing home characteristics | Total | 91 | 100 | 912 | 63.16 | 532 | 36.85 |
| Size‡ | Small | 35 | 36.46 | 250 | 67.15 | 119 | 32.25 | 0.004 |
|      | Medium | 43 | 47.25 | 437 | 64.26 | 243 | 35.74 |
|      | Large | 13 | 14.29 | 225 | 56.96 | 170 | 43.04 |
| Type of foundation | Public | 6 | 6.59 | 39 | 55.71 | 31 | 44.29 | 0.1857 |
|      | Private | 85 | 93.41 | 873 | 63.54 | 501 | 36.46 |
| Year of foundation | Before 1 July 2008 | 42 | 46.15 | 504 | 61.69 | 313 | 38.31 | 0.1866 |
|      | After 1 July 2008 | 49 | 53.85 | 408 | 65.07 | 219 | 34.93 |
| Region | Urban | 47 | 51.65 | 427 | 56.86 | 324 | 43.14 | <0.0001 |
|      | Rural | 44 | 48.35 | 485 | 69.99 | 208 | 30.01 |
| Nursing staff ratio | RN + NA/RN + NA + PCA | 11.4 | 4.24 | 11.18 | 3.81 | 11.25 | 3.19 | 0.7378 |
| Meeting nursing staffing standard | Yes | 77 | 84.62 | 760 | 62.76 | 451 | 37.24 | 0.0472 |
|      | No | 14 | 15.38 | 152 | 65.24 | 81 | 34.76 |
| Meeting PCA staffing level standard | Yes | 34 | 37.36 | 249 | 57.77 | 182 | 42.23 | 0.0057 |
|      | No | 57 | 62.64 | 663 | 65.45 | 350 | 34.55 |

†Resource utilization group (RUG) categories: 1, rehabilitation; 2, extensive care, special care, clinically complex; 3, cognitive impairment, behavioral problems; and 4, reduced physical function.‡Nursing home size by bed number: small (10–29), medium (30–99) and large (≥100). CHF, congestive heart failure; NA, nurse aid; PCA, personal care assistant; RN, registered nurse.
nursing homes in Korea are required to hire just one nursing staff member (either RN or NA) per 25 residents, and one PCA per 2.5 residents according to the Elderly Welfare Act. Despite the low nursing staffing standard under the policy, nursing staff (meeting the nursing staffing standard) was significantly associated with the severity and consistency of pain, which can support the importance of enacting and implementing this nurse staffing standard. Several countries have adopted staffing standards for nursing homes. For example, the USA federal staffing standards for all certified nursing homes require one RN for one shift (8 consecutive hours), 7 days a week. For the two remaining shifts, one RN and one licensed nurse (either an RN or a licensed vocational nurse/licensed practical nurse) are required. Several states in the USA who they have taken care of in the homes to ensure quality pain management. There were potential measurement errors in assessing the pain of highly frail older nursing home residents, which might be a limitation of the present study. However, the interRAI LTCF is the most widely tested and used tools specializing in assessing such a vulnerable population. Nurses with training assessed the residents per patient day. The staffing standards of all countries focus on providing sufficient staff with qualifications to meet residents’ care needs. Excessive demands on nursing care (e.g. inadequate nurse staffing) increase the workload and adversely affect performance. Thus, proper levels of nursing staff and meeting staffing standard are important to reduce the severity and consistency of pain. As a rapidly aging country, the expansion of long-term care services and facilities, including nursing homes, is unavoidable in Korea. Quality of care and quality of life for nursing home residents continue to be important outcomes. Pain management is one of them. In the present study, we examined the prevalence of pain, and assessed the characteristics of pain, and significant individual and institutional (nursing home) factors associated with

| Resident characteristics | Having severe pain (yes = 1) | Having consistent pain (yes = 1) |
|--------------------------|-----------------------------|---------------------------------|
|                          | OR  | CI            | P-value | OR  | CI            | P-value |
| Sex                      |     |               |         |     |               |         |
| Male                     | 1.706 | 0.939 | 3.100 | 0.080 | 0.904 | 0.492 | 1.660 | 0.744 |
| Female                   |     |               |         |     |               |         |
| Age (years)              |     |               |         |     |               |         |
| 65–74                    | 1.34 | 0.666 | 2.697 | 0.413 | 2.098 | 0.871 | 5.054 | 0.099 |
| 75–84                    | 1.412 | 0.69 | 2.889 | 0.346 | 2.084 | 0.846 | 5.130 | 0.110 |
| ≥85 years                |     |               |         |     |               |         |
| Medical Aid beneficiary  |     |               |         |     |               |         |
| No                       | 1.277 | 0.806 | 2.022 | 0.297 | 1.280 | 0.744 | 2.202 | 0.373 |
| Yes                      |     |               |         |     |               |         |
| Marital status           |     |               |         |     |               |         |
| Married                  | 1.087 | 0.578 | 2.043 | 0.796 | 1.111 | 0.536 | 2.303 | 0.776 |
| Unmarried                |     |               |         |     |               |         |
| Case mix (RUG)           |     |               |         |     |               |         |
| 1                        | 0.899 | 0.467 | 1.731 | 0.749 | 0.817 | 0.355 | 1.881 | 0.635 |
| 2, 3, 4                  |     |               |         |     |               |         |
| 5, 6                     | 0.432 | 0.19 | 0.983 | 0.045 | 0.893 | 0.356 | 2.242 | 0.810 |
| 7                        | 0.649 | 0.378 | 1.115 | 0.118 | 1.022 | 0.507 | 2.061 | 0.951 |
| Depressive symptoms      |     |               |         |     |               |         |
| 0–14 range               | 1.233 | 1.159 | 1.312 | <0.0001 | 1.206 | 1.123 | 1.295 | <0.0001 |
| Cognitive function       |     |               |         |     |               |         |
| 0–6 range                | 0.872 | 0.754 | 1.008 | 0.065 | 0.732 | 0.610 | 0.878 | 0.001 |
| Activities of daily living |     |               |         |     |               |         |
| 0–6 range                | 1.161 | 1.009 | 1.337 | 0.037 | 1.053 | 0.907 | 1.222 | 0.501 |
| Nursing home characteristics |     |               |         |     |               |         |
| Size‡                    |     |               |         |     |               |         |
| Small                    | 1.095 | 0.588 | 2.037 | 0.776 | 1.324 | 0.666 | 2.633 | 0.424 |
| Medium                   | 1.113 | 0.527 | 2.353 | 0.779 | 0.596 | 0.25 | 1.419 | 0.242 |
| Large                    |     |               |         |     |               |         |
| Type of foundation       |     |               |         |     |               |         |
| Public                   | 1.236 | 0.448 | 3.412 | 0.683 | 1.084 | 0.368 | 3.195 | 0.884 |
| Private                  |     |               |         |     |               |         |
| Year of foundation       |     |               |         |     |               |         |
| Before 1 July 2008       | 1.256 | 0.723 | 2.182 | 0.418 | 2.228 | 1.204 | 4.125 | 0.011 |
| After 1 July 2008        |     |               |         |     |               |         |
| Region                   |     |               |         |     |               |         |
| Rural                    | 0.703 | 0.438 | 1.128 | 0.144 | 0.713 | 0.420 | 1.209 | 0.210 |
| Urban                    |     |               |         |     |               |         |
| Nursing staff ratio      |     |               |         |     |               |         |
| RN + NA/RN + NA + PCA   | 0.980 | 0.908 | 1.057 | 0.597 | 1.068 | 1.000 | 1.141 | 0.051 |
| Nursing staff level      |     |               |         |     |               |         |
| RN + NA level            |     |               |         |     |               |         |
| Meeting the standard     | 0.514 | 0.265 | 0.996 | 0.049 | 0.420 | 0.197 | 0.893 | 0.024 |
| PCA level                |     |               |         |     |               |         |
| Meeting the standard     | 1.484 | 0.856 | 2.572 | 0.160 | 1.233 | 0.668 | 2.277 | 0.503 |
| Fit statistics           |     |               |         |     |               |         |
| −2 Res log pseudo-likelihood | 8101.23 |           | 8704.30 |     |               |         |
| Generalized χ²           | 1196.93 |           | 1170.67 |     |               |         |

Total n = 1444. †Resource utilization group (RUG) categories: 1, rehabilitation; 2, extensive care, special care, clinically complex; 3, cognitive impairment, behavioral problems; and 4, reduced physical function. ‡Nursing home size by bed number: small (10–29), medium (30–99) and large (≥100). NA, nurse aid; PCA, personal care assistant; RN, registered nurses.
pain management. These findings provide insight into the population whose pain we should carefully assess and manage, and suggest managerial strategies to improve pain management; that is, meeting standards for nursing staff. For future studies, other quality of life outcomes and associated factors should also be examined in nursing home settings.

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**Disclosure statement**

The authors declare no conflict of interest.

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