Feature Article

The effect of registered nurses on nursing home residents' outcomes, controlling for organizational and health care market factors☆

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ABSTRACT

Despite cumulative and integrative evidence of registered nurse (RN) staffing on nursing home residents' outcomes worldwide, few studies integrate the effects of residents' case mix, healthcare markets, and nurse staffing on psychotropic-medication use and weight loss in Korea. This article examined the relationship between nurse staffing and residents' quality-of-care outcomes, controlling for long-term healthcare market characteristics in Korea. Using a multilevel cross-sectional design, a disproportionate stratified random sampling was used. Of 87 nursing homes contacted, 60 agreed to participate. Weighted linear regression was used to test the hypotheses. RN hours per resident day (HPRD) had a statistically significant positive impact on reducing the number of residents with psychotropic medication ($ß = -.331$, $p = .008$). Greater RN HPRD positively marginally related to fewer residents with cognitive impairment ($ß = -0.201$, $p = .139$). Higher turnover of RN staff related to decreased proportions of residents with weight loss ($ß = -.331$ $p = .008$). Policymakers should cautiously consider requiring mandatory nurse staffing in nursing homes in Korea, where it is still acceptable to have certified nurse aids as substitutes for RNs.

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Universal care through long-term-care (LTC) social insurance in Korea was legally introduced in 2008; considerably later than in other developed countries. The major recipients of LTC social insurance are elders who are over 65 or those with geriatric disease (Kim, 2016). Funding sources consist of mandatory insurance fees from citizens, about 20% copayment by long-term-care recipients, and regional or national governments.[1,2] After enactment, the number of nursing homes has increased about 235%.[2] Although LTC is a social form of insurance in Korea, each nursing home has free competition; that is, recipients of LTC insurance or family members can freely choose their nursing home. The legal introduction of social insurance in 2008 made it possible for for-profit nursing homes to enter the LTC market.[3] The major problem in the LTC market in Korea is that the revenue of the owner is an important factor in LTC insurance, deteriorating sound competition and quality of care of residents among nursing homes and reducing optimal care.[1,4] The public corporation covers about 88% of nursing home costs, and competition among nursing homes has been become intense because the number of investor-owned nursing homes is increasing (comprising 40% of total nursing homes in Korea; 54.6% privately owned, 42% corporate-based, and 3.5% government-run nursing homes; [3,5,6]).

Scientific research supported the contribution and importance of registered nurses (RNs) in nursing homes; however, nursing homes employ more certified nurse aids (CNAs) than RNs to reduce costs and because of a shortage of RNs in LTC settings or rural areas in Korea.[7] In Korea, nursing homes have no legal requirement to hire RNs, permitting them to hire CNAs instead.[8]

Also, in Korea, RNs are concentrated in metropolitan areas, whereas nursing homes in rural and fishing villages are more likely to have CNAs.[5] The variation in RN staffing deviates dramatically, often by 10 times according to size, type of ownership, or location of the nursing home.[9] Only 2.9% of total nursing homes in Korea hire staff above the proposed legal staff requirement, despite staffing incentives, because it is very hard to recruit professional staff in LTC settings due to regional imbalances.[10] Furthermore, due to cost issues, nursing homes do not budget for a more professional nursing workforce.[11] The national data on turnover of RNs in nursing homes in Korea is unavailable; the turnover of RNs in U.S. nursing homes was reported to be between 34% and 42%.[12] Only one study reported a mean turnover rate of RNs in Korea: about 5.94%.[13] Residents reported mixed outcomes: the greater the turnover of RNs, the more likely residents had pressure ulcers,[14] a 27% increase emerged of residents using antidepressant medications,[13] and residents with dehydration, bed rest, and use of psychotic medication increased.[15] However, other studies reported that more turnover of RNs aligned with better resident outcomes.[16]

Organizational commitment is statistically significant for nursing home residents' outcomes.[3] Nursing homes in metropolitan areas reported improved resident outcomes compared with those in rural areas.[5] Small-sized nursing homes reported less use of antidepressant medications for residents with depression.[17] Very few studies discerned the location of nursing homes when studying quality issues following the 2008 enactment of LTC social insurance.[18]

Under these unstable LTC market conditions, quality of care for nursing home residents is inevitably a major concern in Korea, aligning with inappropriate use of psychotropic medications and weight loss. The misuse or overuse of psychotropic medications is quite hazardous for residents.[19] About 58% of nursing home residents in Korea took inappropriate medications.[20] LTC-insurance beneficiaries prescribed more tricyclic antidepressants and benzodiazepines than community-based nursing home residents in Korea.[21] Very limited research reported that about 17–51% of nursing home residents had been prescribed psychotropic medications inappropriately, resulting in high levels of cognitive impairment and inappropriate communication.[22,23]

The appropriate nutrition of nursing home residents is another important outcome to consider because it impacts rehabilitation, hospitalization, immune systems, infection, and quality of life.[24,25] The prevalence of severe malnutrition in Korea was reported among 36.9% of residents.[26] Researchers supported and reported that more RN input related to better eating patterns[27] and more input in helping residents eat.[28] No recent studies described the impact of RN staffing on residents' nutrition problems.

Researchers also reported severity of residents' health status as an important predictor of resident outcomes. Case mix is a means of classifying care, based on the degree of care and services provided to residents.[29] Organizational characteristics and residents' case mix explained more than 50% of quality-measure deviation.[30] In systematic review studies, more than half did not used case mix when examining quality outcomes in nursing homes.[18] Nursing homes with a higher proportion of residents with lower quality of health aligned with worse quality-of-care outcomes. U.S. government quality measures, issued by the Centers for Medicare & Medicaid Services, were also influenced by the proportion of residents' severity of illness by demographics, ADL, and physical and cognitive function.[30] Thus, multivariate risk adjustment is necessary to decrease case-mix effects when evaluating the relationship between predictor variables and quality-of-care variables.[30]

In the United States, the Center for Medicare and Medicaid developed case-mix systems called Resource Utilization Groups in the Minimum Data Set for nursing home residents, based on clinical features, need for assistance for activities of daily living, and special needs for treatment including rehabilitation or intravenous medication. The Resource Utilization Groups (RUGS) system has been used to estimate costs and for research purposes.[31] Comparing specific classification systems for nursing home residents In the United States (the Minimum Data Set's 66 RUGS), residents' severity is classified by a total of six grades in Korea, mainly based on the needs for assistance to accomplish ADLs.[32] In Korea, only people who classify under Grades 1–5 total six grades are entitled to be admitted to nursing homes by the Korean National Health Insurance Corporation.[1]

Regardless of income level, people who are over 65 years or are younger than 65 but have geriatric diseases are eligible for LTC insurance for the elderly. Applicants should have a formal physical and mental assessment by qualified healthcare professionals including RNs from the National Health Insurance Corporation.[33] Elders who are totally dependent for daily-living needs are classified as Grade 1 (usually residents requiring bed-rest or with severe dementia who are unable to eat, clothe, or bathe independently, or who have frequent aggressive behaviors). Elders who have a general need for help with ADLs are classified as Grade 2 (people who are unable to eat, clothe, and bathe independently, or who sometimes have aggressive behaviors). Elders who have

somewhat of a need for help with ADLs are classified as Grade 3 (people who have difficulty eating, clothing, and bathing and are able to go out with the help of others). Elders who have a restricted need for help with ADLs are classified as Grade 4. Finally, elders with dementia are classified as Grade 5 (people who have dementia with physical competencies; 34). This grade system also reflects on the insurance system and case-mix for research purposes.

Under the financial pressure of government social insurance in Korea, ownership is another important factor impacting staffing and residents' outcomes.[35] Authors of a systematic review of the ownership of nursing homes reported that nonprofit nursing homes had improved quality of care compared with for-profit nursing homes,[35–37] but more recent research results about the impact of ownership on outcomes was inconsistent, and is complex; very current research discerned type of ownership as a moderating factor.[3] Although the type of ownership of nursing homes has been studied mainly in Western countries,[37–39] only one study reported that the for-profit nursing home compared with nonprofit nursing homes in Korea accompanies concerns about quality, cost containment, and inappropriate recruiting of residents.[3] Also, nursing home residents' healthcare outcomes were more sensitive to healthcare-market competition,[3] as were nonprofit nursing homes, compared with for-profit nursing homes.

Very few extant studies integrated effects of residents' case mix, healthcare markets, and nurse staffing on quality of care. The objective of this study was to examine the relationship between nurse staffing and residents' quality-of-care outcomes, while controlling for long-term healthcare-market characteristics. The specific hypothesis follow:

1. Nursing homes with higher nursing-staff hours per resident day (HPRD) will have a lower proportion of residents using psychotic medication, controlling for organizational and long term care market factors.
2. Nursing homes with higher nursing-staff HPRD will have lower proportions of residents with weight loss, controlling for organizational and long term care market factors.
3. Nursing homes with low levels of turnover will have lower proportions of residents with weight loss, controlling for organizational and long term care market factors.
4. Nursing homes with low levels of turnover will have lower proportions of residents using psychotic medication, controlling for organizational and LTC market factors.

Research design

A multilevel cross-sectional design was used to analyze nursing home data from 60 nursing homes in Korea. Disproportionate stratified random sampling was used to gain greater geographical representation across Korea. Using nursing home lists provided by the Korean National Insurance Corporation (total nursing home $N = 1,647$), the list was divided into subgroups of the 17 administrative districts and the researcher randomly assigned 1 to 5 nursing homes in each district. The researcher contacted a total of 87 nursing homes and 60 nursing homes agreed to participate in this study. Following institutional review board (IRB) approval, participating organizations were recruited and data accrued in 2017 and January of 2018. This study was approved by the researcher's university IRB (No 136-4).

Variables and measures

Data accrued on nursing staff, organizational characteristics, and market-competition characteristics from participating organizations directly and from open-access government data.[34]

Independent variable

Organizational-level independent variables included RN HPRD and turnover rate, the proportion of Grade 1 and 2 (residents with severe need), and ownership (profit or nonprofit). RN staffing data for the previous week accrued directly from participating organizations and HPRD was calculated. Because the duty shift and allocation of nurse staffing differed by participating organizations, the exact number of hours during the previous week was collected. The method entailed dividing the total number of RN hours per day by the number of residents who received nursing care to calculate HPRD. Turnover was calculated based on the number of RNs who left the job in a year divided by the total number of RNs at the end of the calendar year (as suggested by[12]).

LTC market variables were collected, including the location (metropolitan, medium size, and small size) and number of RNs in each administrative district from the open-access Korean National Health Insurance Corporation[2] Herfindahl−Hirschman Index (HHI) to measure healthcare-market competition, based on the method proposed by Choi, Choi, Lee, Han, and Kim.[3] HHI also has been used in the healthcare market to measure how many organizations are concentrated in the healthcare industry.[40] The number of residents in each participating nursing home was divided by the total number of nursing homes in each of the 17 provinces and the result squared for each of the 60 participating nursing homes. Then, nursing homes were grouped based on the province and the total HHI index summed of all nursing homes in the 17 provinces. Higher values refer to more competition, ranging from 0 to 1 (as in[41]).

Dependent variables

The dependent variables in this study were the proportion of residents with psychiatric medications (including antidepressants, anti-anxiety medications, and sleeping pills), and weight loss, which was applied based on the Minimum Data Set 3.0 Quality Measures by the Centers for Medicare & Medicaid.[42]

The proportion of residents with psychiatric medication was measured by the following formula:

$$= \frac{\text{Number of residents using psychiatric medication within 6 months}}{\text{Total number of residents in a nursing home within 6 months}}$$

The proportion of residents with psychiatric medication was measured by the following formula

$$= \frac{\text{Number of residents with weight loss (5\% and 10\%) within 6 months}}{\text{Total number of residents in a nursing home within 6 months}}$$

Data analysis

A weighted linear regression model was used to test the hypotheses and perform preliminary analyses to confirm no violation of normality, linearity, and multicollinearity. RN HPRD and turnover data were entered at Step 1(Model 1); the proportion of residents with severe issues (Grade 1 and 2) at Step 2 (Model 2); and the HHI index, location, and RN number in each province and ownership type at Step 3 (Model 3).

Results

Descriptive statistics on participating organizations

Table 1 summarizes the descriptive characteristics of participating organizations. Among the 60 participating organization, 68.4% did not employ any RN. The average number of beds was 74.53 (SD = 55.57). The average RN HPRD was 0.108 (6.48 minutes), CNA HPRD was 0.162

Table 1
Descriptive statistics ($N = 60$).

Variable	Frequency or mean	% or SD
Institution		
Staffing		
RN numbers within NH	1.48	2.891
CNA numbers within NH	1.95	1.443
Care worker numbers within NH	26.58	20.522
Ownership		
Profit	10	16.9
Nonprofit	49	83.1
Number of beds	75.13	55.835
Occupancy rate	91.82	13.242
Location		
Metropolitan(over million)	29	48.3
Medium size(round half million∼ million)	13	21.7
Small size(5∼round half million)	13	21.7
Rural (below 50 thousand)	5	8.3
Religion		
Protestant	11	19.6
Catholic	3	5.4
Buddhist	3	5.4
None	39	69.6
Education of residents		
Middle school	81.059	24.723
High school	10.977	14.330
College	5.550	12.360
Graduate	0.847	3.110
Facility evaluation by Korean National Insurance Corporation		
1st grade	23	52.3
2nd grade	8	18.2
3rd grade	6	13.6
4th grade	7	15.9

(9.72 minutes), and care worker HPRD was 2.58 (2 hours 34.8 minutes). The turnover rate of RNs was about 50.5%, of CNAs was 44.99%, and of care workers was 34.37%. Regarding residents' health-related outcomes, each nursing home has about 6.1% residents with falls; 65.1% with psychiatric medications (sleeping pills, antidepressants, etc.); 72.8% with cognitive problems; 72.5% with urinary or fecal incontinence; 4.6% residents with weight-loss problems; and 1.2% with pressure ulcers. Again, the average RN HPRD was only 6.48 minutes.

Health-care-market characteristics and organizational characteristics on residents' weight loss and use of psychotic meditation (see Table 2)

The case mix of residents was another predictor. The greater the number of residents with more severe inabilities (Grades 1 and 2), the lower the number of the residents with psychotic medications ($\beta = -.25$, $p = .033$), and with weight loss ($\beta = -.19$, $p = .062$). The HHI index ranged from the 0.000025 (Kangwon and Chungbook province, more competitive) to 0.003761 (Jeju Island, less competitive). In this study, competition among nursing homes was quite a strong factor; less competition in a geographic area related to more use of psychiatric medication ($\beta = .371$, $p = .003$) and weight loss ($\beta = .313$, $p = .002$). Along with the competitive nature of nursing homes, location was also a strong factor in residents' outcomes. The number of the RNs in each of the 17 provinces showed mixed results. The more RNs in each province, the fewer residents with weight loss ($\beta = -.809$, $p = 0$). However, the more RNs in the province related to more residents with psychotic medication ($\beta = .566$, $p = 0$).

Registered-nurse staffing predictors on residents' weight loss and use of psychotic medication (see Table 2)

RN HPRD in each nursing home had a statistically significant positive impact on lowering the number of residents with psychiatric medication ($\beta = -.331$ $p = .008$). The greater the turnover rate of RNs, the lower the proportion of residents with weight loss ($\beta = -.331$ $p = .008$).

Table 2
Results of linear regression on residents' outcomes.

	Model 1			Model 2			Model 3		
	B	ß	t-stat	B	ß	t-stat	B	ß	t-stat
Residents proportion with psychotic medication									
RN HPRD	−100.630	−.263	−2.340**	−107.301	−.280	−2.487**	−126.688	−.331	−2.710***
RN Turnover	0.052	.013	0.120	0.179	.046	0.401	0.086	.022	0.189
Proportion of grade 1 and 2 (residents with severity)				−0.979	−.143	−1.278	−1.708	−.250	−2.175**
HHI							30806.850	.371	3.115***
location							29.471	.544	4.075***
RN Number in each province							0.002	.566	3.909***
Ownership (profit nonprofit)							41.450	.148	1.440
Residents proportion with weight loss									
RN HPRD	5.716	.116	1.006	3.246	.066	0.616	15.287	.310	−3.072***
RN Turnover	−0.035	−.069	−0.597	0.012	.025	0.228	−0.096	−.192	−1.998**
Proportion of Grades 1 and 2 (residents with severity)				−0.362	−.412	−3.874***	−0.158	−.180	−1.895*
HHI							−3339.577	−.313	−3.172***
location							−1.013	−.146	−1.316
RN Number in each province							0.000	−809	−6.742***
Ownership (profit nonprofit)							−0.838	−.023	−0.274

Note. RN - registered nurse, HPRD = hours per resident day, HHI = Herfindahl-Hirschman Index, * $p < .1$ ** $p < .05$ *** $p < .01$.

Discussion

This study is quite meaningful in that it simultaneously entailed investigating RN characteristics and organizational and market characteristics on residents' outcomes. The first and second hypotheses were partially supported. This study reported that the greater the supply of RNs in the province, the greater the use of psychotropic medications of residents, but supported the notion that more input of professional RNs in each nursing home (calculated as HPRD) aligned with a significant decrease in the use of psychiatric medication[13,15,43]: the more RN HPRD, the less psychotropic medications for residents. Considering the number of medications was an important factor in hopitalization and clinic visits in Korea. Professional RNs play a critical role in assessing multiple medication effects and providing professional communication with healthcare providers about medication dosages or changes in prescription.[44] The actual number or HPRD of RNs has an important impact on appropriate medication management. This study also reported that more RNs related to a decreased risk of residents with poor nutrition and decreased weight loss, consistent with studies of recent decades,[27,28,45,46] but a dearth of studies emerged on this issue recently.[47]

Nutritional problems for nursing home residents are a prevailing issue. Researchers identified that more than half of nursing home residents in Italy were at risk of malnutrition,[24,48] 20.1% in Germany, 22.5% in Austria, and 18.2% in The Netherlands.[25] RNs and directors of nursing in nursing homes play critical roles in assessing the nutritional status of residents (appetite, food restrictions due to disease or cultural factors, side effects of medication, and cultural food preferences). Based on scientific and professional assessments, RNs can design and apply scientific nutritional programs for residents.[49] Currently, regular accreditation quality indicators by the Korean National Health Insurance Company[50] focus on the supply of food and sanitation of the kitchen and do not include weight measurements of residents. The numbers of RNs on staff directly impacts weight-loss policy and better nutrition for nursing home residents.[25,51] Thus, weight assessments by professional RNs should be included in mandatory LTC policies and regulations in Korea.

The low level of RN staffing related to burnout and poor working conditions, with high levels of turnover in nursing homes. RN HPRD (6.48 minutes) in this study was much lower than even the minimal nurse staffing HPRD (0.75, 45 minutes) proposed in the United States. About 0.3 RNs are working in a nursing home, which means that only 19.7% of RNs are among the total nurse staffing in nursing homes in Korea.[9] The Centers for Medicare & Medicaid Services and Abt Associates[52] proposed minimums of 1hour and 4.8 minutes of professional RNs. Historically, the Nursing Home Reform Act of 1987 in the United States mandated one RN for the day shift and a licensed nurse for evening and night shifts; however, many nursing home experts criticized this act as inadequate to meet the needs of residents.[53] Similar political regulatory implementation for better working conditions in nursing homes is urgent in Korea. Financial support from the government should be a prerequisite. State-level subsidies in the United States were effective in increasing nurse staffing and achieving fewer pressure ulcers for residents.[54]

The third and fourth hypotheses were not supported in this research. Turnover was not a statistically significant factor in this research. Very limited research in Korea reported that turnover factors impact resident outcomes in Korea. A turnover increase of 12.44% of RNs related to a 36% increase in residents with antidepressants.[15] A 4.5% turnover of RNs aligned with a 27.21% increase in the use of antidepressants.[13] The turnover intention of care workers in 14 Korean nursing homes was influenced by organizational support and commitment.[55]

This study's results also showed that the severity of residents' condition impacted residents' outcomes overall. Staffing standards should reflect residents' classification based on acuity and severity because staffing overtime is quite sensitive to residents' severity of condition.[52,56] The five-level classification describes residents with diverse diseases and conditions in Korea; a system that is quite inappropriate compared with the 66 RUGS system, grounded in residents' individual assessments.[32] Minimum nursing home nurse staffing should be defined by residents' acuity, differentiating RNs from total nurse staffing HPRD, as in the U.S. Centers for Medicare & Medicaid Services' Nursing Home Compare Five-Star Rating system,[57] providing a quality-report system for the public. Additional research is necessary to establish the appropriate optimal HPRD for each type of staffing (RNs vs. CNAs vs. care workers) considering residents' acuity for management efficiencies. For several decades, more than 150 nursing home staffing studies across the world compared the ratio of RNs to licensed practical nurses and CNAs, delineating the strongest

factor in resident outcomes.[53] With 0.05 HPRD (about 3 minutes), an increase in the number of RNs compared to CNAs yielded that the proportion of residents with deteriorated outcomes decreased by about 0.58% in Korea.[58] Policymakers should be cautious about mandating nurse staffing in nursing homes in Korea, where it is still acceptable to have CNAs as substitutes for RNs.

Limitations

The cause-and-effect relationship between nurse staffing and resident outcomes could not be confirmed in this observational cross-sectional design. All possible confounding factors that could relate to nurse staffing and resident outcomes should be investigated in the future, including financial resources or cost. Other healthcare factors should be studied in the future. Previous studies reported on size,[14,59] nursing home staff's demographic or educational characteristics and professional jurisdiction,[60,61] the amount of organizational support for staff,[55] diverse cognitive or physical programs for residents,[62] residents' case mix,[30] use of agency nurse staffing,[36,63] and the implementation of LTC policies.[64,65]

To confirm a causal relationship, a factorial analysis may be useful in an experimental design (as in[66]). Process-focused outcome measures beyond structure-focused measures should be studied in the future, including specific nursing interventions. The weak relationship or significance of interventions may be important to identify because most data on staff was exceptionally lacking. More longitudinal research with a large database should be conducted to offset this limitation.

Conclusion

This study had several policy implications for improving the quality of care of nursing home residents in Korea. Mandatory RN presence is required to decrease the number and incidence of residents with psychiatric medications and weight loss. A professional weight assessment, monitoring system, and medication-management system by RNs is urgent in nursing homes.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.gerinurse.2018.11.004.

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