

Predictors of Patient Safety Activities among Registered Nurses and Nurse Aides in Long-term Care Facilities

Youran Lee

Yonsei University College of Nursing

Eunhee Cho (✉ ehcho@yuhs.ac)

Yonsei University College of Nursing <https://orcid.org/0000-0002-7871-6848>

Database

Keywords: Patient safety activity, Patient safety culture, Nurses, Nurse aides, Long-term care

Posted Date: September 9th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-57367/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

Background

In Korea, registered nurses (RNs) and nurse aides (NAs) are legally permitted as substitutes for long-term care (LTC) facilities, even though they have very different levels of education and standards of qualifications. This study aimed to explore the factors that influence patient safety activities of the RNs and NAs working in LTC facilities and to identify the relationship between patient safety culture (PSC) and patient safety activities.

Methods

This was a cross-sectional, descriptive study. The study participants were 88 RNs and 71 NAs who worked at 33 LTC facilities for more than three months. The questionnaires were collected by e-mail or mobile application and kept confidential. Data were analyzed using SPSS version 25.0.

Results

The mean scores of PSC and patient safety activities were 4.03 ± 0.51 points, 4.29 ± 0.49 points out of 5, respectively. There was significant correlation between PSC and patient safety activities ($r = .23, p = .004$). Factors influencing patient safety activities among RNs and NAs in LTC facilities were registered nurse ($\beta = .377, p < .001$), organizational system of PSC ($\beta = .314, p < .010$), and work shift type (fixed night shift, on-call, 24-hour shift) ($\beta = -.264, p = .004$), which explained about 36.0% of total variance ($F = 5.69, p < .001$).

Conclusion

The findings indicate the need for the mandatory placement of RNs by improving current domestic regulations that can be replaced without distinctions between the level of education and qualifications of RNs and NAs to strengthen patient safety activities at LTC facilities. Additionally, the importance of an organizational safety system and effective working shift types to prevent residents' safety accidents in LTC facilities is indicated.

Background

South Korea became an aged society in 2000, defined as an elderly population (≥ 65 years) accounting for 14% or more of the total population, only 17 years after becoming an aging society. This is the shortest period observed around the world [1]. In addition to the aging of the population, female economic participation and the nuclearization of families have made it challenging to provide care for older people with general weakness and chronic diseases. In response, the Korean government assumed the responsibility for addressing problems related to the elderly and enacted and enforced a long-term care (LTC) insurance system in July 2008 [2]. A total of 160,594 older people were admitted to 3,390 LTC facilities that were included in the institutional coverage under LTC insurance, as of the end of 2018 [3].

Elderly LTC residents often display behavioral and cognitive disorders, such as dementia, delusion, depression, anger, and aggression; most of them cannot conduct their daily lives independently for more than six months, highlighting the need for intensive management of safety incidents among elderly LTC residents [4]. In addition to cognitive and sensory impairments, polypharmacy due to a number of comorbidities has led to an increased rate of safety incidents, including falls, bedsores, infection, and medication error, among elderly nursing home residents [5–7]. Approximately 22% of residents who stayed at skilled nursing facilities in the United States experienced an adverse event, and 59% of these adverse events were preventable [8]. In the Netherlands, 46% of patients at nursing homes developed one or more adverse events among pressure ulcers, falls, and urinary system infections [9].

Although the incidence of adverse events at LTC facilities has not been reported in Korea, 84.2% of LTC facility staffs have experienced a safety incident [10], indicating the seriousness of safety risks for the elderly in LTC facilities. Other countries (e.g., the United States, Canada, England and Germany) have long been discussing the quality management of LTC facilities as a major policy issue [11]. Based on the literature on the quality of LTC facilities, these countries report that problems such as falls, pressure ulcers, infections, medication errors, and malnutrition in the resident population of these facilities are preventable, and are associated with nursing staff shortages [6]. The quality of care is closely related to the standards and levels of staffing. Particularly, high staffing standards and staffing levels, including registered nurses (RNs), have been linked to positive outcomes such as improved quality of service delivery, improved physical functions, lower incidence of falls, pressure ulcers, and malnutrition, and reduced hospitalization rates among elderly residents of care facilities [12–17].

The staffing standards for nursing homes in the United States are centered on the nursing staff, and the federal government's staffing standards stipulate that nursing homes must be staffed adequately to maintain and improve the physical, mental, psychological, and emotional wellbeing of elderly nursing home residents [18]. Each state has its own minimum staffing standards for RNs and licensed practical nurses/licensed vocational nurses in nursing homes [19]. Further, these standards present the daily minimum nursing service time by RN, licensed practical nurses/licensed vocational nurses, and clinical nurse aide per patient and recommend that 30% of such nursing service should be provided by an RN and that a nurse should be on duty 24 hours a day [18].

Contrastingly, there are no legal grounds for specifying the staffing level and direct nursing time in LTC facilities in Korea. The existing legal stipulation for nursing staffing in LTC facilities requires one RN or a nurse aide (NA) per 25 residents with more than 30 beds, and one RN and NA with 10–30 beds [20]. However, there is a problem with the wide gap between the levels of education and licensure for an RN and NA. While RNs complete a four-year curriculum at a university certified by the Korea Accreditation Board of Nursing Education (KABONE) and obtain a license if they pass the government examination, NAs

complete a one-year program from an educational training institution and obtain a certificate if they pass the government examination. Therefore, there is a significant difference in the level of personnel between RN and NA. In 2019, there were 1.75 persons nursing staff per LTC facility in Korea, of which only 0.28 persons are nurses [21, 22]. The vulnerable staffing structure in LTC facilities can have numerous adverse effects on the safety of their elderly residents; the influences of RN and NA staffing levels should be also considered.

Patient safety experts emphasize that structural problems related to the organizational system, compared to an individual's error or indifference, are the more important causes of error, and they recommend ameliorating the safety system of work environments and establishing a patient safety culture (PSC) in order to prevent errors [23]. It is commonly believed that PSC promotes patient safety activities and has a positive impact on safety outcomes [24]. Organizations with a positive PSC stress the importance of organizational policies, systematic processes, leadership that emphasize patient safety, team work through efficient communication, efficient staffing allocation, and a reporting system for medical malpractice [25]. Many studies on PSC observed that higher perceptions of PSC among nursing providers had a greater positive impact on patient safety activities [5, 26, 27]. However, the perception of PSC among nursing home employees was worse overall compared to that of hospital employees [4, 5, 28]. Additionally, the perception of PSC varies depending on the staff of nursing homes [29].

Patient safety activities refer to all activities for identifying potential problems and preventing or improving them to prevent any hazardous or adverse events among patients [30]. Particularly, nurses play an important role in identifying and managing risk to ensure patient safety at nursing homes [30, 31]. The main patient safety activities in LTC facilities include prevention of falls, pressure ulcers, infection, medication safety, inspection of equipment, fire safety, and education for residents [32, 33]. Previous studies have investigated employees' perceptions of PSC in nursing homes [4, 5, 34–37], but research on the relationship between the perceptions of PSC and patient safety activities of nursing staff is inadequate. Particularly, no study has attempted to investigate the relationship between the perception of PSC and patient safety activities among RNs and NAs, who responsible for the care and safety of elderly nursing home residents, regarding legislation allowing NAs to function as RNs, irrespective of their qualifications. This study aims to examine the level of patient safety activities and identify the predictors of patient safety activities among RNs and NAs working in LTC facilities.

Methods

Study design

This study is a descriptive survey aimed at identifying the predictors of patient safety activities of RNs and NAs in LTC facilities.

Participants

RNs and NAs who have been working in a nursing home for at least three months and provided informed consent to participate in this study were enrolled. Sample size was calculated utilizing the G*power 3.1.9.4 software for regression analysis with a significance level (α) of .05, moderate effect size of .15, power ($1-\beta$) of .80, and 16 independent variables with reference to previous studies. The minimum required sample size was 143. We included data from 159 people in 33 facilities in the final analysis.

Data collection and ethical consideration

The study was approved by the Institutional Review Board of the Y University Health System (Approval No. Y-2019-0096, dated 28 Aug 2019). Data were collected from RNs and NAs who work in LTC facilities from October 8 to October 31, 2019. We conveniently selected the LTC facilities from the National Health Insurance Service (NHIS) data on LTC facilities nationwide after classifying the LTC facilities as < 100 beds and \geq 100 beds. We called the head of the selected LTC facilities to explain the purpose and contents of the study and obtained their permission to collect data. We obtained written and informed consent from all participants. The questionnaires were collected by e-mail or mobile application and kept confidential.

Instruments

Patient safety culture

The perception of patient safety in LTC facilities was assessed using the Korean Patient Safety Culture Scale for LTC facilities developed by Yoon and Wu [10]. This 27-item scale consists of four factors: manager's leadership (nine items), work attitude (six items), organizational system (seven items), and managerial practice (five items). Each item was rated on a five-point Likert scale from "strongly disagree" (1) to "strongly agree" (5); a higher score indicated a higher perception of PSC. The reliability of the scale was .95 in the study by Yoon and Wu [10], and .84 in our study.

Patient safety activities

The patient safety activities tool was developed by the researchers for residents of LTC facilities based on the tools developed by Park et al. [38] for hospital nurses and the patient safety goals of the Joint Commission in the United States. To test the content validity of the instrument, we formed a patient safety expert panel comprising four nursing professors and three geriatric nurse practitioners working in LTC facilities (Appendix A). The expert panel rated the validity of each item for measuring the properties of patient safety activities in LTC facilities using a content validity checklist based on a scale consisting of "very relevant (4)," "quite relevant (3)," "somewhat relevant (2)," and "not relevant (1)." The content validity index (CVI) for each item was computed based on the criterion suggested by Lynn [25], and items with a CVI of 0.8 or higher were selected. Based on this restriction, all 41 items were selected. Patient safety activities consisted of five domains: safe medication administration (eight items), fall prevention (13 items), infection prevention (12 items), pressure ulcer prevention (five items), and equipment/fire inspection (three items). Each item was rated on a five-point Likert scale from "strongly disagree" (1) to "strongly agree" (5), with a higher score indicating a higher compliance with patient safety activities in the corresponding domain. The reliability of the entire instrument

was .83 in our study, with .79 for safe medication administration, .78 for infection prevention, .77 for fall prevention, .79 for pressure ulcer prevention, and .82 for equipment/fire inspection.

Data analysis

The collected data were analyzed using the SPSS Window 25.0 (IBM Corp. Armonk, NY, USA) software. First, participants' general characteristics and level of PSC and patient safety activities were analyzed with descriptive statistics. Second, variations in patient safety activities according to general organizational characteristics and patient safety characteristics were analyzed using independent t-tests, one-way ANOVA, followed by Scheffé post hoc test. Third, the relationship between PSC and patient safety activities was analyzed by calculating Pearson's correlation coefficient. Fourth, the predictors of patient safety activities were identified using multiple regression analysis.

Results

Descriptive analysis of participants and facilities

Participants' demographic characteristics, work-related characteristics, and organizational characteristics are shown in Table 1. In total, 159 participants enrolled, comprised of RNs (55.3%) and NAs (44.7%). The vast majority of them were women (98.7%), and the mean age was 50.92 ± 8.47 years. There were more single (54.1%) participants than married (45.9%), and the most common education level was a bachelor's degree (32.7%). The most common career length at their current facility was between one and five years (34.6%). The most common work shift type was three shifts (42.8%), followed by fixed day shift (27.7%), and other (either fixed night shift, on-call, 24-hour shift; 16.4%). In all, 73.0% of the participants had reported a safety incident in a year, and the most common type of reported safety incident was falls (68.6%), followed by bedsores (37.7%), medication error (15.7%), and burns (8.2%). The vast majority (93.7%) completed a safety incident prevention course, included in safety nursing activities within the past year. Regarding organizational characteristics, the most common facility admission capacity was 100–199 (40.3%), and the mean number of residents assigned per RN or NA was 75.54, with a range of 10–296. Regarding the LTC facility evaluation ratings, the majority (74.8%) received an A rating, followed by a B rating (12.6%) and C rating (12.6%). The most common type of LTC ownership was a foundation (34.0%), followed by public (33.3%) and private (32.7%). The most common proportion of RNs in the nursing staff (between RNs and NAs) was 50–74% (47.2%).

(Insertion Table 1)

Perception of PSC and level of patient safety activities

The participants' perception of PSC and level of patient safety activities are shown in Table 2. The mean perception of PSC was 4.03 ± 0.51 out of 5, and the mean score for patient safety activities was 4.29 ± 0.49 out of 5. By occupation, the perception of PSC was 3.94 ± 0.52 among RNs and 4.15 ± 0.47 among NAs. The mean patient safety activities score was 4.46 ± 0.35 among RNs and 4.08 ± 0.56 among NAs.

(Insertion Table 2)

Patient safety activities according to demographic and work-related characteristics

Patient safety activities were significant for occupation ($t = -5.28, p < .001$), marital status ($t = 2.47, p = .015$), education level ($t = 3.43, p = .019$), work shift type ($t = 8.09, p < .001$), experiences of reporting safety incidents ($t = -2.47, p = .015$), mean number of assigned residents ($t = 4.77, p = .010$), facility evaluation ratings ($t = 5.64, p = .004$), and proportion of RNs ($t = 3.63, p = .014$) (see Table 3). RNs performed more patient safety activities than NAs. Employees working two shifts, three shifts, and fixed day shift cycles were more active regarding patient safety than "other" shifts (i.e., fixed night shift, on-call, 24 hours). Employees who experienced adverse patient safety incidents performed more patient safety activities than those who did not. Employees at the LTC facilities with a higher percentage of RNs than NAs and good evaluation ratings performed high patient safety activities.

(Insertion Table 3)

Relationship between participants' perception of PSC and patient safety activities

Table 4 shows the correlations between participants' perception of PSC and patient safety activities. There was a significant correlation between the perception of PSC and patient safety activities ($r = .23, p = .004$). In terms of each domain of patient safety activities, the perception of PSC was significantly positively correlated with safe medication ($r = .24, p = .002$), infection prevention ($r = .27, p = .004$), fall prevention ($r = .18, p = .021$), and equipment/fire inspection ($r = .29, p < .001$). Further, in terms of each domain of the perception of PSC, patient safety activities were significantly positively correlated with work attitude ($r = .30, p < .001$) and organizational system ($r = .26, p < .001$).

(Insertion Table 4)

Factors influencing of patient safety activities

Multiple regression was performed using variables identified as predictors of patient safety activities in RNs and NAs in previous studies and variables that significantly differed in the univariate analysis in our study to identify the predictors of patient safety activities among RNs and NAs in LTC facilities. We included into the regression the domains of PSC, manager leadership, work attitude, organizational system, and managerial practice. Although education level significantly differed in the univariate analysis, it was excluded in the regression analysis. Considering that high school graduates are all NAs, there is a strong correlation between education level and occupation. Nominal variables were all dummy-coded. Multicollinearity, residuals, and outliers were assessed to test

the assumption of regression for the independent variables with all satisfying the criteria. Therefore, the regression model generated in this study was found to satisfy all assumptions of the regression equation.

Table 5 shows the results of the analysis of the predictors of patient safety activities among RNs and NAs in LTC facilities. The predictors of participants' patient safety activities were: RNs ($\beta = .377, p < .001$), the organizational safety system domain of PSC ($\beta = .314, p = .010$), and "other" work shift type (i.e., fixed night shift, on call, 24-hour shift; $\beta = -.264, p = .004$). These variables explained 36.0% of patient safety activities in LTC facilities ($F = 5.69, p < .001$). Hence, RNs working at LTC facilities displayed higher levels of patient safety activities than NAs. The level of patient safety activities was higher among those who perceived the facility as having a good safety organizational system. In addition, employees working three shift cycles displayed higher levels of patient safety activities than the "other" shift type.

(Insertion Table 5)

Discussion

This study aimed to identify the predictors of patient safety activities among RNs and NAs working in 33 in LTC facilities nationwide. Our results found that RNs have the most important influence on patient safety activities compared to NAs and the level of patient safety activities of RNs and NAs showed significant differences. Hence, as health professionals providing bedside care for residents in LCT facilities, RNs are key personnel in charge of residents' health and safety management [5, 6]. A study by Shin [14] on Korea's LTC facilities showed that with increasing care time per resident compared to other nursing staff, the more effective is the quality of care (e.g. preventing falls, decreasing tube feeding and also aggressive behavior). In addition, a study by Bostick et al [12], which systematically analyzed 87 government documents published from 1975 to 2003 in the United States, found that the higher the number of RNs in a nursing home, the better improve are resident outcomes (e.g. functional availability, pressure ulcers, weight loss). Hence, the proportion of RNs was emphasized as the most important factor in patient safety activities in LTC facilities [40].

These studies showed that replacing RNs with NAs is extremely unreasonable as there is a substantial gap in education and qualification. Therefore, the current article of the Welfare of Senior Citizens Act that stipulating RNs and NAs to be at an equivalent level without distinguishing their qualifications must be amended to better ensure safety and quality of care for LTC facility residents. In addition, the proportion of RNs employed at LTC facilities in Korea is 0.1%, significantly lower compared to other countries (e.g., United States = 34.3%, Netherlands = 28.2%, Germany = 50.9%, Japan = 20.7%) [44]. Due to the low standards of RNs, more than seven out of ten facilities have no RNs at all. [22, 23]. Among our participants, 73.6% had reported a safety incident in the past year. These results show the seriousness of residents' safety at LTC facilities in Korea [10]. Therefore, in order to reduce adverse events of residents in LTC facilities, the mandatory placement of RNs to assess and effectively manage residents at risk should be legally stipulated [6, 12, 18]. Despite the challenge of keeping current with nursing staffing standards for LTC facilities in developed countries for Korea, the current nursing staffing allocation standard should be revised to a minimum standard of at least one RN per a 24-hour period [18]. Further, the evaluation criteria for LTC facilities must include indicators of patient safety outcomes such as the prevalence of falls, pressure ulcers, restraints, medication errors incidence, catheter-related infections, and medication errors, to promote patient safety activities and improve the quality of care [42]. Modification of the current RNs' staffing standard for LTC facilities in Korea is also essential for a comprehensive management of such safety quality indicators for the LTC facility residents.

PSC influences attitudes and behaviors of employees, regarding adherence of patient safety regulation and the practice of patient safety activities within the organization [43]. In this study, an organizational safety system of PSC was a second predictor of patient safety activities in line with a previous finding that system factors including organizational factors are more important than individual factors in PSC [23]. Regarding organizational systems of PSC, developed countries have long recognized the significance of a patient safety reporting system and have implemented such (or they have enacted laws stipulating the mandatory reporting of serious events) and have provided information through evaluation [44]. The purpose of such patient safety reporting systems is to alter the learning culture to one where staff members learn from their failures by identifying the cause of safety incidents and apply such learnings to practice. The most important aspect of learning from experience is to establish an organizational culture with an open reporting system, including actual adverse events and near misses [45, 46]. An effective reporting system identifies safe behaviors that should be adapted to prevent errors, encompassing the individuals' adherence to their safety responsibilities, promises to maintain patient safety, efforts to acquire the latest knowledge on patient safety, and their learnings based on errors to achieve safety goals [47]. Further, noting the finding that administering a patient safety education program to nursing home staff led to a reduction of potential safety incidents (e.g., falls and pressure ulcers) by increasing the staff's awareness of PSC [48], establishing a standardized educational system for nursing home staff is crucial. Thus, teamwork and personnel management founded on open communication, trust, and cooperation within the organization are warranted [49].

Per the recently enacted Patient Safety Act, Korea has also established an external reporting system to which relevant hospitals report patient safety incidents. The 'Patient Safety Reporting Learning System' was utilized as evidence for governmental policymaking and macroscopic improvement activities to enhance patient safety and quality of care by establishing and analyzing a patient safety information database, containing data electronically submitted by hospitals [50]. The reporting system for LTC facilities should also be reinforced to examine the state of safety incidents and relevant problems, based on which appropriate safety improvement activities should be launched. In particular, these suggest that establishing an organizational safety system such as guidelines for actions or emergency treatment protocols (in response to a safety incident) and the computerization of the reporting system in LTC facilities is an effective method.

In this study, the level of patient safety activities increased with increasing perception of PSC for staff in LTC facilities. This is consistent with previous findings that there is a significant correlation between the employee's perception of PSC and the outcomes of patient safety activities [4, 26, 27, 35, 51]. Therefore, as noted by other research, the measurement of PSC in LTC facilities helps improve quality of care and patient safety [35]. However, recent studies indicate a difference in the perception of PSC among staff in LTC facilities and nursing homes [29, 52]. Although administrators are in a position to lead the

PSC of LTC facilities, they perceived better PSC than did clinical staff. The latter spend more time with residents and perceived PSC as lower than other employees of the LTC facility [29]. RNs also perceived lower PSC in LTC facilities than NAs [53]. These findings are consistent with our findings. Because participants' perceptions of PSC reflect the current level of PSC in the LTC facility, these results suggest that RNs have a more critical view of the PSC in their LTC facility compared to NAs. Despite the lower perception of PSC, RNs showed significantly higher levels of patient safety activities. Amid the special situation in Korea where RNs are legally considered replaceable by NAs in LTC facilities [20], these results highlight the importance of RNs, who more critically perceive the current PSC and strive to improve it. Since perceptions of PSC vary widely among staff in LTC facilities, it was recommended that PSC scores should be checked according to occupation for the change and evaluation of PSC in LTC facilities [29]. Therefore, managers of LTC facilities should continually measure perceived patient safety among their employees and utilize the findings as the starting point for improving PSC and increasing compliance with patient safety activities [28].

The Agency for Healthcare Research and Quality (AHRQ) in the United States requires nursing homes to periodically conduct surveys on PSC of employees and submit the results to enhance their acceptance of PSC. This management system aims to encourage employees to recognize the level of PSC and the safety problems of residents in the facilities and to engage in quality improvement activities [25]. Therefore, the institution that manages the LTC facilities in Korea should periodically investigate the perception of PSC by occupation and organize a quality control system so that it can be reflected in safety activities and safety management of residents of LTC facilities.

In this study, shift types were identified as a factor affecting patient safety activities of RNs and NAs in LTC facilities. The fixed night shift, 24-hour rotational shift and on-call shift had greater negative impacts on patient safety activities compared to three day shifts. This may be attributable to staff members who work these shift types to be more likely to work excessive hours, possibly contributing to fatigue. Although no previous study examined the impact of night shift or overtime on patient safety in LTC facilities, studies of acute care hospitals observed that fatigue caused by night shift and overtime increased the incidence of medical errors, mortality, readmission rate, and the incidence of surgical complications [54–56]. In the United States, Germany, and Japan, nursing home staff members generally work three shifts, and staffing standards per work hour are enforced [19]. However, under the current standards of nursing staff in Korea, nurses or nursing assistants cannot take care of residents around the clock. Hence, Korea should also develop a minimum staffing allocation standard based on three shifts. Further, 24-hour patient safety activities are required, as most nursing home residents are older people who are frail or have dementia, with 24-hour supervision by RNs. However, additional studies are needed to pinpoint the cause underlying the impact of shift type on patient safety activities.

Our results are significant in elucidating the need to amend regulations pertinent to RN allocation standards in LTC facilities in Korea, transitioning the current work shift to a three consecutive shifts system, and establish a safety system at the organizational level to promote resident safety in LTC facilities.

Conclusion

Our results show the importance of enhancing the quality of safety for LTC facility residents by improving the nursing staffing standard, such as requiring the presence of RNs 24-hours a day and increasing staffing, and establishing an effective shift system to strengthen patient safety activities in LTC facilities. Further, our findings suggest the importance of establishing a standardized organizational system, such as patient safety-oriented leadership, an incident reporting and communication system, a facility environment that promotes the prevention of safety incidents, and safety education programs, to foster a safety culture in LTC facilities and to ensure the safety of residents.

Abbreviations

AHRQ
Agency for Healthcare Research and Quality
CVI
content validity index
KABONE
Korea Accreditation Board of Nursing Education
LTC
long-term care
NHIS
National Health Insurance Service
NA
nurse aide
RN
registered nurse
PSC
patient safety culture.

Declarations

Ethics approval and consent to participate

The study was approved by the Institutional Review Board of the Y University Health System (Approval No. Y-2019-0096). Written informed consent was obtained from all participants before enrolment into the study. This method of informed consent was approved by the ethics committee.

Consent for publication

Not applicable

Availability of data and materials

The data used in this study are available at Appendix A. All data were approved by the respondents.

Competing interests

The authors declare that they have no competing interests.

Funding

Not applicable.

Authors' contributions

YL, EC made a substantial contribution to the conception and the design of the study. YL designed and conducted the research, analyzed the data and contributed to the manuscript. EC designed and supervised the research, and contributed to the manuscript. Both authors revised and approved the final version of the manuscript.

Acknowledgements

The authors would like to thank the long-term care facilities, registered nurses and nurse aides for participating in the survey to improve the safety of residents.

References

1. National Health Insurance Service (NHIS). List of results of regular evaluation of facility benefits for long-term care facilities in 2018. Seoul: NHIS; 2019. http://www.longtermcare.or.kr/npbs/d/m/000/moveBoardView?menuId=npe0000000770&bKey=B0009&search_boardId=60351. Accessed 11 Dec 2019.
2. Ministry of Health and Welfare (MOHW). 2019 Status of welfare facilities for the elderly. Sejong: MOHW; 2019. http://www.mohw.go.kr/react/jb/sjb030301vw.jsp?PAR_MENU_ID=03&MENU_ID=0321&CONT_SEQ=349899&page=1. Accessed 30 Mar 2020.
3. Bonner AF, Castle NG, Perera S, Handler SM. Patient safety culture: A review of the nursing home literature and recommendations for practice. *Ann Longterm Care*. 2008;16(3):18–22. PMC3119574.
4. Castle NG, Sonon KE. A culture of patient safety in nursing homes. *Qual Saf Health Care*. 2006;15(6):405–8. <https://doi.org/10.1136/qshc.2006.018424>.
5. Rust TB, Wagner LM, Hoffman C, Rowe M, Neumann I. Broadening the patient safety agenda to include safety in long-term care. *Healthc Q*. 2008;11:31–4. <http://doi.org/10.12927/hcq.2008.19646>.
6. Barber ND, Alldred DP, Raynor DK, Dickinson R, Garfield S, Jesson B. Care homes' use of medicines study: prevalence, causes and potential harm of medication errors in care homes for older people. *Qual Saf Health Care*. 2009;18:341–6. <https://doi.org/10.1136/qshc.2009.034231>.
7. Levinson DR. (2006). Adverse events in skilled nursing facilities: National incidence among Medicare beneficiaries. Document OEI-06-11-00370. Washington DC: Department of Health and Human Services. Available from: <https://resourcesforrisk.com/docs/oei-06-11-00370.pdf>.
8. Van Gaal BGI, Schoonhoven L, Mintjes-de Groot JAJ, Defloor T, Habets H, Voss A, et al. Concurrent incidence of adverse events in hospitals and nursing homes. *J Nurs Scholarsh*. 2014;46(3):187–98. <https://doi.org/10.1111/jnu.12063>.
9. Yoon SH, Wu XL. Content analysis of patient safety culture in nursing homes. *J Korean Acad Nurs Adm*. 2013;19(1):118–27. <http://doi.org/10.11111/jkana.2013.19.1.118>.
10. Hyer K, Thomas KS, Branch LG, Harman JS, Johnson CE, Weech-Maldonado R. The influence of nurse staffing levels on quality of care in nursing homes. *Gerontologist*. 2011;51(5):610–6. <http://doi.org/10.1093/geront/gnr050>.
11. Bostick JE, Rantz MJ, Flesner MK, Riggs CJ. Systematic review of studies of staffing and quality in nursing homes. *J Am Med Dir Assoc*. 2006;7(6):366–76. <https://doi.org/10.1016/j.jamda.2006.01.024>.
12. Spilsbury K, Hewitt C, Stirk L, Bowman C. The relationship between nurse staffing and quality of care in nursing homes: A systematic review. *Int J Nurs Stud*. 2011;48(6):732–50. <https://doi.org/10.1016/j.ijnurstu.2011.02.014>.
13. Shin JH, Hyun TK. Nursing staffing and quality of care of nursing home residents in Korea. *J Nurs Scholar*. 2015;47(6):555–64. <https://doi.org/10.1111/jnu.12166>.
14. Hickey EC, Young GJ, Parker VA, Czarnowski EJ, Saliba D, Berlowitz DR. The effects of changes in nursing home staffing on pressure ulcer rates. *J Am Med Dir Assoc*. 2005;6:50–3. <https://doi.org/10.1016/j.jamda.2004.12.003>.

15. Schnelle JF, Simmons SF, Harrington C, Cadogan M, Garcia E, Bates-Jensen B. Relationship of nursing home staffing to quality of care. *Health Serv Res.* 2004;39:225–50. <https://doi.org/10.1111/j.1475-6773.2004.00225.x>.
16. Weech-Maldonado R, Meret-Hanke L, Neff MC, Mor V. Nurse staffing patterns and quality of care in nursing homes. *Health Care Manage Rev.* 2004;29(2):107–16. <https://doi.org/10.1097/00004010-20040400000004>.
17. Harrington C, Schnelle JF, McGregor M, Simmons SF. The need for higher minimum staffing standards in U.S. nursing homes. *Health Serv Insights.* 2016;9:13–9. <https://doi.org/10.4137/HSI.S38994>.
18. Harrington C, Choiniere J, Goldmann M, Jacobsen FF, Lloyd L, McGregor M, et al. Nursing home staffing standards and staffing levels in six countries. *J Nurs Scholarsh.* 2012;44(1):88–98. <https://doi.org/10.1111/j.1547-5069.2011.01430.x>.
19. Ministry of Government Legislation. Long-term care insurance. Sejong: The National Law Information Center; 2019. <http://www.law.go.kr/%EB%B2%95%EB%A0%B9/%EB%85%B8%EC%9D%B8%EC%9E%A5%EA%B8%B0%EC%9A%94%EC%96%91%EB%B3%B4%ED%97%9E> Accessed 22 Dec 2019.
20. Ministry of Health and Welfare (MOHW). Status of long-term care facilities in 2019. Sejong: MOHW; 2019. http://www.mohw.go.kr/react/jb/sjb030301vw.jsp?PAR_MENU_ID=03&MENU_ID=0321&CONT_SEQ=349899&page=1. Accessed 12 Nov 2019.
21. National Health Insurance Service (NHIS). Statistics of long-term care insurance in 2019. Seoul: NHIS; 2019. <https://www.nhis.or.kr/static/html/wbd/g/a/wbdga0101.html>. Accessed 15 Aug 2019.
22. Wachter RM, Gupta KG. Understanding patient safety. 3rd ed. YN: McGraw-Hill Education; 2018.
23. Institute of Medicine: committee on Quality of Health Care in America. Crossing the quality chasm: A new health system for the 21st century. Washington DC: National Academies Press; 2001.
24. Agency for Health Research and Quality (AHRQ). Hospital survey on patient culture. Rockville: AHRQ; 2004. <http://www.ahrq.gov/qual/patientsafetyculture/hospindex.htm>. Accessed 3 Jan 2020.
25. Thomas KS, Hyer K, Castle NG, Branch LG, Ansel R, Weech-Maldonado R. Patient safety culture and the association with safe resident care in nursing homes. *Gerontologist.* 2012;52(6):802–811. <https://doi.org/10.1093/geront/gns007>.
26. Bonner AF, Castle NG, Men A, Handler SM. Certified nursing assistants' perceptions of nursing home patient safety culture: Is there a relationship to clinical outcomes? *J Am Med Dir Assoc.* 2009;10:11–20. <https://doi.org/10.1016/j.jamda.2008.06.004>.
27. Handler SM, Castle NG, Studenski SA, Perera S, Fridsma DB, Nace DA, et al. Patient safety culture assessment in the nursing home. *Qual Saf Health Care.* 2006;15:400–4. <https://doi.org/10.1136/qshc.2006.018408>.
28. Banaszak-Holl J, Reichert H, Greene MT, Mody L, Wald HL, Crnich C, et al. Do safety culture scores in nursing homes depend on job role and ownership? Results from a national survey. *J Am Geriatr Soc.* 2017;65(10):2244–50. <http://doi.org/10.1111/jgs.15030>.
29. Milligan F, Dennis S. Improving patient safety and incident reporting. *Nurs Stand.* 2004;19(7):33–6. <http://doi.org/10.7748/ns2004.10.19.7.33.c3733>.
30. Glancy GD, Chaimowitz G. The clinical use of risk assessment. *Can J Psychiatry.* 2005;50:12–7. <http://doi.org/10.1177/070674370505000104>.
31. Jang HE, Song Y, Kang H-Y. Nurses' perception of patient safety culture and safety control in patient safety management activities. *J Korean Acad Nurs Adm.* 2017;23(4):450–59. <https://doi.org/10.11111/jkana.2017.23.4.450>.
32. Park H-H, Kim S. A structural equation model of nurses' patient safety management activities. *J Korean Acad Nurs Adm.* 2019;25(2):63–72. <https://doi.org/10.11111/jkana.2019.25.2.63>.
33. Ree E, Wiig S. Employees' perceptions of patient safety culture in Norwegian nursing homes and home care services. *BMC Health Serv Res.* 2019;19:607–16. <https://doi.org/10.1186/s12913-019-4456-8>.
34. Li Y, Cen X, Cai X, Temkin-Greener H. Perceived patient safety culture in nursing homes associated with “nursing home compare” performance indicators. *Med Care.* 2019;57(8):641–7. <https://doi.org/10.1097/MLR.0000000000001142>.
35. Gartshore E, Waring J, Timmons S. Patient safety culture in care homes for older people: a scoping review. *BMC Health Serv Res.* 2017;17:752. <https://doi.org/10.1186/s12913-017-2713-2>.
36. Titlestad I, Haugstvedt A, Igland J, Graue M. Patient safety culture in nursing homes: a cross-sectional study among nurses and nursing aides caring for residents with diabetes. *BMC Nurs.* 2018;17(1):36–8. <https://doi.org/10.1186/s12912-018-0305-z>.
37. Park SJ, Kang JY, Lee YO. A study on hospital nurses' perception of patient safety culture and safety care activity. *J Korean Crit Care Nurs.* 2012;5(1):44–55. <https://www.jkccn.org/journal/crossRefTDM.php?number=106>.
38. Lynn MR. Determination and quantification of content validity. *Nurs Res.* 1986;35(6):382–6.
39. Rust TB, Wagner LM, Hoffman C, Rowe M, Neumann I. Broadening the patient safety agenda to include safety in long-term care. *Healthc Q.* 2008;11(3):31–4. <http://doi.org/10.12927/hcq.2008.19646>.
40. OECD. Health at a glance 2019: OECD indicators. Paris: OECD Publishing; 2019. <https://doi.org/10.1787/4dd50c09-en>.
41. Agency for Health Research and Quality (AHRQ). Resident safety practices in nursing home settings. Rockville: AHRQ; 2016. https://effectivehealthcare.ahrq.gov/sites/default/files/pdf/nursing-home-safety_technical-brief.pdf. Accessed 12 Dec 2019.
42. Cooper MD. Towards a model of safety culture. *Saf Sci.* 2000;36:111–36. [https://doi.org/10.1016/S0925-7535\(00\)00035-7](https://doi.org/10.1016/S0925-7535(00)00035-7).
43. The Joint Commission (TJC). National patient safety goals effective January 2020 hospital accreditation program. Oakbrook Terrace: TJC; 2019. https://www.jointcommission.org/assets/1/6/NPSG_Chapter_HAP_Jan2020.pdf. Accessed 30 Mar 2020.
44. Donaldson L. An organisation with a memory: report of an expert group on learning from adverse events in the NHS chaired by the chief medical officer. Rockville: AHRQ; 2005. <https://psnet.ahrq.gov/issue/organisation-memory-report-expert-group-learning-adverse-events-nhs-chaired-chief-medical>.

Accessed 13 Mar 2020.

45. Leape LL. Reporting of adverse events. *N Engl J Med*. 2002;347:1633–8. <http://doi.org/10.1056/NEJMNEJMhpr011493>.
46. Wiegmann DA, Zhang H, von Thaden TL, Sharma G, Gibbons AM. Safety culture: An integrative review. *Int J Aviat Psychol*. 2004;14(2):117–34. https://doi.org/10.1207/s15327108ijap1402_1.
47. Damery S, Flanagan S, Rai K, Combes G. Improving safety in care homes: Protocol for evaluation of the Walsall and Wolverhampton care home improvement programme. *BMC Health Serv Res*. 2017;17(1):86. <http://doi.org/10.1186/s12913-017-2013-x>.
48. Ree E, Wiig S. Employees' perceptions of patient safety culture in Norwegian nursing homes and home care services. *BMC Health Serv Res*. 2019;19:607. <https://doi.org/10.1186/s12913-019-4456-8>.
49. Korea Institute for Healthcare Accreditation (KOIHA). Patient safety report learning system. Seoul: KOIHA; 2017. <https://www.kops.or.kr/portal/main.do>. Accessed 7 Dec 2019.
50. Smith SN, Greene MT, Mody L, Banaszak-Holl J, Peterson LD, Meddings J. Evaluation of the association between Nursing Home Survey on Patient Safety culture (NHSOPS) measures and catheter-associated urinary tract infections: results of a national collaborative. *BMJ Qual Saf*. 2017;27(6):464–73. <http://doi.org/10.1136/bmjqs-2017-006610>.
51. Wisniewski AM, Erdley W, Singh R, Servoss, Naughton BJ, Singh G. Assessment of safety attitudes in a skilled nursing facility. *Geriatr Nurs*. 2007;28(2):126–36. <https://doi.org/10.1016/j.gerinurse.2007.01.001>.
52. Yoon SH, Kim SY, Wu XL. Perception of workers on patient safety culture and degree of patient safety in nursing homes in Korea. *J Korean Acad Nurs Adm*. 2014;20(3):247–56. <http://doi.org/10.11111/jkana.2014.20.3.247>.
53. Ricciardi R, Nelson J, Francone TD, Roberts PL, Read TE, Hall JF, et al. Do patient safety indicators explain increased weekend mortality? *J Surg Res*. 2016;200(1):164–70. <http://doi.org/10.1016/j.jss.2015.07.030>.
54. Attenello FJ, Wen T, Cen SY, Ng A, Kim-Tenser M, Sanossian N, et al. Incidence of “never events” among weekend admissions versus weekday admissions US hospitals: National analysis. *BMJ*. 2015;350:h1460. <https://doi.org/10.1136/bmj.h1460>.
55. Hendey GW, Barth BE, Soliz T. Overnight and postcall errors in medication orders. *Acad Emerg Med*. 2005;12:629–34.
56. Hendey GW, Barth BE, Soliz T. Overnight and postcall errors in medication orders. *Acad Emerg Med*. 2005;12:629 – 34.

Tables

Table 1 Demographic and work related characteristics of participants (N=159)

From: Predictors of Patient Safety Activities among Registered Nurses and Nurse Aides in Long-term Care Facilities

Characteristics	Categories	n (%)	M ± SD (range)
Occupation	Nurse aides (NAs)	71 (44.7)	
	Registered nurse (RNs)	88 (55.3)	
Gender	Men	2 (1.3)	
	Women	157 (98.7)	
Age (years)	<40	18 (11.3)	50.92 ± 8.47
	40-49	40 (25.2)	(25.00-69.00)
	50-59	79 (49.7)	
	60≤	22 (13.8)	
Marital status	Single	86 (54.1)	
	Married	73 (45.9)	
Education level	High school	41 (25.8)	
	Diploma/associate	50 (31.4)	
	Bachelor	52 (32.7)	
	Graduate	16 (10.1)	
Career at current facility (years)	<1	51 (32.1)	51.91 ± 56.79
	1-4	55 (34.6)	(0.25-25.67)
	5-9	32 (20.1)	
	10≤	21 (13.2)	
Work shift type	2 shifts	21 (13.2)	
	3 shifts	68 (42.8)	
	Fixed day shift	44 (27.7)	
	Others	26 (16.3)	
Experiences of reporting safety incident in a year	No	43 (27.0)	
	Yes	116 (73.0)	
Reported a safety incident in a year ^a	Medication error	25 (15.7)	
	Infection	20 (12.6)	
	Fall	109 (68.6)	
	Pressure ulcer	60 (37.7)	
	Burn	13 (8.2)	
	Others	3 (1.9)	
Safety incident prevention education in a year	No	10 (6.3)	
	Yes	149 (93.7)	
Facility admission capacity (beds)	<100	47 (29.5)	151.69 ± 74.23
	100-199	64 (40.3)	(25.00-296.00)
	200≤	48 (30.2)	
Mean number of residents assigned per a nursing staff (person)	<50	78 (49.1)	
	50-99	46 (28.9)	75.54 ± 63.57
	100≤	35 (22.0)	(10.00-296.00)
Facility evaluation rating	A	119 (74.8)	
	B	20 (12.6)	
	C	20 (12.6)	
Ownership	Public	53 (33.3)	
	Foundation	54 (34.0)	

	Private	52 (32.7)
Proportion of RN (%) ^b	<25	22 (13.8)
	25-49	33 (20.8)
	50-74	75 (47.2)
	75≤	29 (18.2)

M = mean; SD = standard deviation. ^a multiple responses. ^b Proportion of RNs=RNs/(RNs + NAs) x100.

Table 2 Level of patient safety culture and patient safety activities

From: Predictors of Patient Safety Activities among Registered Nurses and Nurse Aides in Long-term Care Facilities

Variables	Total (N=159)		RN (n = 88)		NA (n = 71)	
	M ± SD	Min-Max	M ± SD	Min-Max	M ± SD	Min-Max
Patient safety culture	4.03 ± 0.51	2.11-5.00	3.94 ± 0.52	2.11-4.81	4.15 ± 0.47	3.19-5.00
Leadership of manager	4.02 ± 0.61	1.44-5.00	3.94 ± 0.63	1.44-5.00	4.12 ± 0.58	2.33-5.00
Work attitude	4.35 ± 0.53	2.55-5.00	4.28 ± 0.54	2.50-5.00	4.44 ± 0.50	3.17-5.00
Organizational system	4.16 ± 0.55	2.29-5.00	4.04 ± 0.55	2.29-5.00	4.30 ± 0.52	3.00-5.00
Managerial practice	3.50 ± 0.74	1.20-5.00	3.39 ± 0.74	1.20-4.80	3.64 ± 0.73	1.60-5.00
Patient safety activities	4.29 ± 0.49	2.80-5.00	4.46 ± 0.35	3.57-5.00	4.08 ± 0.56	2.80-5.00
Safety medication	4.05 ± 0.64	1.75-5.00	4.18 ± 0.54	2.13-5.00	3.90 ± 0.73	1.75-5.00
Infection prevention	4.30 ± 0.61	2.17-5.00	4.48 ± 0.45	3.17-5.00	4.08 ± 0.70	2.17-5.00
Fall prevention	4.38 ± 0.52	2.69-5.00	4.53 ± 0.40	3.46-5.00	4.19 ± 0.60	2.69-5.00
Pressure ulcer prevention	4.46 ± 0.71	1.00-5.00	4.75 ± 0.35	3.80-5.00	4.11 ± 0.87	1.00-5.00
Equipment/fire inspection	4.26 ± 0.73	2.33-5.00	4.44 ± 0.65	2.33-5.00	4.04 ± 0.77	2.33-5.00

M = mean; SD = standard deviation; Min = minimum value; Max = maximum value; RN = registered nurse; NA = nurse aide.

Table 3 Comparison of patient safety activities by demographic and job related characteristics of participants (N=159)

From: Predictors of Patient Safety Activities among Registered Nurses and Nurse Aides in Long-term Care Facilities

Characteristics	Categories	Patient safety activities	
		M ± SD	t or F (p)
Occupation	NAs	4.08 ± 0.56	- 5.28 (<.001)
	RNs	4.46 ± 0.35	
Age (years.)	<40	4.07 ± 0.62	0.46 (.713)
	40-49	4.07 ± 0.38	
	50-59	4.19 ± 0.57	
	60≤	3.70 ± 0.70	
Marital status	Single	4.38 ± 0.44	2.47 (.015)
	Married	4.19 ± 0.53	
Education level	High school ^a	4.09 ± 0.63	3.43 (.019) a<b,c,d
	Diploma/associate ^b	4.34 ± 0.39	
	Bachelor ^c	4.39 ± 0.44	
	Graduate ^d	4.34 ± 0.46	
Career at current facility (years)	<1	4.23 ± 0.49	0.81 (.489)
	1-4	4.27 ± 0.54	
	5-9	4.40 ± 0.41	
	10≤	4.32 ± 0.47	
Work shift type	2 shifts ^a	4.12 ± 0.72	8.09 (<.001) a,b,c>d
	3 shifts ^b	4.03 ± 0.58	
	Fixed day shift ^c	4.20 ± 0.62	
	Others ^d	3.80 ± 0.72	
Experiences of reporting safety incident in a year	No	4.13 ± 0.54	-2.47 (.015)
	Yes	4.35 ± 0.46	
Safety incident prevention education in a year	No	4.41 ± 0.55	0.71 (.494)
	Yes	4.28 ± 0.49	
Facility admission capacity (beds)	<100	4.21 ± 0.58	1.59 (.207)
	100-199	4.28 ± 0.50	
	200≤	4.39 ± 0.36	
Mean number of residents assigned per a nursing staff (person)	<50 ^a	4.17 ± 0.51	4.77 (.010) a<c
	50-99 ^b	4.38 ± 0.51	
	100≤ ^c	4.44 ± 0.34	
Facility evaluation rating	A ^a	4.34 ± 0.47	5.64 (.004) a,b>c
	B ^b	4.35 ± 0.46	
	C ^c	3.95 ± 0.53	
Ownership	Public ^a	4.41 ± 0.35	2.39 (.095)
	Foundation ^b	4.23 ± 0.60	
	Private ^c	4.23 ± 0.48	
Proportion of RNs (%) ^e	<25 ^a	4.02 ± 0.62	3.63 (.014) a<d
	25-49 ^b	4.32 ± 0.53	

50-74 ^c	4.29 ± 0.45
75≤ ^d	4.46 ± 0.35

*Including fixed night shift, on-call, and 24-hour shift.

†Proportion of RNs=RNs/(RNs+NAs) x 100

M = mean; SD = standard deviation; yrs = years; NA = nurse aide; RN = registered nurse.

^{a,b,c,d} Scheffe's test.

Table 4 Correlation coefficients of patient safety culture and patient safety activities (N=159)

From: Predictors of Patient Safety Activities among Registered Nurses and Nurse Aides in Long-term Care Facilities

Variables	Patient safety culture r (p)	Subcategories			
		Leadership of manager r (p)	Work attitude r (p)	Organizational system r (p)	Managerial practice r (p)
Patient safety activities	.23 (.004)	.13 (.099)	.30 (<.001)	.26 (<.001)	.11 (.179)
Safety medication	.24 (.002)	.17 (.032)	.32 (<.001)	.26 (.001)	.11 (.181)
Infection prevention	.23 (.004)	.17 (.035)	.28 (<.001)	.24 (<.003)	.10 (.191)
Fall prevention	.18 (.021)	.08 (.313)	.26 (.001)	.23 (.004)	.09 (.262)
Pressure ulcer prevention	-.05 (.509)	-.07 (.394)	.03 (.682)	-.01 (.982)	-.12 (.134)
Equipment/fire inspection	.29 (<.001)	.16 (.049)	.27 (.001)	.28 (<.001)	.30 (<.001)

Table 5 Factors influencing patient safety activities (N=159)

From: Predictors of Patient Safety Activities among Registered Nurses and Nurse Aides in Long-term Care Facilities

Variables	B	SE	β	t	p	Multi-collinearity statistics	
						Tolerance	VIF
(Constant)	2.17	.50		4.35	<.001		
Age	.00	.00	.072	1.03	.306	.83	1.21
Marital status (ref: single)	-.12	.06	-.147	-1.92	.057	.69	1.45
Career at current facility	.00	.00	.106	1.38	.170	.69	1.45
Work shift type (ref: 3 shifts)							
2 shifts	-.02	.11	-.011	-0.14	.887	.72	1.39
Fixed day shift	-.00	.10	-.002	-0.02	.985	.47	2.14
Others ^a	-.36	.12	-.264	-2.95	.004	.51	1.97
Nurses' proportion (%)	-.00	.00	-.149	-1.40	.163	.36	2.77
Facility admission capacity	.00	.00	.057	0.48	.634	.28	3.56
Mean number of residents assigned per a nursing staff	-.00	.01	-.010	-0.11	.916	.43	2.32
Ownership (ref: public)							
Foundation	-.02	.13	-.016	-0.12	.901	.26	3.87
Private	.02	.13	.018	0.15	.884	.26	3.85
Facility evaluation rating (ref: A)							
B	.02	.12	.014	0.18	.861	.68	1.49
C	-.13	.11	-.088	-1.15	.254	.69	1.45
Experiences of reporting safety incident in a year (ref: no)	.12	.08	.109	1.49	.140	.76	1.32
Occupation_RN (ref: NA)	.37	.08	.377	4.64	<.001	.62	1.63
Subcategories of patient safety culture							
Leadership of manager	-.04	.08	-.050	-0.51	.614	.41	2.43
Work attitude	.13	.10	.137	1.23	.222	.33	3.04
Organizational system	.28	.11	.314	2.61	.010	.28	3.55
Managerial practice	-.03	.06	-.047	-0.52	.605	.50	1.99
R ² =.44, Adjusted R ² =.36, F=5.69, p<.001							

SE = standard errors; VIF = variance inflation factors; RN = registered nurse; NA = nurse aide.

^a Others : fixed night shift, on-call, 24-hour.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [rawdata.xlsx](#)
- [AppendixAfinalr.docx](#)