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

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Database

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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 (β = .377, p < .001), organizational system of PSC (β = .314, p < .010), and work shift type (fixed night shift, on-call, 24-hour shift) (β = −.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.
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-β) 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 ≥ 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 LTC 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]. This 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 application

**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.

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**References**


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
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>n (%)</th>
<th>M ± SD (range)</th>
</tr>
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<tr>
<td>Occupation</td>
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<td>71 (44.7)</td>
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<tr>
<td>Gender</td>
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<td>35 (22.0)</td>
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<tr>
<td>Facility evaluation rating</td>
<td>C</td>
<td>20 (12.6)</td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>Public</td>
<td>53 (33.3)</td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>Foundation</td>
<td>54 (34.0)</td>
<td></td>
</tr>
</tbody>
</table>
### Table 1 Proportion of RN (%)\(^b\)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Total (N=159)</th>
<th>RN (n = 88)</th>
<th>NA (n = 71)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;25</td>
<td>Private 52 (32.7)</td>
<td>22 (13.8)</td>
<td>29 (18.2)</td>
</tr>
<tr>
<td>25-49</td>
<td>33 (20.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-74</td>
<td>75 (47.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75≤</td>
<td>29 (18.2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(a\) M = mean; SD = standard deviation. \(b\) 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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total (N=159)</th>
<th>RN (n = 88)</th>
<th>NA (n = 71)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient safety culture</td>
<td>M ± SD</td>
<td>Min-Max</td>
<td>M ± SD</td>
</tr>
<tr>
<td>Leadership of manager</td>
<td>4.03 ± 0.51</td>
<td>2.11-5.00</td>
<td>3.94 ± 0.52</td>
</tr>
<tr>
<td>Work attitude</td>
<td>4.35 ± 0.53</td>
<td>2.55-5.00</td>
<td>4.28 ± 0.54</td>
</tr>
<tr>
<td>Organizational system</td>
<td>4.16 ± 0.55</td>
<td>2.29-5.00</td>
<td>4.04 ± 0.55</td>
</tr>
<tr>
<td>Managerial practice</td>
<td>3.50 ± 0.74</td>
<td>1.20-5.00</td>
<td>3.39 ± 0.74</td>
</tr>
<tr>
<td>Patient safety activities</td>
<td>M ± SD</td>
<td>Min-Max</td>
<td>M ± SD</td>
</tr>
<tr>
<td>Safety medication</td>
<td>4.05 ± 0.64</td>
<td>1.75-5.00</td>
<td>4.18 ± 0.54</td>
</tr>
<tr>
<td>Infection prevention</td>
<td>4.30 ± 0.61</td>
<td>2.17-5.00</td>
<td>4.48 ± 0.45</td>
</tr>
<tr>
<td>Fall prevention</td>
<td>4.38 ± 0.52</td>
<td>2.69-5.00</td>
<td>4.53 ± 0.40</td>
</tr>
<tr>
<td>Pressure ulcer prevention</td>
<td>4.46 ± 0.71</td>
<td>1.00-5.00</td>
<td>4.75 ± 0.35</td>
</tr>
<tr>
<td>Equipment/fire inspection</td>
<td>4.26 ± 0.73</td>
<td>2.33-5.00</td>
<td>4.44 ± 0.65</td>
</tr>
</tbody>
</table>

\(M = \) mean; SD = standard deviation; Min = minimum value; Max = maximum value; RN = registered nurse; NA = nurse aide.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>Patient safety activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M ± SD t or F (p)</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td>NAs</td>
<td>4.08 ± 0.56 - 5.28 (&lt;.001)</td>
</tr>
<tr>
<td></td>
<td>RNs</td>
<td>4.46 ± 0.35</td>
</tr>
<tr>
<td><strong>Age (years.)</strong></td>
<td>&lt;40</td>
<td>4.07 ± 0.62 0.46 (.713)</td>
</tr>
<tr>
<td></td>
<td>40-49</td>
<td>4.07 ± 0.38</td>
</tr>
<tr>
<td></td>
<td>50-59</td>
<td>4.19 ± 0.57</td>
</tr>
<tr>
<td></td>
<td>60≤</td>
<td>3.70 ± 0.70</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td>Single</td>
<td>4.38 ± 0.44 2.47 (.015)</td>
</tr>
<tr>
<td></td>
<td>Married</td>
<td>4.19 ± 0.53</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td>High school</td>
<td>4.09 ± 0.63 3.43 (.019)</td>
</tr>
<tr>
<td></td>
<td>Diploma/associate</td>
<td>4.34 ± 0.39 a,b,c,d</td>
</tr>
<tr>
<td></td>
<td>Bachelor</td>
<td>4.39 ± 0.44</td>
</tr>
<tr>
<td></td>
<td>Graduate</td>
<td>4.34 ± 0.46</td>
</tr>
<tr>
<td><strong>Career at current facility (years)</strong></td>
<td>&lt;1</td>
<td>4.23 ± 0.49 0.81 (0.489)</td>
</tr>
<tr>
<td></td>
<td>1-4</td>
<td>4.27 ± 0.54</td>
</tr>
<tr>
<td></td>
<td>5-9</td>
<td>4.40 ± 0.41</td>
</tr>
<tr>
<td></td>
<td>10≤</td>
<td>4.32 ± 0.47</td>
</tr>
<tr>
<td><strong>Work shift type</strong></td>
<td>2 shifts</td>
<td>4.12 ± 0.72 8.09 (&lt;.001)</td>
</tr>
<tr>
<td></td>
<td>3 shifts</td>
<td>4.03 ± 0.58</td>
</tr>
<tr>
<td></td>
<td>Fixed day</td>
<td>4.20 ± 0.62</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>3.80 ± 0.72</td>
</tr>
<tr>
<td><strong>Experiences of reporting safety incident in a year</strong></td>
<td>No</td>
<td>4.13 ± 0.54 -2.47 (.015)</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>4.35 ± 0.46</td>
</tr>
<tr>
<td><strong>Safety incident prevention education in a year</strong></td>
<td>No</td>
<td>4.41 ± 0.55 0.71 (.494)</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>4.28 ± 0.49</td>
</tr>
<tr>
<td><strong>Facility admission capacity (beds)</strong></td>
<td>&lt;100</td>
<td>4.21 ± 0.58 1.59 (.207)</td>
</tr>
<tr>
<td></td>
<td>100-199</td>
<td>4.28 ± 0.50</td>
</tr>
<tr>
<td></td>
<td>200≤</td>
<td>4.39 ± 0.36</td>
</tr>
<tr>
<td><strong>Mean number of residents assigned per a nursing staff (person)</strong></td>
<td>&lt;50&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.17 ± 0.51 4.77 (.010)</td>
</tr>
<tr>
<td></td>
<td>50-99&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.38 ± 0.51 a,c</td>
</tr>
<tr>
<td></td>
<td>100≤&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.44 ± 0.34</td>
</tr>
<tr>
<td><strong>Facility evaluation rating</strong></td>
<td>A&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.34 ± 0.47 5.64 (.004)</td>
</tr>
<tr>
<td></td>
<td>B&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.35 ± 0.46</td>
</tr>
<tr>
<td></td>
<td>C&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.95 ± 0.53</td>
</tr>
<tr>
<td><strong>Ownership</strong></td>
<td>Public&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.41 ± 0.35 2.39 (.095)</td>
</tr>
<tr>
<td></td>
<td>Foundation&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.23 ± 0.60</td>
</tr>
<tr>
<td></td>
<td>Private&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.23 ± 0.48</td>
</tr>
<tr>
<td><strong>Proportion of RNs (%)</strong>&lt;sup&gt;e&lt;/sup&gt;</td>
<td>&lt;25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.02 ± 0.62 3.63 (.014)</td>
</tr>
<tr>
<td></td>
<td>25-49&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.32 ± 0.53 a,d</td>
</tr>
</tbody>
</table>
50-74  4.29 ± 0.45  
75≤  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

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

**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

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>2.17</td>
<td>.50</td>
<td></td>
<td>4.35</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.00</td>
<td>.00</td>
<td>.072</td>
<td>1.03</td>
<td>.306</td>
<td>.83</td>
<td>1.21</td>
</tr>
<tr>
<td>Marital status (ref: single)</td>
<td>-.12</td>
<td>.06</td>
<td>-.147</td>
<td>-1.92</td>
<td>.057</td>
<td>.69</td>
<td>1.45</td>
</tr>
<tr>
<td>Career at current facility</td>
<td>.00</td>
<td>.00</td>
<td>.106</td>
<td>1.38</td>
<td>.170</td>
<td>.69</td>
<td>1.45</td>
</tr>
<tr>
<td>Work shift type (ref: 3 shifts)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 shifts</td>
<td>-.02</td>
<td>.11</td>
<td>-.011</td>
<td>-0.14</td>
<td>.887</td>
<td>.72</td>
<td>1.39</td>
</tr>
<tr>
<td>Fixed day shift</td>
<td>-.00</td>
<td>.10</td>
<td>-.002</td>
<td>-0.02</td>
<td>.985</td>
<td>.47</td>
<td>2.14</td>
</tr>
<tr>
<td>Others a</td>
<td>-.36</td>
<td>.12</td>
<td>-.264</td>
<td>-2.95</td>
<td>.004</td>
<td>.51</td>
<td>1.97</td>
</tr>
<tr>
<td>Nurses' proportion (%)</td>
<td>-.00</td>
<td>.00</td>
<td>-.149</td>
<td>-1.40</td>
<td>.163</td>
<td>.36</td>
<td>2.77</td>
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<tr>
<td>Facility admission capacity</td>
<td>.00</td>
<td>.00</td>
<td>.057</td>
<td>.48</td>
<td>.634</td>
<td>.28</td>
<td>3.56</td>
</tr>
<tr>
<td>Mean number of residents assigned per a nursing staff</td>
<td>.00</td>
<td>.01</td>
<td>-.010</td>
<td>-0.11</td>
<td>.916</td>
<td>.43</td>
<td>2.32</td>
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<tr>
<td>Ownership (ref: public)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foundation</td>
<td>-.02</td>
<td>.13</td>
<td>-.016</td>
<td>-.12</td>
<td>.901</td>
<td>.26</td>
<td>3.87</td>
</tr>
<tr>
<td>Private</td>
<td>.02</td>
<td>.13</td>
<td>.018</td>
<td>.15</td>
<td>.884</td>
<td>.26</td>
<td>3.85</td>
</tr>
<tr>
<td>Facility evaluation rating (ref: A)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>.02</td>
<td>.12</td>
<td>.014</td>
<td>.18</td>
<td>.861</td>
<td>.68</td>
<td>1.49</td>
</tr>
<tr>
<td>C</td>
<td>-.13</td>
<td>.11</td>
<td>-.088</td>
<td>-1.15</td>
<td>.254</td>
<td>.69</td>
<td>1.45</td>
</tr>
<tr>
<td>Experiences of reporting safety incident in a year (ref: no)</td>
<td>.12</td>
<td>.08</td>
<td>.109</td>
<td>1.49</td>
<td>.140</td>
<td>.76</td>
<td>1.32</td>
</tr>
<tr>
<td>Occupation_RN (ref: NA)</td>
<td>.37</td>
<td>.08</td>
<td>.377</td>
<td>4.64</td>
<td>&lt;.001</td>
<td>.62</td>
<td>1.63</td>
</tr>
<tr>
<td>Subcategories of patient safety culture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership of manager</td>
<td>-.04</td>
<td>.08</td>
<td>-.050</td>
<td>-.51</td>
<td>.614</td>
<td>.41</td>
<td>2.43</td>
</tr>
<tr>
<td>Work attitude</td>
<td>.13</td>
<td>.10</td>
<td>.137</td>
<td>1.23</td>
<td>.222</td>
<td>.33</td>
<td>3.04</td>
</tr>
<tr>
<td>Organizational system</td>
<td>.28</td>
<td>.11</td>
<td>.314</td>
<td>2.61</td>
<td>.010</td>
<td>.28</td>
<td>3.55</td>
</tr>
<tr>
<td>Managerial practice</td>
<td>-.03</td>
<td>.06</td>
<td>-.047</td>
<td>-0.52</td>
<td>.605</td>
<td>.50</td>
<td>1.99</td>
</tr>
</tbody>
</table>

$R^2 = .44$, 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