Nurse-Perceived Patient Adverse Events depend on Nursing Workload

Jeong-Hee Kang a, Chul-Woung Kim b,*, Sang-Yi Lee c

aDepartment of Nursing Science, Youngdong University, Youngdong, Korea. 
bDepartment of Preventive Medicine, College of Medicine, Chungnam National University, Research Institute for Medical Sciences, Daejeon, Korea. 
cDepartment of Health Policy and Management, School of Medicine, Jeju National University, Jeju, Korea.

Received: February 10, 2015 
Revised: October 7, 2015 
Accepted: October 7, 2015 

KEYWORDS:
non-nursing task, 
nursing workload, 
patient adverse event

Abstract
Objectives: The purpose of this study was to investigate the correlation between nursing workload and nurse-perceived patient adverse events.
Methods: A total of 1,816 nurses working in general inpatient units of 23 tertiary general hospitals in South Korea were surveyed, and collected data were analyzed through multilevel logistic regression analysis.
Results: Among variables related to nursing workload, the non-nursing task experience had an influence on all four types of patient adverse events. Nurses with non-nursing tasks experienced patient adverse events—falls (odds ratio (OR) = 1.31), nosocomial infections (OR = 1.23), pressure sores (OR = 1.16), and medication errors (OR = 1.23)—more often than occasionally. In addition, when the bed to nurse ratio was higher, nurses experienced cases of pressure sores more often (OR = 1.35). By contrast, nurses who said the nursing workforce is sufficient were less likely than others to experience cases of pressure sores (OR = 0.78). Hospitals with a relatively high proportion of nurses who perceived the nursing workforce to be sufficient showed a low rate of medication error (OR = 0.28).
Conclusion: The study suggested that the high level of nursing workload in South Korea increases the possibility of patient adverse events.

1. Introduction

Nursing workload, which refers to the direct supervision of patients, may affect the incidence of patient adverse events. That is, the incidence of patient adverse events may increase when the number of patients allocated to each nurse is high and nursing workload is great. Patient adverse events that occur within a hospital not only put patients at a direct disadvantage but also place significant financial burden on the healthcare system [1].

Three variables were used in previous studies to determine nurses’ workload: the number of beds per nurse [2]; the number of patients per nurse (showing the amount of nursing workforce available); and patient severity [3]. Moreover, by measuring the number of
non-nursing tasks performed by nurses, such as transporting patients, delivering and retrieving food trays, and housekeeping duties, the level of nursing workload may be computed [4]. When the number of non-nursing tasks performed by each nurse is high, it may be concluded that there is a heavy workload burden and, thus, that nurses may not be able to properly carry out jobs that require professional skills, such as training and consultation [4]. In other words, when the number of non-nursing tasks performed by nurses increases, patient adverse events may occur because nurses lack the time to provide patients with necessary supervision. This, in turn, may affect the quality of the healthcare service provided at the hospital [4,5].

When a hospital lacks sufficient nursing workforce, patients may not be provided with timely nursing, and patient adverse events, such as medication error, patient falls, nosocomial infections, pressure sores, cardiopulmonary resuscitation failure, and death, may occur [6–9].

Due to the lack of nursing workforce in South Korea, nurses may face considerable workload and have to perform numerous non-nursing tasks [10], and this may influence the incidence of patient adverse events. Comprising 46.0% of the healthcare personnel in South Korea the number of active nurses in the Korean population is 4.8/1,000 people, which is lower than the Organization for Economic Cooperation and Development average of 9.3 [11,12]. Switzerland and Norway had the highest number of nurses/1,000 people: 16.6 and 16.5, respectively, [10]. In other words, nurse staffing in Korea was half of the average in Organization for Economic Cooperation and Development countries and a quarter of that in Northern European countries such as Switzerland and Norway. Furthermore, the number of nurses per acute-stage patient in South Korea is 0.33. This is very low in comparison to the 1.56 nurses in the USA, 1.75 in Norway, and 1.61 in Australia [11]. According to the current state of nursing management pay rates implemented in South Korea, the nursing workforce of South Korean hospitals is not at an optimal level [13].

The purpose of study is to evaluate the workload and the amount of non-nursing tasks performed by nurses who work at tertiary general hospitals and to analyze the causality between patient adverse events and workload, as perceived by nurses.

2. Material and methods

2.1. Participants

A total of 11,731 nurses participated in the union training program, and 5,654 nurses participated in the survey, for a response rate of 48.2%. The present study analyzed 1,816 nurses who worked at the general ward of the 23 tertiary general hospitals whose number of respondents per hospital was 10 or above.

2.2. Data

The dependent variables were the four categories of patient adverse events as perceived by the nurses: medication errors, patient falls, nosocomial infections, and pressure sores. Nurses were asked the question, “How often did you perceive in-hospital accidents and patient side effects over the past year?” for each category, and the answers were rated on a 4-point scale (1 = not at all, 2 = very few times, 3 = occasionally, and 4 = frequently). The patient adverse events perceived by the nurses were classified into dichotomous variables with 0 indicating not at all and very few times and 1 indicating occasionally and frequently.

The major explanatory variable in this study was the workload of the nurses. The workload of the nurses could be measured using three different variables: (1) the amount of the non-nursing tasks performed; (2) the bed to nurse ratio, which is an objective nurse workforce variable; and (3) the nurses’ subjective perception regarding whether or not sufficient workforce is available.

The first of these variables, the amount of non-nursing tasks performed by nurses, was measured using the delivering and retrieving food trays, housekeeping duties, and transporting patients variables. Nurses were asked, “How often did you perform non-nursing tasks over the past year?” Their answers were rated on a 4-point scale (1 = not at all, 2 = very few times, 3 = occasionally, and 4 = frequently). The performance of the non-nursing tasks was classified into dichotomous variables with 0 indicating not at all and very few times and 1 indicating occasionally and frequently. The tasks were also sorted into three categories, delivering and retrieving food trays, transporting patients, and housekeeping duties as follows: not performed at all/performed very few times for all three categories (0); not performed at all/performed very few times for at least one of the three categories (1); performed occasionally/performed frequently for at least one of the three categories (2); and performed occasionally/performed frequently for all three categories (3).

The second of the explanatory variables was the bed to nurse ratio. This is an objective nursing workforce variable. At a tertiary general hospital, there are six possible grades of bed to nurse ratios, with higher grades implying a lower nurse-workforce to bed ratio. In this study, the bed to nurse ratio was classified into < 2.5 beds per nurse (1); 2.5–3.0 beds per nurse (2); and 3.0–3.5 beds per nurse (3).

The third of the explanatory variables was the nurses’ subjective perception of the presence of sufficient workforce. In order to measure the nurses’ subjective perception regarding the sufficiency of their workforce,
three items of the Korean General Unit Nursing Work Index were used. This index is composed of six sub-factors and 26 items, the former being Participation in the decision making process, Nursing process, Adequate nurse staffing, Education for improving quality of care, Organizational support and management of the hospital, and Physician-nurse relationship [14]. In this study, Adequate nurse staffing was used to measure the nurses’ subjective perception of whether or not enough workforce was available around them. This variable was composed of three items, including Enough staff to get the work done. For the nurse-level nurse staffing, the mean of each of the three items in adequate nurse staffing was calculated based on the sum of scores by all of the participating nurses. As for the hospital-level nurse staffing, the mean of each of the three items in adequate nurse staffing was calculated based on the sum of scores by nurses belonging to each hospital.

The hospital-related variables (bed to nurse ratio and hospital ownership type) are items disclosed on the Health Insurance Review & Assessment Service homepage [15]. The hospital ownership types were classified so that small-medium private hospitals and private university hospitals were classified as private hospitals (0) while the national university hospitals, local medical centers, and specialized public hospitals were classified as public hospitals (1). Sex, a nurse-related variable, was sorted as either male (0) or female (1), and education was sorted into 3-year college (0), 4-year university (1), and graduate school (2). Nurse position was sorted into charge nurse (0) and staff nurse (1). Working departments were sorted, based on various branches of internal medicine, into the pediatric department (1), the surgical department (2), and the obstetrics and gynecology department (3).

2.3. Ethical considerations

The data used in this study were collected from a structured self-report questionnaire survey conducted with nurses in May 2010. The survey was conducted after the purpose of the study was explained to nurses participating in a union training program organized by the Health & Medical Workers’ Union, and consent was obtained from participating nurses. The study protocol was approved by the Institutional Review Board (IRB) of Chungnam National University, Daejeon, Korea (IRB No. 14-03).

2.4. Data analysis

Descriptive statistical analysis was conducted to determine the extent of non-nursing tasks performed by nurses as well as the level of experienced patient adverse events. In order to examine the relationship between the nursing workload and experienced patient adverse event at the level of both the nurse and the hospital, a two-stage multilevel logistic regression analysis was carried out. HLM 7 (hierarchical linear model), a multilevel statistical analysis program, was also used.

To determine the suitability of the multilevel analysis model, the null hypothesis at the hospital level was verified. If the null hypothesis that random variance = 0 for the dependent variables at the hospital level is dismissed, it can be concluded that there is a difference in the dependent variables for each hospital. When the differences in the dependent variables between hospitals are confirmed, multilevel analysis can be deemed suitable [16].

The multilevel analysis model used for nurse-perceived medication errors is as follows. A dependent variable here is the medication errors. The dependent variable here (medication errors) is dichotomous, in which there are only two possible outcomes.

Nurse level:

\[ \text{Logit (Medication Error)} = \beta_{0j} + \beta_{1j}(\text{Sex}_{ij}) + \beta_{2j}(\text{Education}_{ij}) + \beta_{3j}(\text{Position}_{ij}) + \beta_{4j}(\text{Clinical experience}_{ij}) + \beta_{5j}(\text{Non_Nursing Task}_{Nurse}_{ij}) + \beta_{6j}(\text{Pediatrics}_{ij}) + \beta_{7j}(\text{Surgery}_{ij}) + \beta_{8j}(\text{Obstetrics and Gynecology}_{ij}) + \beta_{9j}(\text{NWSTF}_{Nurse}_{ij}) \]

Hospital level:

\[ \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Ownership}_{j}) + \gamma_{02}(\text{Bed to Nurse Ratio}_{j}) + \gamma_{03}(\text{Type}_{j}) + \gamma_{04}(\text{NWSTF}_{Hospital}_{j}) + \epsilon_{0j} \]

3. Results

3.1. General characteristics

A majority of the participating nurses were female (99.6%) and staff nurses (92.7%). Most were aged 25–29 years (41.7%) with the next biggest majority aged between 30 years and 39 years (29.0%) followed by younger than 25 years (24.4%) and older than 40 years (3.9%). The average clinical experience in nurses was 6 years with 3–6 years being the most common (31.7%) followed by < 3 years (25.1%), > 10 years (20.0%), and 7–9 years (13.7%). As for education, many of the nurses were 3-year college (50.8%) with 4-year university 43.1%, and graduate or higher 5.2%.

In terms of hospital ownership, there were more private hospitals (82.6%) than public hospitals (17.4%). The bed to nurse ratio was most commonly 2.5–2.9 beds per nurse (47.8%), then < 2.5 beds per nurse (30.4%), and then 3.0–3.4 beds (21.7%; Table 1).

3.2. Performance of non-nursing tasks and the frequency of patient adverse events

The most frequently performed non-nursing tasks among the 1,816 nurses were transporting patients (91.6%), delivering and retrieving food trays (77.9%),
and housekeeping duties (68.6%). The most frequently experienced patient adverse events were falling (57.1%), nosocomial infections (52.4%), pressure sores (45.2%), and medication error (36.9%; Table 2).

Of the nurses who worked at 23 tertiary general hospitals, 92.0% reported transporting patients, 80.4% delivering food and food trays, and 69.6% cleaning the wards. Approximately 59.0% of the nurses at the tertiary general hospitals reported dealing with patients falling, while 52.2% had experience with nosocomial infections, 46.4% with pressure sores, and 36.6% with medication error (Table 3).

### 3.3. The relationship between the nursing workload and patient adverse events

Patient falls: The nursing workload variable that influenced the frequency of patients falling, as experienced by nurses, was the performance of non-nursing tasks. Nurses who performed non-nursing tasks experienced 1.31 times more cases of patients falling than those who did not. Moreover, nurses who worked at public hospitals had 0.49 times fewer cases of patients falling than the nurses who worked at private hospitals.

Nosocomial infection: The nursing workload variable that influenced the amount of nosocomial infections in patients, as experienced by nurses, was the performance of non-nursing tasks. Nurses who performed non-nursing tasks experienced 1.23 times more cases of nosocomial infections than those who did not.

Pressure sores: The nursing variables that influenced the amount of pressure sores in patients, as experienced by nurses, were the performance of non-nursing tasks, bed to nurse ratio, and the nurse’s subjective perception that there was adequate nurse staffing. Nurses who performed non-nursing tasks experienced 1.16 times more cases of pressure sores in patients than those who did not perform non-nursing tasks. When bed to nurse ratios were higher, nurses experienced 1.35 times more cases of pressure sores in patients. In other words, more cases of pressure sores in patients were experienced by nurses in smaller nursing workforces. Nurses who reported that they had adequate nurse staffing around them experienced 0.78 times fewer cases of pressure sores.

Medication error: The nursing workload variables that influenced medication errors were the performance of non-nursing tasks and the nurse’s subjective perception that there was adequate nurse staffing. Hospitals with higher percentages of nurses who reported having enough workforce around them experienced 0.28 times fewer cases of medication errors; nurses who performed non-nursing tasks experienced 1.23 times more cases of medication error than those who did not. Nurses who worked at public hospitals experienced 0.42 times fewer cases of medication error than those who worked at private hospitals (Table 4).

### 4. Discussion

Through this study, it was found that 3.6–5.7 out of every 10 nurses who work at the general hospital ward of tertiary general hospitals in South Korea had experienced patient adverse events in the past year.

In the present study, workload-related variables affected nurse-perceived patient adverse events. Workload-related variables of nurses can be classified into non-professional workload, such as nurses’

---

**Table 1.** General nurse-level and hospital-level characteristics of participants.

| Variable* | n   | %   |
|-----------|-----|-----|
| Nurse level |     |     |
| Sex        |     |     |
| Female     | 1,808 | 99.6 |
| Male       | 8    | 0.4 |
| Age (y)    |     |     |
| < 25       | 444  | 24.4 |
| 25–29      | 757  | 41.7 |
| 30–39      | 527  | 29.0 |
| ≥ 40       | 71   | 3.9 |
| Clinical experience (y) |     |     |
| < 3        | 456  | 25.1 |
| 3–6        | 575  | 31.7 |
| 7–9        | 249  | 13.7 |
| ≥ 10       | 363  | 20.0 |
| Education  |     |     |
| College    | 922  | 50.8 |
| University | 783  | 43.1 |
| Graduate   | 95   | 5.2 |
| Position   |     |     |
| Staff nurse | 1,684 | 92.7 |
| Charge nurse | 132  | 7.3 |
| Total      | 1,816 | 100.0 |
| Hospital level |     |     |
| Ownership  |     |     |
| Private    | 19   | 82.6 |
| Public     | 4    | 17.4 |
| Bed to nurse ratio |     |     |
| < 2.5      | 7    | 30.4 |
| 2.5–2.9    | 11   | 47.8 |
| 3.0–3.4    | 5    | 21.7 |
| Total      | 23   | 100.0 |

*Variables of age, education, and clinical experience had 17, 16, and 173 missing cases, respectively.

**Table 2.** Distribution of nurse-perceived patient adverse events, non-nursing tasks: nurse level.

| Variables | n   | %   |
|-----------|-----|-----|
| Patient adverse events* |     |     |
| Medication error | 671 | 36.9 |
| Patients fall | 1,037 | 57.1 |
| Nosocomial infection | 952 | 52.4 |
| Pressure sore | 820 | 45.2 |
| Non-nursing tasks† |     |     |
| Delivering and retrieving food trays | 1,415 | 77.9 |
| Housekeeping duties | 1,246 | 68.6 |
| Transporting patients | 1,663 | 91.6 |

*Nurses were asked whether these adverse events had occurred occasionally or frequently in the past year, involving them or their patients; †Percentage of nurses who performed the non-nursing tasks occasionally or frequently.
performance of non-nursing tasks (housekeeping duties, transporting patients, and delivering food and food trays), and professional workload, such as nurse’s subjective perception that there was adequate nurse staffing and bed to nurse ratio.

All three nursing workload variables handled in this study influenced nurses’ experience with patient adverse events. In particular, nurses’ performance of non-nursing tasks was a significant explanatory variable for the four categories of patient adverse events (medication error, nosocomial infection, patient fall, and pressure sore). Performance of non-nursing tasks was strongly related to patient fall and medication error [4].

First, for non-professional workload, Nurses in South Korea quite frequently perform non-nursing tasks, even in tertiary general hospitals, where the nursing workforce is comparatively large. About 6.8—9.1 out of 10 nurses working at the general hospital ward of tertiary general hospitals had performed non-nursing tasks, such as housekeeping duties, transportation of patients, and delivery of food and food trays, in the past year. The performance of the non-nursing tasks investigated in this study was difficult to directly compare to those found in previous studies because the questionnaires employed by the studies differed. That is to say, while the questionnaire used in the current study dealt with performances of nurses in the past year, the questionnaire used in the International Hospital Outcomes Study dealt with performances of nurses in the last shift. According to nurses’ performance of non-nursing tasks worldwide, as measured by the International Hospital Outcomes Study, transporting patients was most common among nurses in the USA (45.7%), with those in Canada (33.3%) and Germany (53.7%) following. Delivering food and food trays was the non-nursing task most common among nurses in Germany (71.8%), with those in the USA (42.5%) and Canada (39.7%) following. Housekeeping duties were more commonly performed by nurses in

### Table 3. Distribution of nurse-perceived patient adverse events, non-nursing tasks: hospital level.

| Patient adverse events | Medication error | Patients fall | Nosocomial infection | Pressure sore |
|------------------------|-----------------|---------------|----------------------|--------------|
| Mean                   | 36.6            | 59.0          | 52.2                 | 46.4         |
| SD                     | 12.7            | 12.9          | 11.1                 | 11.0         |
| Minimum                | 21.0            | 38.2          | 29.4                 | 21.1         |
| 25th Percentile        | 24.0            | 48.8          | 44.0                 | 39.2         |
| 75th Percentile        | 45.2            | 67.8          | 61.0                 | 53.8         |
| Maximum                | 64.4            | 86.5          | 70.8                 | 62.5         |
| Non-nursing tasks      |                 |               |                      |              |
| Delivering & retrieving food trays | 80.4 | 8.5 | 51.5 | 77.8 |
| Housekeeping duties    | 69.6            | 14.0          | 42.3                 |              |
| Transporting patients  | 92.0            | 8.4           | 64.4                 | 88.2         |

### Table 4. Nurse-perceived patient adverse events correlated to nurse’s workload.

| Fixed effect                 | Medication error | Patients fall | Nosocomial infection | Pressure sore |
|------------------------------|------------------|---------------|----------------------|--------------|
|                              | OR               | CI            | OR                   | CI           |
| Hospital-level               |                  |               |                      |              |
| Ownership (ref. Private)     | 0.41             | 0.30—0.60     | 0.49                 | 0.33—0.72    |
| Bed to nurse ratio           | 0.96             | 0.67—1.37     | 1.07                 | 0.81—1.42    |
| Nurse staffing_hospital†     | 0.28*            | 0.10—0.77     | 0.35                 | 0.12—1.03    |
| Nurse-level                  |                  |               |                      |              |
| Sex (ref. Female)            | 0.20             | 0.02—1.75     | 0.07                 | 0.01—0.53    |
| Clinical experience          | 1.01             | 0.98—1.04     | 1.04*                | 1.01—1.07    |
| Education                    | 1.05             | 0.90—1.23     | 0.94                 | 0.79—1.13    |
| Position                     | 0.82             | 0.53—1.27     | 1.57                 | 0.94—2.61    |
| Work department (ref. Medicine) | 1.01           | 0.95—1.67     | 0.95                 | 0.55—1.64    |
| Pediatrics                   | 0.91             | 0.69—1.19     | 0.60                 | 0.46—0.78    |
| Surgery                      | 0.98             | 0.42—2.29     | 0.30                 | 0.19—0.50    |
| Obstetrics and gynecology    | 1.23             | 1.06—1.42     | 1.31                 | 1.13—1.52    |
| Non-nursing tasks            | 0.91             | 0.76—1.10     | 0.98                 | 0.74—1.31    |
| Nurse staffing_nurse‡        | 0.14†            | 0.18†         | 0.19†                | 0.09†        |

*p < 0.05, †p < 0.01, ‡Nurse staffing_hospital: The mean of each of the three items in adequate nurse staffing was calculated based on the sum of scores by nurses belonging to each hospital, †Nurse staffing_nurse: The mean of each of the three items in adequate nurse staffing was calculated based on the sum of scores by all of the participating nurses. CI = confidence interval; OR = odds ratio.
Nursing workload and patient adverse events

Canada (42.9%) than in the USA (34.3%) [5]. Moreover, in the present study, the important workload-related variables that affect the four types of nurse-perceived patient adverse events (medication errors, falls, nosocomial infections, pressure sores) were nonprofessional workloads. These results are consistent with those of previous studies in which delivering food and food trays showed a correlation with patient falls, and transporting patients showed a correlation with errors in intravenous fluid administration [4].

In addition, for nurse’s subjective perception that there was adequate nurse staffing from variables related to professional workload, the high workload of nurses in South Korea was also confirmed through the nurse’s subjective perception that there was adequate nurse staffing. Only 8.7% of the participating nurses agreed with the first of the three categories, Enough staff to get the work done, in regard to the nurse’s subjective perception that there was adequate nurse staffing. Furthermore, only 6.7% agreed that Enough registered nurses on staff to provide quality patient care, while 14.3% agreed that Adequate support services allow nurses to spend time with patients. While the subjective awareness that there is adequate nurse staffing in South Korea was in the 10–19% range, the subjective perception that there was enough workforce in major abroad hospitals was, even at the lowest, high in the 20–29% range. In a study conducted abroad using the same questions [5], 38.1% of the nurses in Scotland, 36.5% in Germany, 35.2% in Canada, 34.4% in the United States, and 29.0% in England agreed that Enough staff to get the work done; 37.7% of the nurses in Germany, 37.4% in Canada, 36.3% in Scotland, 33.4% in the USA, and 28.4% in England agreed that Enough registered nurses on staff to provide quality patient care. About 52.9% of the nurses in Germany, 43.1% in the USA, 42.5% in Canada, and 41.1% in Scotland and England agreed with the statement that Adequate support services allow nurses to spend time with patients [5]. Nurse’s subjective perception that there was adequate nurse staffing, which may be seen as an indicator of subjective nursing workload, had significant relevance to nurses’ experience with pressure sores and medication errors. This was confirmed in previous studies as well; nurses in Finland were less likely to experience patient adverse events, such as medication error, patient fall, nosocomial infection, and pressure sores, when they thought that the nursing workforce around them was sufficient [17]. Similarly, nurses in Swiss hospitals were less likely to experience medication error, nosocomial infection, and pressure sores in patients when they thought that the nursing workforce had sufficient resources [9].

When professional workload out of the nursing workload was bed to nurse ratio, the bed to nurse ratio, which can be seen as an objective workload variable, was significantly related to nurses’ experience with pressure sores. It was reported in previous studies that patient adverse events, such as medication error, pressure sores, and patient fall, may be decreased when more nursing workforce is provided [18]. Indeed, the incidence rate of medication error and pressure sores was decreased at the University of Iowa Hospitals and Clinics, Iowa City, IA, USA when the ratio of nursing staff was higher or when the ratio of the nursing time provided by the nurses themselves was higher [7]. In addition, when the average score for nurses’ experience of patient adverse events was compared in hospitals in The Netherlands and Finland after dividing the patient-to-nurse ratio into three groups (< 4 patients, 5—9 patients, and > 10 patients per nurse), the average score for nurses’ experience with patients fall was the highest in the Dutch hospital for the group with over 10 patients per nurse, while the average score for nurses’ experience with medication error was the highest in the group of 5—9 patients per nurse. Furthermore, in the Finnish hospital, the average scores for nurses’ experience with both patients fall and nosocomial infections was the highest in the group of over 10 patients per nurse [19].

In the current study, we empirically showed that the nurses’ experience of patient adverse events and high nursing workload are related. Workload that was high in terms of both subjective and objective workload variables was related to high levels of nurses’ experience of patient adverse events, and the burden of having to perform non-nursing tasks was related to nurses’ experience with all types of patient adverse events. If nursing workload, which plays a vital role in enhancing the quality of patient safety and nursing services in hospitals, can be decreased, then patient safety may be ensured, and the quality of nursing services may be increased.

Conflicts of interest

All authors have no conflicts of interest to declare.

Acknowledgments

This work was supported by research fund of Chungnam National University (2014-2152-01).

References

1. De Vries EN, Ramrattan MA, Smorenburg SM, et al. The incidence and nature of in-hospital adverse events: a systematic review. Qual Saf Health Care 2008 Jun;17(3):216–23.
2. Duffield C, Diers D, O’Brien-Pallas L, et al. Nursing staffing, nursing workload, the work environment and patient outcomes. Appl Nurs Res. 2011 Nov;24(4):244–55.
3. Graf CM, Millar S, Feiteau C, et al. Patients’ needs for nursing care: beyond staffing ratios. J Nurs Admin 2003 Feb;33(2):76–81.
4. Al-Kandari F, Thomas D. Perceived adverse patient outcomes correlated to nurses’ workload in medical and surgical wards of
selected hospitals in Kuwait. J Clin Nurs 2008 Feb;18(4):581–90.
5. Aiken LH, Clarke SP, Sloane DM, et al. Nurses’ reports on hospital care in five countries. Health Aff (Millwood) 2001 May–Jun; 20(3):43–53.
6. Aiken LH, Clarke SP, Sloane DM, et al. Hospital nurse staffing and patient mortality, nurse burn out and job dissatisfaction. JAMA 2002 Oct 23–30;288(16):1987–93.
7. Blegen MA, Goode CJ, Reed L. Nurse staffing and patient outcomes. Nurs Res. 1998 Jan-Feb;47(1):43–50.
8. Needleman J, Buerhaus P, Mattke S, et al. Nurse-staffing levels and the quality of care in hospitals. New Engl J Med 2002 May 30;346(22):1715–22.
9. Schubert M, Glass TR, Clarke SP, et al. Rationing of nursing care and its relationship to patient outcomes: the Swiss extension of the International Hospital Outcomes Study. Int J Qual Health Care 2008 Aug;20(4):227–37.
10. Federation of Korean Trade Union Research Center. Labor crisis, nursing crisis: analysis of hospital nurse staffing. Seoul (Korea): Federation of Korean Trade Union Research Center; 2011.
11. Kim JK. Job satisfaction and patient satisfaction related to nurse staffing. Korean Acad Nurs Admin 2007;13(1):98–108.
12. Organization for Economic Cooperation and Development. OECD health data: statistics and indicators for 30 countries. Paris: Meadowbrook; 2013.
13. Institute for Hospital Nurses Association. 2009 Survey of Hospital Nurses working conditions (2010, May). Seoul [Internet]. Available from: http://www.khna.or.kr/ [accessed 28.06.10].
14. Kim CW, Lee SY, Kang JH, et al. Application of the Revised Nursing Work Index to evaluate the nurses’ work environments in South Korean hospitals. Asian Nursing Research 2013 Sep;7(3):128–35.
15. Institute for Health Insurance Review & Assessment. Hospital details information (2010, May). Seoul [Internet]. Available from: http://www.hira.or.kr/main.do [accessed 28.06.10].
16. Raudenbush SW, Bryk AS. Hierarchical Linear Models Applications and Data Analysis Methods: Advanced Quantitative Techniques in the Social Sciences Series. 2nd ed. Thousand Oaks (CA): Sage Publications; 2002.
17. Tervo-Heikkinen T, Partanen P, Aalto P, et al. Nurses’ work environment and nursing outcomes: a survey study among Finnish university hospital registered nurses. Int J Nurs Pract 2008 Oct;14(5):357–65.
18. Huston CJ. Outcomes measurement in healthcare. New imperatives for professional nursing practice. Nurs Case Manag 1999 Jul-Aug;4(4):188–95.
19. Hinno S, Partanen P, Vehviläinen-Julkunen VK. Nursing activities, nurse staffing and adverse patient outcomes as perceived by hospital nurses. J Clin Nurs 2011 Jun;21(11–12):1584–93.