Factors affecting patient safety culture in a university hospital under the universal health insurance system
A cross-sectional study from Japan

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Abstract
We conducted a cross-sectional study of patient safety culture aimed at examining the factors that influence patient safety culture in university hospitals under a universal health insurance system. The Hospital Survey on Patient Safety Culture developed by the Agency for Healthcare Research and Quality was used. The survey was distributed to 1066 hospital employees, and 864 responded. The confirmatory factor analysis showed a good fit of the results to the 12-composites model. The highest positive response rates were for “(1) Teamwork within units” (81%) and “(2) Supervisor/manager expectations and actions promoting patient safety” (80%), and the lowest was for “(10) Staffing” (36%). Hayashi’s quantification theory type 2 revealed that working hours per week had the greatest negative impact on patient safety culture. Under a universal health insurance system, workload and human resources might have a significant impact on the patient safety culture.

Abbreviations: AHRQ = Agency for Healthcare Research and Quality, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual.

Keywords: cross-sectional study, factor, patient safety culture, universal health insurance system, university hospital

1. Introduction
Patient safety is an essential component of healthcare quality and safety that should be given the highest priority. However, a number of studies have shown that many opportunities exist for adverse events to occur in general healthcare environments. It is estimated that 98,000 Americans die each year as a result of medical errors that occur in hospitals.[1] Population-based data from the Colorado and Utah Medical Practices Study lead to estimates that preventable adverse events in outpatient settings in the U.S. cause 75,000 hospitalizations annually, with 4839 permanent serious illnesses and 2587 deaths.[2] A systematic review of reports on adverse events during hospitalization found that 9.2% of hospitalizations involved adverse events, of which 43.5% were preventable and 7.4% were fatal.[3] These unintended adverse events result in hospital admissions,[2] longer hospital stays,[4] increased medical expenditures,[4,5] and serious permanent injury or death,[4,6] which is a serious problem for individual patients, hospitals, and society.

A decisive factor in improving the quality and safety of healthcare is fostering an organization’s patient safety culture.[7] The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization’s health and safety management.[8] Many reports suggest that patient safety culture is positively correlated with healthcare quality and safety in facilities, including fewer medical incidents,[9] fewer surgical site infections,[10] less burnout among staff,[11] and reduced staff absenteeism and turnover intentions.[12] Therefore, in order to improve patient safety culture, health-care organizations need to identify the factors that positively influence that culture.[13]
Several studies on factors affecting patient safety culture have been reported. A survey of nursing units in 8 North Carolina hospitals suggested that frequency of contact undergirds relationships between leaders and members and fosters a patient safety culture.[14] According to a systematic review conducted by Weaver et al, interventions such as executive walkrounds, interdisciplinary rounds, team training, or communication initiatives in acute care settings can nurture a patient safety culture.[15] A survey of hospitals with >300 beds and electronic medical record systems in Japan, excluding university hospitals, suggests that the number of days off, the presence of a hospital mission statement on patient safety, and the participation rate for in-hospital patient safety workshops are important factors in fostering a patient safety culture.[16] Because each of these individual studies is limited and heterogeneous in terms of the countries, hospitals, departments, or professions covered, further studies in various settings are needed to increase their generalizability.

In Japan, medical accidents were recognized only as issues of individual negligence, rather than those that concerned the entire organization, until 2000. From 1999 to early 2000, a series of serious medical accidents occurred in Japan, including an error regarding the surgical site due to a patient scheduled for heart surgery being mistaken for one scheduled for lung surgery and incidents where antiseptic solution rather than anticoagulants were administered intravenously to postoperative patients. In response to these medical accidents, in October 2002, hospitals in Japan were obliged to ensure that patient safety was being managed and maintained. In April 2003, university hospitals were required to establish dedicated patient safety managers and management departments. In April 2007, medical institution administrators were required to formulate guidelines that ensured patient safety, form safety management committees, provide training for employees, and assign a person who would be responsible for the safe use of drugs and medical equipment. In general, university hospitals are considered to have different regulations and resources related to patient safety management than other hospitals,[17] which calls for a university hospital-specific study. Furthermore, Japan has one of the few universal health insurance systems in the world. This is one of the most distinctive features of Japanese healthcare and may have a significant impact on the patient safety culture. The universal health insurance system guarantees all citizens a public medical insurance that allows them to freely choose medical institutions, and to receive advanced medical care at low costs, which might result in many patients and increased workload for medical personnel. Therefore, in this study, we quantitatively examined patient safety culture in university hospitals using a questionnaire for all departments to determine the factors that affect patient safety culture under a universal health insurance system.

2. Methods

2.1. Setting

The Osaka Medical and Pharmaceutical University Hospital, the subject of this study, is a university hospital located in Takatsuki City (population: 350,000) in Osaka with 832 beds, 31 departments, and approximately 3000 staff members. The daily work of staffing in medical safety management is carried out by seven core members including the director of the medical safety department. The medical safety committee, which includes approximately 15 other members, meets monthly to review the incidents that have occurred and to conduct medical safety activities.

2.2. Design

In this study, cross-sectional research was conducted. Among 2949 staff members who were in our hospital from 2015 to 2016, staff members randomly selected from each group of experience period (1–5 years, 6–15 years, and 16 years or more) were included as survey subjects. Subjects were recruited using a list of employee numbers to equalize the number of years of experience groups. This cross-sectional research measured patient safety culture through questionnaires administered to employees at a university hospital, compared it to patient safety culture in the U.S., and further examined its relationship to employee background, such as job title and years of work experience.

2.3. Questionnaire

The Japanese version of the Hospital Survey on Patient Safety Culture, developed by the Agency for Healthcare Research and Quality (AHRQ), was authored and validated by 2 bilingual medical safety researchers with a good command of English in a previous study.[16] In this study, this Japanese version was used as a questionnaire to measure patient safety culture.[8,16] Furthermore, it has been reported that the patient safety culture in Japan fits well with the AHRQ’s 12-composites model of patient safety culture.[17] The survey instrument consists of 42 items related to patient safety. All 42 items are either on a 5-point Likert scale (Strongly disagree = 1; Disagree = 2; Neither = 3; Agree = 4; Strongly agree = 5) or on a 5-point frequency scale (Never = 1; Rarely = 2; Sometimes = 3; Most of the time = 4; Always = 5), which are grouped into the following 12 composites of patient safety culture: teamwork within units; supervisor/manager expectations and actions promoting patient safety; organizational learning–continuous improvement; management support for patient safety; overall perceptions of patient safety; feedback and communication about error; communication openness; frequency of events reported; teamwork across units; staffing; handoffs and transitions; and non-punitive response to error. The survey instrument also grades (E) respondents’ perception for an overall grade on patient safety on a 5-point scale (Failing = 1; Poor = 2; Acceptable = 3; Very good = 4; Excellent = 5) and includes items related to the respondent’s background, for example, job title, gender, age, and years of experience.

2.4. Data processing

Several items of the instrument were negatively worded. Disagreeing or responding “Never” to a negatively worded item indicates a positive response, and scores were reversed during analysis.[8,18]

2.5. Statistical analysis

Confirmatory factor analysis was used to examine whether responses to the questionnaire fit the AHRQ’s 12-composites model of patient safety culture.[8] The model was estimated using the method of maximum likelihood estimation, and the goodness of fit of the estimated model was evaluated using the root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR). The RMSEA index was <0.06, or the SRMR index was <0.08, as the indicators of the fitness of the confirmatory factor analysis.[19] The positive response rate in the 12 composites was calculated as follows.[8] The positive response rate for each item was determined using the number of people who answered 4 or 5 as the numerator and the number of people who answered 1, 2, 3, 4, or 5 as the denominator. For each composite, the mean of the positive response rate for each item was calculated.
Category scores were obtained by applying Hayashi’s quantification theory type 2[20–22] with the respondent’s background as the explanatory variable and “(E) Overall grade on patient safety” as the objective variable to examine the impact of the respondent’s background on patient safety culture. The range of scores defined as the difference between the maximum and minimum of the category scores obtained for each explanatory variable was calculated,[23] and the influence on patient safety culture was estimated. Hayashi’s quantification theory type 2 is a linear discriminant analysis of categorical data. This method combines categorical and dummy variables (i.e., 0 or 1) to allow the analysis of quantitative relationships between objective and explanatory variables.[24] Statistical analysis was performed using R version 3.6.2.

2.6. Ethical considerations

Respondents’ information is treated in an anonymized state, and personal information is fully considered. All procedures involving human subjects were approved by the ethics committee of Osaka Medical and Pharmaceutical University (Approval ID: RIN-964, 2886).

3. Results

3.1. Study population

The questionnaires were distributed to 1066 staff members, and 864 responded (81.1% response rate).

3.2. Characteristics of the respondents

The professional backgrounds of the respondents are shown in Table 1. “Nurse” (40.3%) was the most common, followed by “Physician” (27.9%), “Medical staff” (15.5%), and “Unit assistant/clerk/secretary” (13.5%). “Female” (55.7%) was more common, while there was no significant difference in age. Asked how many years of occupational experience they had, 36.9% of respondents answered 1 to 10 years; 25.5% answered “11 to 18 years”; and 34.7% answered “≥19 years.” Asked how many years of experience they had in their current facility, 34.6% answered 1 to 7 years; 24.7% answered “8 to 14 years”; and 39.2% answered “≥15 years.” Asked how many years of experience they had in their current department, 34.8% answered 1 to 3 years; 19.9% answered “4 to 6 years”; and 43.5% answered “≥7 years.” The most common working hours per week were “40 to 59 hours” (57.1%), followed by “20 to 39 hours” (16.8%), “60 to 79 hours” (13.5%), and “≥80 hours” (6.4%). Managers accounted for 25.8% of the respondents; 88.3% had the opportunity to interact with patients; and 70.0% had the opportunity to directly care for patients.

3.3. Results of confirmatory factor analysis

The confirmatory factor analysis results indicate the fitness of the proposed model60 (RMSEA = 0.048; SRMR = 0.050). High standard partial regression coefficients (range: 0.471–0.920) were obtained (Table 2).

3.4. Percentage of positive scores of 12 patient safety culture composites

Figure 1 shows the positive response rate for the 12 composites of patient safety culture. The highest positive response rate was found in “(1) Teamwork within units” (81%), while the lowest was found in “(10) Staffing” (36%). Our results were generally comparable to those of a survey25 of 447,584 respondents at 680 U.S. hospitals.

3.5. Effects of characteristics of respondents on an overall grade on patient safety

Regarding “(E) Overall grade on patient safety,” 4.9% responded “Excellent,” and 48.6% responded “Very good,” with more than half of the positive evaluations (Table 3). Hayashi’s quantification theory type 2 revealed the most negative impact of working hours per week on “(E) Overall grade on patient safety” (Fig. 2).

4. Discussion

Patient safety should be a top priority, and the development of an organization’s patient safety culture is a critical factor in achieving this.[22] In the current study, we investigated the extent to which a patient safety culture was fostered in universities under a universal health insurance system, and the factors that influence it. As a result, the confirmatory factor analysis showed that the results of this study were well suited to the AHRQ’s 12-composites model of patient safety culture (Table 2).[23] According to the positive response rate results, patient safety culture in our hospital was comparable to the U.S. results from the AHRQ survey;[23] Hayashi’s quantification theory type 2[22] showed that working hours per week had the most negative impact on “(E) Overall grade on patient safety” (Fig. 2).

The positive response rate for the 12 composites of patient safety culture in our hospital was similar to the survey result in the U.S. (Fig. 1).[23] Fujita et al found that patient safety culture in the U.S. was higher than in Japan and Taiwan.[26] These facts suggest that patient safety culture in our hospital is as high as it is in the U.S. According to a study by Hamdan et al in a Palestinian public hospital, patient safety initiatives and quality improvement programs were effective in fostering patient safety culture.[27] It is well recognized that patient safety training and education can improve patient safety attitudes and patient outcomes.[28] In our hospital, various patient safety initiatives have been ongoing for more than a decade under the leadership of the medical safety management department, such as patient safety slogan competitions in which patients participate, patient safety training camps, in-hospital patient safety workshops, and efforts to improve underreporting of incidents. The high level of patient safety culture in our hospital is largely because we have been honestly continuing these efforts. Furthermore, at least in Japanese university hospitals, it is mandatory to have a full-time patient safety staff consisting of three or more doctors, nurses, and pharmacists, while in other general hospitals, it is not.[13] This may also be a factor in the high patient safety culture in our hospital compared to the Japanese results.[24] The factor with the highest percentage of positive responses among the 12 composites was “(1) Teamwork within units” (81%). This was consistent with the U.S. (82%), Japan (70%),[23] and Teleg et al’s findings (85%).[22] In contrast, the lowest factors were “(10) Staffing” (36%), “(12) Nonpunitive response to error” (49%), and “(11) Handoffs and transitions” (51%). This was exactly the same in the U.S.[22] and in the Japanese study.[24] This suggests that perceptions of staffing shortages in the field, punitive responses to medical incidents, and patient safety issues during patient interdepartmental transfers and handovers are common across both cases. On the other hand, “(10) Staffing” was as low as 36% in our hospital, while it was 54% in the U.S., which was a large difference. This may be an indication of the perception that the staff of our hospital have more work and care for more patients than staff in the U.S. It is possible that Japan’s universal health insurance system explains these differences. In fact, Stoyanova et al reported that the distribution of positive responses could be explained by the cultural, organizational, and healthcare system differences.[29] In addition, the survey results of Teleg et al[22] are significantly different from the results of our hospital and the U.S.,[22] in that “(11) Handoffs and transitions” were higher (73%) and “(8) Frequency of events reported” was lower (32%). The fact that this study only included Turkey’s general surgery departments may have
made a difference. These findings suggest that each country and department has a unique patient safety culture.

In order to foster a patient safety culture, healthcare policymakers and managers need to understand the factors that negatively influence patient safety culture and consider how to respond to them. There have been reports that a work shift and occupational burnout negatively affect patient safety culture, and that healthcare workers who work under 40 hours or >60 hours per week have lower patient safety culture scores than those who work 40–59 hours. It has been reported that job satisfaction has the most positive impact on patient safety culture, whereas stress recognition has the most negative

| Characteristic                  | Frequency | Proportion (%) |
|--------------------------------|-----------|----------------|
| Years of survey                |           |                |
| 2015                           | 440       | 50.9           |
| 2016                           | 424       | 49.1           |
| What is your staff position in this hospital? | | |
| Physician                      | 241       | 27.9           |
| Nurse                          | 348       | 40.3           |
| Medical staff                  | 134       | 15.5           |
| Unit assistant/clerk/secretary | 117       | 13.5           |
| Other                          | 18        | 2.1            |
| Missing                        | 6         | 0.7            |
| Gender                         |           |                |
| Male                           | 370       | 42.8           |
| Female                         | 481       | 55.7           |
| Missing                        | 13        | 1.5            |
| Age (yr)                       |           |                |
| <20                            | 2         | 0.2            |
| 20–29                          | 184       | 21.3           |
| 30–39                          | 221       | 25.6           |
| 40–49                          | 229       | 26.5           |
| ≥50                            | 212       | 24.5           |
| Missing                        | 16        | 1.9            |
| How long have you worked in your current specialty or profession? | | |
| 1–2 yr                         | 79        | 9.1            |
| 3–5 yr                         | 99        | 11.5           |
| 6–10 yr                        | 141       | 16.3           |
| 11–18 yr                       | 220       | 25.5           |
| ≥19 yr                         | 300       | 34.7           |
| Missing                        | 25        | 2.9            |
| How long have you worked in this hospital? | | |
| 1–2 yr                         | 95        | 11.0           |
| 3–4 yr                         | 92        | 10.6           |
| 5–7 yr                         | 112       | 13.0           |
| 8–14 yr                        | 213       | 24.7           |
| ≥15 yr                         | 339       | 39.2           |
| Missing                        | 13        | 1.5            |
| How long have you worked in your current hospital work area/unit? | | |
| 1 yr                           | 100       | 11.6           |
| 2 yr                           | 100       | 11.6           |
| 3 yr                           | 100       | 11.6           |
| 4–6 yr                         | 172       | 19.9           |
| ≥7 yr                          | 376       | 43.5           |
| Missing                        | 16        | 1.9            |
| Typically, how many hours per week do you work in this hospital? | | |
| <20 h                          | 14        | 1.6            |
| 20–39 h                        | 145       | 16.8           |
| 40–59 h                        | 493       | 57.1           |
| 60–79 h                        | 117       | 13.5           |
| ≥80 h                          | 55        | 6.4            |
| Missing                        | 40        | 4.6            |
| Are you a manager currently?   |           |                |
| Yes                            | 223       | 25.8           |
| No                             | 626       | 72.5           |
| Missing                        | 15        | 1.7            |
| In your staff position, do you typically have direct interaction or contact with patients? | | |
| Yes                            | 763       | 88.3           |
| No                             | 90        | 10.4           |
| Missing                        | 11        | 1.3            |
| In your staff position, do you typically have direct care for patients? | | |
| Yes                            | 605       | 70.0           |
| No                             | 241       | 27.9           |
| Missing                        | 18        | 2.1            |
### Table 2
Results of confirmatory factor analysis for patient safety culture composites in the current hospital.

| Composites                          | Codes | Items                                                                 | Standard partial regression coefficients |
|-------------------------------------|-------|----------------------------------------------------------------------|------------------------------------------|
| 1. Teamwork within units            | A1    | People support one another in this unit.                              | 0.774                                    |
|                                     | A3    | When a lot of work needs to be done quickly, we work together         | 0.764                                    |
|                                     |       | as a team to get the work done.                                       |                                          |
|                                     | A4    | In this unit, people treat each other with respect.                   | 0.768                                    |
|                                     | A11   | When one area in this unit gets really busy, others help out.         | 0.581                                    |
| 2. Supervisor/manager expectations  | B1    | My supervisor/manager says a good word when he/she sees a job done    | 0.602                                    |
| and actions promoting patient safety|       | according to established patient safety procedures.                  |                                          |
|                                     | B2    | My supervisor/manager seriously considers staff suggestions for       | 0.701                                    |
|                                     |       | improving patient safety.                                             |                                          |
|                                     | B3*   | Whenever pressure builds up, my supervisor/manager wants us to work   | 0.614                                    |
|                                     |       | faster, even if it means taking shortcuts.                            |                                          |
|                                     | B4*   | My supervisor/manager overlooks patient safety problems that happen   | 0.672                                    |
|                                     |       | over and over.                                                        |                                          |
| 3. Organizational learning–Continuous    | A6    | We are actively doing things to improve patient safety.               | 0.649                                    |
| improvement                          | A9    | Mistakes have led to positive changes here.                           | 0.662                                    |
|                                     | A13   | After we make changes to improve patient safety, we evaluate          | 0.506                                    |
|                                     |       | their effectiveness.                                                  |                                          |
| 4. Management support for patient    | F1    | Hospital management provides a work climate that promotes             | 0.639                                    |
| safety                              |       | patient safety.                                                       |                                          |
|                                     | F8    | The actions of hospital management show that patient safety is a top  | 0.625                                    |
|                                     |       | priority.                                                             |                                          |
|                                     | F9*   | Hospital management seems interested in patient safety only after    | 0.718                                    |
|                                     |       | an adverse event happens.                                             |                                          |
| 5. Overall perceptions of patient    | A10*  | It is just by chance that more serious mistakes don’t happen around    | 0.471                                    |
| safety                               |       | here.                                                                |                                          |
|                                     | A15   | Patient safety is never sacrificed to get more work done.             | 0.575                                    |
|                                     | A17*  | We have patient safety problems in this unit.                         | 0.591                                    |
|                                     | A18   | Our procedures and systems are good at preventing errors from          | 0.614                                    |
|                                     |       | happening.                                                            |                                          |
| 6. Feedback and communication about  | C1    | We are given feedback about changes put into place based on event     | 0.723                                    |
| error                                |       | reports.                                                             |                                          |
|                                     | C3    | We are informed about errors that happen in this unit.                | 0.767                                    |
|                                     | C5    | In this unit, we discuss ways to prevent errors from happening         | 0.754                                    |
| 7. Communication openness            | C2    | Staff will freely speak up if they see something that may              | 0.666                                    |
|                                     |       | negatively affect patient care.                                       |                                          |
|                                     | C4    | Staff feel free to question the decisions or actions of those with    | 0.706                                    |
|                                     |       | more authority.                                                       |                                          |
|                                     | C6*   | Staff are afraid to ask questions when something does not seem right. | 0.658                                    |
| 8. Frequency of events reported     | D1    | When a mistake is made, but is caught and corrected before             | 0.714                                    |
|                                     |       | affecting the patient, how often is this reported?                   |                                          |
|                                     | D2    | When a mistake is made, but has no potential to harm the patient,     | 0.920                                    |
|                                     |       | how often is this reported?                                           |                                          |
|                                     | D3    | When a mistake is made that could harm the patient, but does not,     | 0.730                                    |
|                                     |       | how often is this reported?                                           |                                          |
| 9. Teamwork across units            | F2*   | Hospital units do not coordinate well with each other.                | 0.706                                    |
|                                     | F4    | There is good cooperation among hospital units that need to work      | 0.558                                    |
|                                     |       | together.                                                             |                                          |
|                                     | F6*   | It is often unpleasant to work with staff from other hospital units.  | 0.587                                    |
|                                     | F10   | Hospital units work well together to provide the best care for patients.| 0.704                                    |
| 10. Staffing                        | A2    | We have enough staff to handle the workload.                          | 0.535                                    |
|                                     | A5*   | Staff in this unit work longer hours than is best for patient care.   | 0.407                                    |
|                                     | A7*   | We use more agency/temporary staff than is best for patient care.     | 0.610                                    |
| 11. Handoffs and transitions        | A14*  | We work in “crisis mode” trying to do too much, too quickly.          | 0.646                                    |
|                                     | F3*   | Things “fall between the cracks” when transferring patients from one  | 0.693                                    |
|                                     |       | to another.                                                           |                                          |
|                                     | F5*   | Important patient care information is often lost during shift         | 0.671                                    |
|                                     |       | changes.                                                              |                                          |
|                                     | F7*   | Problems often occur in the exchange of information across hospital    | 0.738                                    |
|                                     |       | units.                                                                |                                          |
|                                     | F11*  | Shift changes are problematic for patients in this hospital.          | 0.544                                    |
effect. A study of healthcare workers in a Tunisian center’s intensive care unit reported that a significantly lower patient safety culture was associated with a higher workload. The current study also showed that the number of working hours per week had the most negative impact on the overall assessment of patient safety (Fig. 2). These facts clearly suggest the existence of a positive relationship between maintaining an appropriate workload and work–life balance and patient safety culture. While years of service at the hospital had a positive impact on patient safety culture, patient safety culture scores decreased...
when the number of years of intra-departmental experience was greater than 7 years (Fig. 2). Departmental transfers to avoid staying in the same department for too long may be effective in preventing a decline in patient safety culture. No clear tendency was found in the number of years of occupational experience. From the above, healthcare policymakers and managers need to foster a patient safety culture in consideration of workload, work–life balance, and reassignment.

The current study has several limitations. First, this study is a cross-sectional study. Because of its design, in which the temporal precedence of the explanatory variables analyzed as causes over the objective variables was unknown, we were not able to identify these causal relationships. Second, the questions in the Japanese version of the Hospital Survey on Patient Safety Culture used in this study were not validated by back-translation.

5. Conclusion
In this study, we have shown that working hours are the factor that has the most negative impact on patient safety culture. Under a universal health insurance system, workload and human resources might have a significant impact on the patient safety culture. It is important to continue regularly monitoring and maintaining patient safety culture. Future studies should be conducted in various settings. Furthermore, it is desirable to consider the decisive factors that negatively affect the patient safety culture of working hours and how to deal with them.

Acknowledgments
The authors gratefully acknowledge the completion of the questionnaire by respondents, the paperwork conducted by the clerical staff, and the entry of the data into a computer by Survey Research Center Co., Ltd.

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References

[1] Institute of Medicine (US) Committee on Quality of Health Care in America. To Err is Human: Building a Safer Health System. (Kohn LT, Corrigan JM, Donaldson MS, eds). Washington (DC): National Academies Press (US); 2000.

[2] Woods DM, Thomas EJ, Holl JL, et al. Ambulatory care adverse events and preventable adverse events leading to a hospital admission. Qual Saf Health Care. 2007;16:127–31.

[3] 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;17:216–23.

[4] Classen DC, Pestotnik SL, Evans RS, et al. Adverse drug events in hospital patients. Excess length of stay, extra costs, and attributable mortality. JAMA. 1997;277:301–6.

[5] Bates DW, Spell N, Cullen J, et al. The costs of adverse drug events in hospitalized patients. Adverse Drug Events Prevention Study Group. JAMA. 1997;277:307–11.

[6] Zegers M, de Buijne MC, Wagner C, et al. Adverse events and potentially preventable deaths in Dutch hospitals: results of a retrospective patient record review study. Qual Saf Health Care. 2009;18:297–302.

[7] Weaver SJ, Lubomkis LH, Wilson RF, et al. Promoting a culture of safety as a patient safety strategy: a systematic review. Ann Intern Med. 2013;158:369–74.

[8] Sorra J, Gray L, Streagle S, et al. AHRQ Hospital Survey on Patient Safety Culture: User's Guide. (Westat, ed.). Rockville, MD: Agency for Healthcare Research and Quality; 2016. Available at: https://www.ahrq.gov/sops/hospital/index.html.

[9] Mardon RE, Khanna K, Sorra J, et al. Exploring relationships between hospital patient safety culture and adverse events. J Patient Saf. 2010;6:226–32.

[10] Fan CJ, Pawlik TM, Daniels T, et al. Association of safety culture with surgical site infection outcomes. J Am Coll Surg. 2016;222:122–8.

[11] Moseburg SE, Dennison Himmelfarb C. The association between professional burnout and engagement with patient safety culture and outcomes: a systematic review. J Patient Saf. 2018;14:15307–19.

[12] Zhang X, Li Q, Guo Y, et al. From organisational support to second victim-related distress: role of patient safety culture. J Nurs Manag. 2019;27:1818–25.

[13] Alenezi A, Pandaan RPM, Almazan JU, et al. Clinical practitioners’ perception of the dimensions of patient safety culture in a government hospital: a one-sample correlational survey. J Clin Nurs. 2019;28:4496–503.

[14] Anderson AD, Floegel TA, Holler L, et al. Exploring the relationship between contact frequency, leader-member relationships, and patient safety culture. J Nurs Adm. 2019;49:441–6.

[15] Fujita S, Wu Y, Iida S, et al. Patient safety management systems, activities and work environments related to hospital-level patient safety culture: a cross-sectional study. Medicine (Baltim). 2019;98:e18352.

[16] Taneda K, Okumura Y, Aizawa Y, et al. Reliability and validity of the Japanese version of the hospital survey on patient safety culture. Jap J Qual Saf Healthc. 2009;4:10–24.

[17] Ito S, Seto K, Kigawa M, et al. Development and applicability of Hospital Survey on Patient Safety Culture (HSOPS) in Japan. BMC Health Serv Res. 2011;11:28.

[18] Abu-El-Noor NI, Abu-El-Noor MK, Abuowda YZ, et al. Patient safety culture among nurses working in Palestinian governmental hospital: a pathway to a new policy. BMC Health Serv Res. 2019;19:550.

[19] Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equ Model A Multidiscip J 1999;6:1–55.

[20] Hayashi C. On the prediction of phenomena from qualitative data and the quantification of qualitative data from the mathematico-statistical point of view. Ann Inst Stat Math. 1952;3:69–98.

[21] Tanaka Y. Review of the methods of quantification. Environ Health Perspect. 1979;32:113–23.

[22] Suzuki T, Kudo A. Recent application of quantification II in Japanese medical research. Environ Health Perspect. 1979;32:131–41.

[23] Matsuba T, Ding C, Lu L, et al. The utility of Hayashi’s quantification theory type 2 for the rapid assessment of the epidemiological survey in the developing countries—in a case of the vaccine coverage survey in Yunnan Province, China. J Epidemiol. 1998;8:24–7.

[24] Koshiba Y, Ohtani H. Public perception of physical risks: effect of the experience of repeated explosion accidents at a chemical plant. Open J Saf Sci Technol. 2015;5:45–54.

[25] Famolaro T, Yount ND, Burns W, et al. Hospital Survey on Patient Safety Culture: 2016 User Comparative Database Report. (Westat, ed.). Rockville, MD: Agency for Healthcare Research and Quality; AHRQ Publication No. 16-0021-EF; 2016.

[26] Fujita S, Seto K, Ito S, et al. The characteristics of patient safety culture in Japan, Taiwan and the United States. BMC Health Serv Res. 2013;13:20.

[27] Hamdan M, Saleem AA. Changes in patient safety culture in palestinian public hospitals: impact of quality and patient safety initiatives and programs. J Patient Saf. 2018;14:67–73.

[28] Teleg M, Kaya S. Staff perceptions of patient safety culture in general surgery departments in Turkey. Afr Health Sci. 2019;19;2208–18.

[29] Stoyanova R, Dimova R, Tarnovska M, et al. Comparing patient safety culture in Bulgarian, Croatian and American hospitals - preliminary results. Med Pharm Rep. 2019;92:265–70.

[30] Khoshshakhlagh AH, Khatoooni E, Akbarzadeh I, et al. Analysis of affecting factors on patient safety culture in public and private hospitals in Iran. BMC Health Serv Res. 2019;19:1009.

[31] Al Nadabi W, Faisal M, Mohammed MA. Patient safety culture in Oman: a national study. J Eval Clin Pract. 2020;26:1406–15.

[32] Tili MA, Aouicha W, Ben Rejeb M, et al. Assessing patient safety culture in 18 Tunisian adult intensive care units and determination of its associated factors: a multi-center study. J Crit Care. 2020;56:208–14.