

# Empirical Study of Patient Safety Culture

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## Abstract

The purpose of this study is to find the key factors to improve patient safety by using survey data based on The Hospital Survey on Patient Safety Culture which is a questionnaire from the Agency for Healthcare Research and Quality (AHRQ). Participants were 1084 healthcare professionals belonging to the Faculty of Medicine of Kindai University, who participated in the training seminar of TeamSTEPPS (Team Strategies and Tools to Enhance Performance and Patient Safety) in January 2017. Frequency of events reported is treated as outcome variable because it is a proxy for patient safety. Ordered probit model is conducted to examine the relationship between frequency of events reported and other variables of medical safety. Several variables related with supervisor's actions promoting safety, management support for patient safety, feedback and communication about error, communication openness, and teamwork across units are statistically significant ( $p < .01$ ). Communication factors are relatively important. Above all, the actions of hospital management and supervisor are crucial.

**Keywords:** *patient safety, Hospital Survey on Patient Safety Culture (HSOPSC), TeamSTEPPS, Frequency of events reported, feedback, communication*

## 1. INTRODUCTION

Failures of teamwork and communication are a leading cause of medical errors. The particularity of healthcare team is diversity of its members. Physicians, nurses, pharmacists, technicians, and other healthcare professionals who may have different backgrounds must coordinate their activities and cooperate with each other to make patient care safe and efficient as a team. Therefore it makes difficult to establish a shared mental model in a healthcare team.

In 1999 the Institute of Medicine (IOM) released a report, "Err is Human: Building a Safer Health System" which estimated that as many as 98,000 Americans die each year as a result of healthcare errors (Kohn LT, et al.(1999)). Communication failures have been identified by the Joint Commission as the primary root cause in more than 70% of

sentinel events from 1995 to 2003 (Joint Commission on Accreditation of Healthcare Organizations (2004)). From 2004 to 2005, communication failure were a contributing factor in 25% to 41% of sentinel events in Australia (Wakefield J. (2007)).

Kindai University Faculty of Medicine in Japan has implemented TeamSTEPPS (Team Strategies and Tools to Enhance Performance and Patient Safety) since 2013 with the aim of reducing medical errors. Kindai University Faculty of Medicine which was established in 1974 has 929 beds in hospital. This empirical research is based on the survey of patient safety which was conducted in the training seminar of TeamSTEPPS in the Faculty of Medicine of Kindai University. TeamSTEPPS is one of the most popular team training methods in healthcare.

The main purpose of this study is to investigate statistically the key factors which influent on patient safety by using survey data of healthcare profes-

sionals who have trained TeamSTEPPS.

Chapter2 summarizes the framework of TeamSTEPPS. Chapter3 introduces several literatures related with the patient safety culture and teamwork especially from the view point of TeamSTEPPS. Chapter4 explains methods and results of this statistical analysis. Chapter5 is concluded.

## 2. TEAMSTEPPS

TeamSTEPPS (Team Strategies and Tools to Enhance Performance and Patient Safety) is an evidence-based teamwork training system developed in the United States. TeamSTEPPS has developed by Department of Defense (DoD) and the Agency for Healthcare Research and Quality (AHRQ) (King, Heidi B. et al. (2008)). TeamSTEPPS can improve communication and teamwork skills among healthcare professionals, and lead to the medical safety. TeamSTEPPS is based on 25 years of research related to teamwork, team training, and culture change.

TeamSTEPPS has four competencies areas: leadership, situation monitoring, mutual support, and communication. Baker David P et al. (2010) shows high intercorrelations among them.

Leadership involves the ability to coordinate the activities of team members by ensuring that team actions are understood, changes in information are shared, and team members have the necessary resources.

Situation Monitoring is the process of actively scanning and assessing situational elements to gain information or understanding, or to maintain awareness to support team functioning. Situation Monitoring concretely includes Cross monitoring and Shared mental model as the tool of TeamSTEPPS. Cross monitoring is a process of monitoring actions of other team members for the purpose of sharing the workload and reducing or avoiding errors. Shared mental model provides team members with a common understanding of the person who is responsible for and what the information requirements are. Shared mental model brings such a situation where team members can anticipate each other's needs.

Mutual Support is the ability to anticipate and support team members' needs through accurate

knowledge about their responsibilities and workload. Mutual support protects team members from work overload that may reduce effectiveness and increase the risk of error. TeamSTEPPS provides tools which are Task assistance, Feedback, Advocacy and assertion, Two-challenge rule, and DESC script.

Task assistance is helping others with tasks to build a strong team so that team members can request for assistance in the context of patient safety. Feedback is the information provided to team members for the purpose of improving team performance. Feedback should be timely, respectful, specific, directed toward improvement, and considerate. Advocacy and assertion is invoked when team members' viewpoints don't coincide with that of the decision maker. The team member asserts a corrective action in a firm and respectful manner. Two-challenge rule is needed when an initial assertion is ignored. It is the team member's responsibility to voice his or her concern assertively at least two times to ensure that it has been heard. The team member being challenged must acknowledge that concern has been heard. DESC script is a constructive approach for managing and resolving conflict.

Communication is a process by which information is clearly and accurately exchanged among team members. TeamSTEPPS tools of communication are SBAR, Call-out, Check-back, and Handoff.

SBAR is an acronym for Situation, Background, Assessment, and Recommendation. SBAR is a technique requiring immediate attention and action concerning a patient's condition. Situation specifies the topic of discussion at first. Background involves information needed to make an informed decision for the patient such as the list of current medication, or vital signs. In Assessment, the situation patient is reported. Finally in Recommendation, what should be done is stated. Call-out is a strategy used to communicate important or critical information. Check-back is a process of employing closed-loop communication to ensure that information conveyed the sender is understood by the receiver as intended. Handoff is the transfer of information during transitions in care across the continuum including an opportunity to ask ques-

**Table 1: Competencies of TeamSTEPPS**

Leadership	Identifies team goals and vision. <ul style="list-style-type: none"> <li>• Utilizes resources efficiently to maximize team performance.</li> <li>• Balances workload within the team.</li> <li>• Delegates tasks or assignments, as appropriate.</li> <li>• Conducts briefs, huddles, and debriefs.</li> <li>• Role models teamwork behaviors.</li> </ul>
Situation Monitoring	Monitors the state of the patient. <ul style="list-style-type: none"> <li>• Monitors fellow team members to ensure safety and prevent errors.</li> <li>• Monitors the environment for safety and availability of resources (e.g., equipment).</li> <li>• Monitors progress toward the goal and identifies changes that could alter the care plan.</li> <li>• Fosters communication to ensure a shared mental model.</li> </ul>
Mutual Support	Provides task-related support and assistance. <ul style="list-style-type: none"> <li>• Provides timely and constructive feedback to team members.</li> <li>• Effectively advocates for the patient using the Assertive Statement, Two-Challenge Rule, or CUS.<sup>2)</sup></li> <li>• Uses the Two-Challenge Rule or DESC script to resolve conflict</li> </ul>
Communication	<ul style="list-style-type: none"> <li>• Provides brief, clear, specific, and timely information.</li> <li>• Seeks information from all available sources.</li> <li>• Uses check-backs to verify information that is communicated.</li> <li>• Uses SBAR, call-outs, check-backs, and handoff techniques to communicate effectively with team members.</li> </ul>

**Table 2: Team KSAs Competences**

Teamwork	Definition
Team leadership	Ability to direct and coordinate activities of other team members, assess team performance, assign tasks, develop KSAs, motivate team members, plan and organize, and establish positive atmosphere
Mutual performance (or situation) monitoring	Ability to develop common understandings of the team environment and apply appropriate task strategies to accurately monitor teammate performance
Backup behavior (or mutual support)	Ability to anticipate other team member's needs through accurate knowledge about their responsibilities; ability to shift workload among members to achieve balance during periods of increased workload or pressure
Adaptability	Ability to adjust strategies based on information gathered from environment through using compensatory behavior and reallocation of intra-team resources: Altering course of action or team repertoire in response to changing conditions
Shared mental models	Knowledge structure of the relationships between task team is engaged in and how team members will interact
Closed loop communication	Sender initiates communication; receiver confirms that the communication has been heard and repeats the content; sender verifies the accuracy of that content
Collective orientation	Propensity to take other's behaviour into account during group interaction; belief in importance of team goal's over individual member's goals
Mutual trust	Shared belief that team members will perform their roles and protect interests of their teammates

Source: King, Heidi B. et al. (2008), Canadian Patient Safety Institute (2011)

tions, clarify, and confirm responses.

Next, other frameworks or teamwork training methods which affected on TeamSTEPPS are explained. Most team training programs in health-care are rooted in human factors principles which have been used extensively to enhance the design of

equipment, work environments and human performance in aviation and the military. (Canadian Patient Safety Institute (2011)). Because many accidents attribute to pilot errors, for example, inadequate communication, and failure of coordination, the aviation industry developed Crew Resource

Management (CRM). Most of team training programs implemented are based on CRM.

Anesthesia Crisis Resource Management (ACRM) was developed by David Gaba and colleagues at Stanford University. ACRM focuses on leadership, teamwork, communication and resource management. The team skills were adopted from research on aviation teams. ACRM was designed to support anesthesiologists effectively by working in multidisciplinary team including physicians, nurses, technicians, and other medical professionals in high risk environment such as an operating room, an emergency room, or an intensive care unit.

KSAs (Knowledge, Skills, and Abilities) served as the foundation for the TeamSTEPPS Initiative (King, Heidi B. et al. (2008)). Table 2 shows the definition of each component of KSAs. Team leadership, Mutual performance (or situation) monitoring, Backup behavior (or mutual support), Adaptability, Shared mental models, Closed loop communication, Collective orientation, and Mutual trust are conceptually similar to competencies of TeamSTEPPS.

### 3. LITERATURE REVIEW

Representative empirical studies of assessment of teamwork training methods indicate the effectiveness of teamwork and communication on patient safety.

Morey John C et al. (2002) evaluates the effectiveness of training and institutionalizing teamwork behaviors, drawn from aviation crew resource management (CRM) programs, on emergency department (ED) staff organized into caregiver teams. A prospective multicenter evaluation using a quasi-experimental, untreated control group design with one pretest and two posttests was conducted. Data were collected at each of the nine participating hospitals from clinical staff (684 physicians, nurses, and technicians). A statistically significant improvement in quality of team behaviors was shown between the experimental and control groups following training ( $p=.012$ ). The clinical error rate significantly decreased from 30.9 percent to 4.4 percent in the experimental group ( $p=.039$ ). In the experimental group, the ED staff's

attitudes toward teamwork increased ( $p=.047$ ) and staff's assessments of institutional support showed a significant increase ( $p=.040$ ).

Stead, Karen et al. (2009) evaluates the effectiveness of the implementation of a TeamSTEPPS program at an Australian mental health facility. The evaluation of patient safety culture and of staff knowledge, skills and attitudes (KSA) to teamwork and communication indicated a significant improvement in two dimensions of patient safety culture (frequency of event reporting, and organizational learning) and a 6.8% increase in the KSA score. Stead, Karen et al. (2009) concludes that TeamSTEPPS implementation had a substantial impact on patient safety culture, teamwork and communication at an Australian mental health facility.

Gillespie, Brigid M. et al. (2010) is the qualitative study of using grounded theory approach to generate a theoretical model to explain the relations between organizational and individual factors that influence interdisciplinary communication in surgery. The sample is 16 participants including surgeons, anaesthetists, and nurses who worked in an operating room of a large metropolitan hospital in south east Queensland in Australia. Participants were interviewed during 2008 using semi-structured individual and group interviews. Gillespie, Brigid M. et al. (2010) concludes that the development of shared mental model has the potential to improve teamwork in surgery, and thus enhance patient safety.

Kesten Karen S. (2011) evaluates data from undergraduate nursing students ( $N = 115$ ) on their performance using a standardized communication tool SBAR. The mean performance scores of the didactic plus role-play students were significantly higher than those who had didactic instruction alone ( $t = -2.6$ ,  $p = 0.005$ ). Interdisciplinary communication training can possibly provide even more effective learning. The results of this study demonstrate that nursing student's knowledge of skilled communication increases as a result of didactic instruction by using a standardized communication technique of SBAR.

Sawyer, Taylor et al. (2013) researches the impact of interprofessional Team Strategies and Tools to Enhance Performance and Patient Safety

(TeamSTEPPS) training on teamwork skills during neonatal resuscitation. It conducts the statistical analysis on forty-two physicians, nurses, and respiratory therapists. As the result, significant improvements in teamwork skills were seen in team structure, leadership, situation monitoring, mutual support, and communication ( $p < .001$ ). Challenges by nurses to scripted mediation order error doubled from 38 percent before the training to 77 percent after the training.

Starmer, Amy J. et al. (2014) conducts a prospective intervention study of a resident handoff-improvement program in nine hospitals, measuring rates of medical errors, preventable adverse events, and miscommunications, as well as a resident workflow. Results shows that in 10740 patient admissions, the medical-error rate decreased by 23% from the preintervention period to the postintervention period, and the rate of preventable adverse events decreased by 30%. Across sites, significant increases were observed in the inclusion of all prespecified key elements in written documents and oral communication during handoff (nine written and five oral elements;  $p < 0.001$  for all 14 comparisons).

#### 4. METHODS AND RESULTS

This study utilizes The Hospital Survey on Patient Safety Culture (HSOPSC) which is a questionnaire from the Agency for Healthcare Research and Quality (AHRQ) (Agency for Healthcare Research and Quality (2016)). The Hospital Survey on Patient Safety Culture (HSOPSC) is used to assess safety culture not only in the United States, but also in other countries. Bodur Said et al. (2010) collects data of physicians and nurses in all public hospitals in Konya which is a large city in Turkey by using the Turkish version of HSOPSC, and statistically analyzes that the overall patient safety score is lower than the benchmark score, and also frequency of events reported is the lowest score. Chen I-Chi et al. (2010) shows that in general, hospital staffs in Taiwan feel positively toward patient safety culture within their organization. Ito Shinya et al. (2011) concludes that the factor structures of the Japanese and the American HSOPSC are almost identical, and the Japanese HSOPSC has acceptable levels of

internal reliability and construct validity, and therefore the HSOPSC can be introduced in Japan. In this way, many countries assess and introduce The Hospital Survey on Patient Safety Culture (HSOPSC).

This study analyzes 1084 healthcare professionals belonging to the Faculty of Medicine of Kindai University, who participated in the training seminar of TeamSTEPPS in January 2017. Kindai University Faculty of Medicine has implemented TeamSTEPPS since 2013, and it began to evaluate its effectiveness.

The Hospital Survey on Patient Safety Culture measures both unit-level and hospital-level aspects of safety culture. Table3 shows Composites and Items ((1)-(12)) of Hospital Survey on Patient Safety Culture: (1) Teamwork Within Units, (2) Supervisor/manager Expectations & Actions Promoting Safety, (3) Organizational Learning-Continuous Improvement, (4) Management Support for Patient Safety, (5) Overall Perceptions of Patient Safety, (6) Feedback and Communication about Error, (7) Communication Openness, (8) Frequency of Events Reported, (9) Teamwork Across Units, (10) Staffing, (11) Handoff & Transitions, (12) Non punitive Response to Errors. Patient Safety Culture Composites and Definitions are explained in Table4.

For the purpose of statistical analysis, each item ((1)-(12)) can be classified into non-outcome variables and outcome variables. Non-outcome variables are used for independent variables of estimation. (5) Overall Perceptions of Patient Safety, (8) Frequency of events reported are outcome variables. (8) Frequency of events reported is considered as the dependent variable for estimation. A reporting culture in which members are prepared to report their errors promotes a safety culture (Reason J. (1997)). Therefore (8) Frequency of events reported is selected for dependent variable for estimation.

Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety. Therefore Hospital management provides a work climate that promotes patient safety and shows that patient safety is a top priority.

To achieve a culture of patient safety, errors are



**Table 3: Hospital Survey on Patient Safety Culture: Composites and Items**

Patient Safety Culture Composite	Patient Safety Culture Items
1.Teamwork Within Units (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree)	(1-1) People support one another in this unit. (1-2) When a lot of work needs to be done quickly, we work together as a team to get the work done. (1-3) In this unit, people treat each other with respect. (1-4) When one area in this unit gets really busy, others help out.
2.Supervisor/manager Expectations & Actions Promoting Safety (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree)	(2-1) My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures. (2-2) My supervisor/manager seriously considers staff suggestions for improving patient safety. (2-3) Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts. (2-4) My supervisor/manager overlooks patient safety problems that happen over and over.
3.Organizational Learning-Continuous Improvement (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree)	(3-1) We are actively doing things to improve patient safety. (3-2) Mistakes have led to positive changes here. (3-3) After we make changes to improve patient safety, we evaluate their effectiveness.
4.Management Support for Patient Safety (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree)	(4-1) Hospital management provides a work climate that promotes patient safety. (4-2) The actions of hospital management show that patient safety is a top priority. (4-3) Hospital management seems interested in patient safety only after an adverse event happens.
5.Overall Perceptions of Patient Safety (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree)	(5-1) Patient safety is never sacrificed to get more work done. (5-2) Our procedures and systems are good at preventing errors from happening. (5-3) It is just by chance that more serious mistakes don't happen around here. (5-4) We have patient safety problems in this unit.
6.Feedback and Communication about Error (Never, Rarely, Sometimes, Most of the time, Always)	(6-1) We are given feedback about changes put into place based on event reports. (6-2) We are informed about errors that happen in this unit. (6-3) In this unit, we discuss ways to prevent errors from happening again.
7. Communication Openness (Never, Rarely, Sometimes, Most of the time, Always)	(7-1) Staff will freely speak up if they see something that may negatively affect patient care. (7-2) Staff feel free to question the decisions or actions of those with more authority. (7-3) Staff are afraid to ask questions when something does not seem right.
8.Frequency of Events Reported (Never, Rarely, Sometimes, Most of the time, Always)	(8-1) When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported? (8-2) When a mistake is made, but has no potential to harm the patient, how often is this reported? (8-3) When a mistake is made that could harm the patient, but does not, how often is this reported?
9.Teamwork Across Units (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree)	(9-1) There is good cooperation among hospital units that need to work together. (9-2) Hospital units work well together to provide the best care for patients. (9-3) Hospital units do not coordinate well with each other. (9-4) It is often unpleasant to work with staff from other hospital units.
10.Staffing (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree)	(10-1) We have enough staff to handle the workload. (10-2) Staff in this unit work longer hours than is best for patient care. (10-3) We use more agency/temporary staff than is best for patient care. (10-4) We work in "crisis mode" trying to do too much, too quickly.
11.Handoffs & Transitions (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree)	(11-1) Things "fall between the cracks" when transferring patients from one unit to another (11-2) Important patient care information is often lost during shift changes. (11-3) Problems often occur in the exchange of information across hospital units. (11-4) Shift changes are problematic for patients in this hospital.
12.Nonpunitive Response to Errors (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree)	(12-1) Staff feel like their mistakes are held against them. (12-2) When an event is reported, it feels like the person is being written up, not the problem. (12-3) Staff worry that mistakes they make are kept in their personnel file.

Source: Agency for Healthcare Research and Quality (2016)

**Table 4: Patient Safety Culture Composites and Definitions**

Patient Safety Culture Composite	Definition
1.Teamwork Within Units	Staff support each other, treat each other with respect, and work together as a team.
2.Supervisor/manager Expectations & Actions Promoting Safety	Supervisors/managers consider staff suggestions for improving patient safety, praise staff for following patient safety procedures, and do not overlook patient safety problems.
3.Organizational Learning-Continuous Improvement	Mistakes have led to positive changes and changes are evaluated for effectiveness.
4.Management Support for Patient Safety	Hospital management provides a work climate that promotes patient safety and shows that patient safety is a top priority.
5.Overall Perceptions of Patient Safety	Procedures and systems are good at preventing errors and there is a lack of patient safety problems.
6.Feedback and Communication about Error	Staff are informed about errors that happen, are given feedback about changes implemented, and discuss ways to prevent errors.
7.Communication Openness	Staff freely speak up if they see something that may negatively affect a patient and feel free to question those with more authority.
8.Frequency of Events Reported	Mistakes of the following types are reported: (1) mistakes caught and corrected before affecting the patient, (2)mistakes with no potential to harm the patient, and (3)mistakes that could harm the patient but do not.
9.Teamwork Across Units	Hospital units cooperate and coordinate with one another to provide the best care for patients.
10.Staffing	There are enough staff to handle the workload and workhours are appropriate to provide the best care for patients.
11.Handoffs & Transitions	Important patient care information is transferred across hospital units and during shift changes.
12.Nonpunitive Response to Error	Staff feel that their mistakes and event reports are not held against them and that mistakes are not kept in their personnel file.

Source: Agency for Healthcare Research and Quality (2016)

**Table 5: Results of Wilcoxon Rank Sum Test****5-1 Sex (male or female)**

	(8-1) Frequency of events reported	(8-2) Frequency of events reported	(8-3) Frequency of events reported
Z	0.721	-0.745	0.592
Probability	0.471	0.456	0.554

**5-2 Whether or not, the respondent is manager (yes or no)**

	(8-1) Frequency of events reported	(8-2) Frequency of events reported	(8-3) Frequency of events reported
Z	0.536	0.524	0.794
Probability	0.592	0.600	0.427

**5-3 Whether or not, the respondent has the direct contact with patients (yes or no)**

	(8-1) Frequency of events reported	(8-2) Frequency of events reported	(8-3) Frequency of events reported
Z	-2.105	-1.266	-1.425
Probability	0.035	0.205	0.154

**Table 6: Results of Kruskal–Wallis Test****6-1 Staff position**

	(8-1) Frequency of events reported	(8-2) Frequency of events reported	(8-3) Frequency of events reported
$\chi^2$	17.141	6.993	30.094
Probability	0.1038	0.7996	0.0015

**6-2 Age**

	(8-1) Frequency of events reported	(8-2) Frequency of events reported	(8-3) Frequency of events reported
$\chi^2$	13.139	10.494	9.466
Probability	0.0106	0.0329	0.0505

**6-3 Faculty**

	(8-1) Frequency of events reported	(8-2) Frequency of events reported	(8-3) Frequency of events reported
$\chi^2$	76.041	65.289	0.601
Probability	0.0004	0.0052	0.0001

not attributed to individual's responsibility to be blamed, but are problem to be solved by organization as a whole and are treated as opportunities to improve the system which should bring a culture of patient safety. To form the structure of organizational learning in organization is critical to create a culture of patient safety. Top of management in hospital should perform leadership to provide a work climate that promotes patient safety and take an initiative to show that patient safety is a top priority. Also leaders should keep the environment where members can freely discuss how to improve the safety culture, and also provide the feedback concerning about errors.

According to table3 Patient Safety Culture Composite of (8) Frequency of events reported has three items:

- (8-1) When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?
- (8-2) When a mistake is made, but has no potential to harm the patient, how often is this reported?
- (8-3) When a mistake is made that could harm the patient, but does not, how often is this reported?

All of three items are incidents because of not harming patients. The item (8-3) where there is possibility that patient might be harmed, is consid-

ered as the most critical case.

To get robust results from statistical analysis, all of (8-1), (8-2), and (8-3) are tried to analyze and all cases must be statistical significant.

Before estimation, nonparametric tests are conducted for several attributes of respondent by each item of Patient Safety Culture Composite of (8) Frequency of events reported.

Wilcoxon Rank Sum Test is conducted for two samples of background information of respondent, sex (male or female), manager (yes or no), and having direct contact with patients (yes or no). Results of analysis are shown in table5.

Result of Wilcoxon Rank Sum Test shows the null hypothesis that two groups of sex (male or female) have the same distribution with the same median, is not rejected ( $p < .1$ ). About the case of manager, the null hypothesis is not rejected ( $p < .1$ ). About the case of having direct contact with patients, (8-1) shows null hypothesis is rejected ( $p < .05$ ), and (8-2) (8-3) show null hypothesis is not rejected ( $p < .1$ ). By the rule that all of (8-1), (8-2), and (8-3) must be statistical significant, the null hypothesis is considered as not to be rejected in this case. Totally, attributes of sex, manager, and having contacts with patients are not necessarily to take into consideration when analyzing Frequency of events reported.

Wilcoxon Rank Sum test is limited to only two groups. Kruskal–Wallis test can be used more than two groups. Kruskal–Wallis test is conducted for



staff position (12 groups), age (5 groups) and faculty (40 groups). Null hypothesis is that medians are same. Results are in table6.

The attributes of respondent that null hypothesis is rejected in all of (8-1), (8-2), and (8-3) are 6-2(age), and 6-3(faculty), respectively ( $p < .1$ ), and ( $p < .01$ ).

By using the results of Wilcoxon Rank Sum Test in table5 and Kruskal–Wallis test in table6, estimations are conducted.

Three items of Patient Safety Culture Composite of (8) Frequency of events reported are dependent variables for estimation.

As I mentioned, three items are as following. (8-1)When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported? (8-2)When a mistake is made, but has no potential to harm the patient, how often is this reported? (8-3) When a mistake is made that could harm the patient, but does not, how often is this reported?

Dependent variables which are possibly affected by attributes of respondent, and therefore controlling such influences are needed for estimation. As Kruskal–Wallis test shows the variables of Frequency of events reported are influenced by age and faculty of respondent, their influences must be controlled.

The estimation method is Ordered Probit Model as follows.

$$Y_i = \alpha + \beta X_i + \sum_{j=1}^2 \gamma_j Z_{ij} + \epsilon_i$$

$Y_i$ : Dependent variable (Three items of Patient Safety Culture Composite of (8) Frequency of events reported)

$X_i$ : Independent variable

$Z_{ij}$ : Controlled variable ( $j=1$ : age,  $2$ : faculty)

$\epsilon_i$ : Error term

Independent variables are selected among Patient Safety Culture Items shown in table3. Concretely, items of Patient Safety Culture Composite which are 1 Teamwork Within Units, 2 Supervisor/manager Expectations & Actions Promoting Safety, 3 Organizational Learning–Continuous Improvement, 4 Management Support for Patient Safety, 6

Feedback and Communication about Error, 7 Communication Openness, 9 Teamwork Across Units, 10 Staffing, 11 Handoff & Transitions, and 12 Non punitive Response to Errors are independent variables.

Estimation results are shown in table7. Cases that Frequency of events reported of (8-1), (8-2), and (8-3) are statistical significant are focused.

Items of each Patient Safety Culture Composite which show statistically significant are summarized as follows.

#### 1. Teamwork Within Units

Nothing

#### 2. Supervisor/manager Expectations & Actions

##### Promoting Safety

(2-2) My supervisor/manager seriously considers staff suggestions for improving patient safety.

(2-3) Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts.

#### 3. Organizational Learning–Continuous

##### Improvement

(3-1) We are actively doing things to improve patient safety.

(3-2) Mistakes have led to positive changes here.

#### 4. Management Support for Patient Safety

(4-1) Hospital management provides a work climate that promotes patient safety.

(4-2) The actions of hospital management show that patient safety is a top priority.

#### 6. Feedback and Communication about Error

(6-1) We are given feedback about changes put into place based on event reports.

(6-3) In this unit, we discuss ways to prevent errors from happening again.

#### 7. Communication Openness

(7-1) Staff will freely speak up if they see something that may negatively affect patient care.

#### 9. Teamwork Across Units

(9-1) There is good cooperation among hospital

Table 7: Estimation Results

**1 Teamwork Within Units**

	(8-1)When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		(8-2)When a mistake is made, but has no potential to harm the patient, how often is this reported?		(8-3)When a mistake is made that could harm the patient, but does not, how often is this reported?	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
(1-1) People support one another in this unit.	0.057	0.060	-0.012	0.060	0.039	0.061
(1-2) When a lot of work needs to be done quickly, we work together as a team to get the work done.	0.039	0.058	0.103	0.058 *	0.029	0.059
(1-3) In this unit, people treat each other with respect.	0.152	0.052 ***	0.085	0.052 *	0.062	0.053
(1-4) When one area in this unit gets really busy, others help out.	0.075	0.039 *	0.034	0.039	0.127	0.040 ***
Number of observations	1047		1047		1047	
$\chi^2$	123.33		89.54		131.06	
Probability	0.0000		0.0000		0.0000	
Pseudo Rsquare	0.043		0.0312		0.0482	

**2 Supervisor/manager Expectations & Actions Promoting Safety**

	(8-1)When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		(8-2)When a mistake is made, but has no potential to harm the patient, how often is this reported?		(8-3)When a mistake is made that could harm the patient, but does not, how often is this reported?	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
(2-1) My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures.	0.026	0.048	0.002	0.048	0.006	0.049
(2-2) My supervisor/manager seriously considers staff suggestions for improving patient safety.	0.202	0.051 ***	0.182	0.052 ***	0.166	0.053 ***
(2-3) Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts.	0.073	0.042 *	-0.063	0.042 *	-0.151	0.043 ***
(2-4) My supervisor/manager overlooks patient safety problems that happen over and over.	0.043	0.041	-0.039	0.041	-0.023	0.042
Number of observations	1056		1056		1056	
$\chi^2$	121.3		104.94		147.91	
Probability	0.0000		0.0000		0.0000	
Pseudo Rsquare	0.0419		0.0362		0.0541	

**3 Organizational Learning–Continuous Improvement**

	(8-1)When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		(8-2)When a mistake is made, but has no potential to harm the patient, how often is this reported?		(8-3)When a mistake is made that could harm the patient, but does not, how often is this reported?	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
(3-1) We are actively doing things to improve patient safety.	0.131	0.052 **	0.208	0.052 ***	0.227	0.053 ***
(3-2) Mistakes have led to positive changes here.	0.187	0.051 ***	0.134	0.050 ***	0.098	0.051 **
(3-3) After we make changes to improve patient safety, we evaluate their effectiveness.	0.070	0.048	0.073	0.048	0.034	0.049
Number of observations	1049		1049		1049	
$\chi^2$	137.8		125.31		151.55	
Probability	0.0000		0.0000		0.0000	
Pseudo Rsquare	0.0481		0.0436		0.0557	

**4 Management Support for Patient Safety**

	(8-1)When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		(8-2)When a mistake is made, but has no potential to harm the patient, how often is this reported?		(8-3)When a mistake is made that could harm the patient, but does not, how often is this reported?	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
(4-1) Hospital management provides a work climate that promotes patient safety.	0.115	0.043 ***	0.112	0.043 ***	0.082	0.044 *
(4-2) The actions of hospital management show that patient safety is a top priority.	0.150	0.045 ***	0.156	0.045 ***	0.127	0.046 ***
(4-3) Hospital management seems interested in patient safety only after an adverse event happens.	-0.091	0.042 **	-0.028	0.041	-0.070	0.042 *
Number of observations	1047		1047		1047	
$\chi^2$	134.55		107.64		136.16	
Probability	0.0000		0.0000		0.0000	
Pseudo Rsquare	0.0469		0.0374		0.0501	

**6 Feedback and Communication about Error**

	(8-1) When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		(8-2) When a mistake is made, but has no potential to harm the patient, how often is this reported?		(8-3) When a mistake is made that could harm the patient, but does not, how often is this reported?	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
(6-1) We are given feedback about changes put into place based on event reports.	0.181	0.041 ***	0.173	0.041 ***	0.127	0.042 ***
(6-2) We are informed about errors that happen in this unit.	0.066	0.045	0.106	0.045 **	0.187	0.046 ***
(6-3) In this unit, we discuss ways to prevent errors from happening again.	0.167	0.042 ***	0.166	0.042 ***	0.131	0.043 ***
Number of observations	1050		1050		1050	
$\chi^2$	168.89		159.19		191.95	
Probability	0.0000		0.0000		0.0000	
Pseudo Rsquare	0.0589		0.0553		0.0706	

**7 Communication Openness**

	(8-1) When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		(8-2) When a mistake is made, but has no potential to harm the patient, how often is this reported?		(8-3) When a mistake is made that could harm the patient, but does not, how often is this reported?	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
(7-1) Staff will freely speak up if they see something that may negatively affect patient care.	0.181	0.034 ***	0.204	0.034 ***	0.183	0.035 ***
(7-2) Staff feel free to question the decisions or actions of those with more authority.	0.101	0.035	0.025	0.034	-0.005	0.035
(7-3) Staff are afraid to ask questions when something does not seem right.	-0.060	0.039	-0.078	0.039 **	-0.094	0.040 **
Number of observations	1052		1052		1052	
$\chi^2$	147.66		124.92		148.22	
Probability	0.0000		0.0000		0.0000	
Pseudo Rsquare	0.0512		0.0433		0.0543	

**9 Teamwork Across Units**

	(8-1) When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		(8-2) When a mistake is made, but has no potential to harm the patient, how often is this reported?		(8-3) When a mistake is made that could harm the patient, but does not, how often is this reported?	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
(9-1) There is good cooperation among hospital units that need to work together.	0.224	0.042 ***	0.209	0.042 ***	0.183	0.043 ***
(9-2) Hospital units work well together to provide the best care for patients.	0.091	0.038 **	0.023	0.037	-0.004	0.038
(9-3) Hospital units do not coordinate well with each other.	-0.012	0.040	0.003	0.040	0.070	0.041 *
(9-4) It is often unpleasant to work with staff from other hospital units.	-0.007	0.029	-0.024	0.029	-0.059	0.030 *
Number of observations	1051		1051		1051	
$\chi^2$	138.32		104.47		130.66	
Probability	0.0000		0.0000		0.0000	
Pseudo Rsquare	0.048		0.0362		0.0479	

**10 Staffing**

	(8-1) When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		(8-2) When a mistake is made, but has no potential to harm the patient, how often is this reported?		(8-3) When a mistake is made that could harm the patient, but does not, how often is this reported?	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
(10-1) We have enough staff to handle the workload.	0.078	0.040 *	0.024	0.040	0.010	0.041
(10-2) Staff in this unit work longer hours than is best for patient care.	0.012	0.032	0.083	0.032 **	0.068	0.033 **
(10-3) We use more agency/temporary staff than is best for patient care.	0.000	0.023	-0.016	0.023	-0.008	0.024
(10-4) We work in "crisis mode" trying to do too much, too quickly.	-0.016	0.037	-0.019	0.037	-0.075	0.037
Number of observations	1053		1053		1053	
$\chi^2$	101.22		83.03		118.33	
Probability	0.0000		0.0000		0.0000	
Pseudo Rsquare	0.0352		0.0289		0.0437	

**11 Handoffs & Transitions**

	(8-1)When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		(8-2)When a mistake is made, but has no potential to harm the patient, how often is this reported?		(8-3)When a mistake is made that could harm the patient, but does not, how often is this reported?	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
(11-1) Things “fall between the cracks” when transferring patients from one unit to another	-0.004	0.029	0.003	0.029	0.024	0.030
(11-2) Important patient care information is often lost during shift changes.	0.018	0.030	-0.031	0.030	-0.050	0.031
(11-3) Problems often occur in the exchange of information across hospital units.	-0.053	0.039	-0.081	0.039	-0.073	0.040 *
(11-4) Shift changes are problematic for patients in this hospital.	-0.018	0.026	0.007	0.026	0.018	0.027
Number of observations		1046		1046		1046
$\chi^2$		93.72		80.89		119.24
Probability		0.0000		0.0000		0.0000
Pseudo Rsquare		0.0328		0.0283		0.0443

**12 NonPunitive Response to Errors**

	(8-1)When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?		(8-2)When a mistake is made, but has no potential to harm the patient, how often is this reported?		(8-3)When a mistake is made that could harm the patient, but does not, how often is this reported?	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
(12-1) Staff feel like their mistakes are held against them.	0.034	0.036	0.038	0.036	0.018	0.037
(12-2) When an event is reported, it feels like the person is being written up, not the problem.	-0.048	0.039	-0.048	0.039	-0.106	0.039 ***
(12-3) Staff worry that mistakes they make are kept in their personnel file.	-0.093	0.041	-0.090	0.040	-0.050	0.041
Number of observations		1050		1050		1050
$\chi^2$		101.02		83.14		122.01
Probability		0.0000		0.0000		0.0000
Pseudo Rsquare		0.0351		0.0288		0.0449



units that need to work together.

10. Staffing

Nothing

11. Handoff & Transitions

Nothing

12. Non punitive Response to Errors

Nothing

Especially the items which are statistically significant at 1% level in all of cases are summarized as follows.

- (2-2) My supervisor/manager seriously considers staff suggestions for improving patient safety.
- (4-2) The actions of hospital management show that patient safety is a top priority.
- (6-1) We are given feedback about changes put into place based on event reports.
- (6-3) In this unit, we discuss ways to prevent errors from happening again.
- (7-1) Staff will freely speak up if they see something that may negatively affect patient care.
- (9-1) There is good cooperation among hospital units that need to work together.

Results of statistical analysis based on The Hospital Survey on Patient Safety Culture suggest that Supervisor/manager Expectations & Actions Promoting Safety, Organizational Learning–Continuous Improvement, Management Support for Patient Safety, Feedback and Communication about Error, Communication Openness, and Teamwork Across Units could be considered as important factors to improve effectively the patient safety. It can be seen that items related with communication are relatively important. Also the actions of hospital management and supervisor are critical.

EI-Jardali Fadi et al. (2011) analyzes the relation between number of events reported which is outcome variable and feedback and communication about errors in Lebanon, and as the result shows that a one unit increase in the composite score for feedback and communication about errors increased the odds of reporting a high number of

events by 1.17 ( $p=.013$ ) by using Generalized Estimating Equation. This result which implies the importance of feedback and communication about errors is similar with the result of this study. Also statistical analysis of Ito Shinya et al. (2011) shows comparatively strong correlation between number of events reported and feedback & communication about errors in Japan.

## 5. CONCLUSION

Staff can discuss freely patient care and have good cooperation among hospital units in the environment where patient safety is considered as a top priority of hospital management. This empirical study could suggest key factors to improve patient safety in Japan. Hospital Survey on Patient Safety Culture (HSOPSC) is used to assess safety culture in many countries including Japan. The limitation of this study is to research in the Faculty of Medicine of Kindai University, but taking it into consideration that other studies using HSOPSC also obtain the same results which show the correlation between number of events reported and feedback & communication about errors, the implication of this empirical study could be generalized to a certain degree. Also causality analysis can't be strictly conducted because data is just cross sectional data and isn't panel data. But periodical studies using 'The Hospital Survey on Patient Safety Culture' are possible. Minetaki K. (2018) provides similar analysis of survey data in 2015. The accumulation of data will make it possible to conduct more accurate empirical study of patient safety.

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## NOTES

- 1) DESC is a meaning as follows.  
D- Describe the specific situation.

- E- Express your concerns about the action.
- S- Suggest other alternatives.
- C- Consequences should be stated.
- 2) CUS is a meaning as follows.
  - C: I am concerned.
  - U: I am uncomfortable.
  - S :This is a safety issue.
- 3) To participate in the AHRQ Hospital Survey on Patient Safety Culture Comparative Database, the survey must be used in its entirety without significant modifications or deletions.

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