

Cognitive Error as the Most Frequent Contributory Factor in Cases of Medical Injury: A Study on Verdict's Judgment Among Closed Claims in Japan

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BACKGROUND: Cognitive errors in the course of clinical decision-making are prevalent in many cases of medical injury. We used information on verdict's judgment from closed claims files to determine the important cognitive factors associated with cases of medical injury.

METHODS: Data were collected from claims closed between 2001 to 2005 at district courts in Tokyo and Osaka, Japan. In each case, we recorded all the contributory cognitive, systemic, and patient-related factors judged in the verdicts to be causally related to the medical injury. We also analyzed the association between cognitive factors and cases involving paid compensation using a multivariable logistic regression model.

RESULTS: Among 274 cases (mean age 49 years old; 45% women), there were 122 (45%) deaths and 67 (24%) major injuries (incomplete recovery within a year). In 103 cases (38%), the verdicts ordered hospitals to pay compensation (median; 8,000,000 Japanese Yen). An error in judgment (199/274, 73%) and failure of vigilance (177/274, 65%) were the most prevalent causative cognitive factors, and error in judgment was also significantly associated with paid compensation (odds ratio, 1.9; 95% confidence interval [CI], 1.0-3.4). Systemic causative factors including poor teamwork (11/274, 4%) and technology failure (5/274, 2%) were less common.

CONCLUSIONS: The closed claims analysis based on verdict's judgment showed that cognitive errors were common in cases of medical injury, with an error in judgment being most prevalent and closely associated with compensation payment. Reduction of this type of error is required to produce safer healthcare. *Journal of Hospital Medicine* 2011;6:109-114.

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KEYWORDS: cognition, error in judgment, failure of vigilance, medical injury.

Promotion of safer healthcare by patient organizations has led to an expansion of studies aimed at understanding medical errors to minimize injury through systemic improvement. These efforts have focused on identifying patient-related factors, reducing technology failures, and improving communication.¹ In contrast, factors related to cognitive errors by healthcare providers have received relatively little attention, although such errors may be an important source of preventable harm.^{1,2}

Limited information is available on the types and prevalence of cognitive factors in cases of medical injury, although cognitive factors may be a major risk for medical injury. If these factors were confirmed to be important factors for medical injury, better educational strategies may be needed to reduce cognitive errors among physicians and to enhance quality improvement and patient safety. Better understand-

ing of these cognitive factors may also help to implement educational programs aimed at the improvement of cognitive performance in medical schools or teaching hospital.³⁻⁵

Closed-claim files for cases of medical injury contain valuable information for investigation of the factors involved in medical errors.³ In Japan, court claims were tried and closed orders were issued by judges without a jury system until 2009. Under this system, representatives for defense and plaintiffs can present medical experts. Courts can also appoint experts independent of either party. Court opinions in Japan are considered as neutral judgments for conflicts between plaintiffs and defendants. Usually there are 3 judges who are required to be involved with each judgment in Japanese courts.

Closed-claim files in cases of medical injury contain information about the types and prevalence of cognitive factors suggested to be causally related to the injuries by

verdicts in district courts. Thus, by analyzing these files, an unbiased description of the characteristics and epidemiology of cognitive factors can be obtained for cases of medical injury, with minimization of potentially biased claims indicated by both parties; ie, plaintiffs vs. hospitals. Therefore, in this study, by using information from closed claims files at district courts in Tokyo and Osaka, Japan, we aimed to determine the important cognitive factors associated with cases of medical injury from such factors as judgment, vigilance, memory, technical competence, or knowledge. Since we anticipated that cognitive factors would dominate among the causative factors, we also explored the association of these factors with cases in which a judgment of paid compensation was made.

Methods

Study Sample

The authors acknowledge that the methodologies are based on those from the Malpractice Insurers' Medical Errors Prevention Study.⁶ A claim was defined as a written demand for compensation for cases of medical injury, based on a similar approach in previous studies.^{7,8} Reviews were performed for closed-claim files for cases of medical injury involving physicians from 2001 to 2005. These files were published by the Division of the Tokyo-Osaka Medical Malpractice Lawsuits, organized by district courts in Tokyo and Osaka. The files included all closed-claim cases of medical injury involving physicians from 2001 to 2005 at district courts in Tokyo and Osaka. The locations of delivery of care were inpatients in this study. All patients in Japan were insured during the study period.

Data Collection

Reviews were conducted by 3 board-certified Japanese physician-investigators specializing in internal medicine (1 chief investigator and 2 coinvestigators). The chief investigator trained the coinvestigators in 1-day sessions with regard to the content of claims files, data collection, and the confidentiality procedure. Reviews were first performed by 1 coinvestigator and then confirmed by the chief investigator.

Data were collected for patient demographics and characteristics of adverse events, including types, locations, clinical areas, and specialties involved in the claims. Classification of specialties was based on that of Singh et al.³ Types of adverse events included minor injury for cases with complete recovery within a year, significant injury for those with complete recovery requiring more than a year, major injury for those with incomplete recovery (any physical sequelae) after more than a year, and death. Clinical areas consisted of surgery, obstetrics, missed diagnosis, delayed diagnosis, medication, and fall. Data for litigation outcomes and the amounts of paid compensation in Japanese Yen (JY) were also collected for claims that received verdicts supporting the plaintiffs.

All factors identified in the verdicts as causally related to the medical injury were recorded for data analysis. Classification of these factors was based on that of Singh et al.³ Cognitive factors were drawn from a list of categories of physicians' tasks provided by the Occupational Information Network. This network is a database of occupational requirements and worker attributes and it describes occupations in terms of the skills and knowledge required, how the work is performed, and typical work settings. The list of cognitive factor categories of physicians' tasks included judgment, vigilance, memory, technical competence, or knowledge. Accordingly, the cognitive factor category list was considered to capture the work of clinicians across the entire range of specialties.³

An example concerning failure of judgment would be that a rapid respiratory rate in initial vital signs was missed or ignored in a patient who complained of upper abdominal pain, was sent home with a diagnosis of gastritis, and eventually died at home; and an autopsy diagnosis of myocardial infarction with congestive heart failure was later confirmed. A vigilance error example would be that, in an electronic ordering system, typing an incorrect medication that has the similar commercial name of a correct medication. An example of failure of memory as a cognitive error would be that a physician forgot a result of laboratory data (positive sputum cytology of lung cancer), and so the physician did not explain it to the patient and did not perform an appropriate subsequent treatment referral. A technical incompetence example would be an operative or procedural injury due to technical problems of physicians. An example of a knowledge error would be that a contraindicated drug combination was prescribed such as the use of both selective serotonin reuptake inhibitor and monoamine oxidase inhibitor.

For systemic factors, a teamwork problem (poor teamwork) was used to describe disruptive team behavior, based on the concept of teamwork described by the Agency for Healthcare Research and Quality and the British Medical Association.^{9,10} Cases with teamwork problems were defined as those in which the original reviewer had judged that 1 or more of the following contributory factors played a role in the error: communication breakdowns, supervision problems, handoff problems, failures to establish clear lines of responsibility, and conflict among clinical staff. Technology failure indicated an error of commission or omission by devices, tools, or machines.

The Japanese courts analyze medical records but they do not open the records to the public and so we could not analyze the medical records of the cases in our study. Thus, we did not judge whether the adverse outcome could have been attributed to medical errors, while we analyzed the claims files and followed the conclusions reached by the end of the claims.

Statistical Analysis

Data are given as proportions for categorical variables and means or medians for continuous variables. Cognitive

TABLE 1. Characteristics of Claims (n = 274)

Characteristic	n (%)
Demographic of patients	
Women	121 (45)
Men	153 (55)
Age, mean ± SD, year	49 ± 22
Adverse outcome	
Minor	57 (21)
Significant	28 (10)
Major	67 (24)
Death	122 (45)
Operative	36
Delayed diagnosis	35
Medication	26
Missed diagnosis	16
Obstetrics	8
Clinical area	
Operative	120 (44)
Delayed diagnosis	54 (20)
Medication	50 (18)
Missed diagnosis	28 (10)
Obstetrics	19 (7)
Fall	3 (1)

NOTE: Demographic of patients, severity of adverse outcome, and involved clinical areas are provided in this table.

Abbreviation: SD, standard deviation.

factors associated with cases receiving adjudication of a compensation payment by district courts (litigation outcomes) were analyzed using a logistic regression model including 5 types of cognitive errors. Analyses were conducted with the Stata SE 10.0 statistical software package (College Station, TX). All *P* values are 2-sided and *P* < 0.05 was considered to be statistically significant. The study was approved by the ethics review board at the institution of the chief investigator.

Results

In a total of 274 closed cases of medical injury, the mean age of the patients was 49 years old and 45% were women (Table 1). The reviews performed by the coinvestigators were all confirmed by the chief investigator without discordance of the reviews between the coinvestigators and the chief investigator. The claims involved death of patients in 45% of cases; injuries that caused significant or major disability in 10% and 24%, respectively (a total of 34%); and minor adverse outcomes of medical care in 21% (57 cases). Closing verdicts supporting the plaintiffs (patients or family) by the district courts were given in 103 claims (38%), with compensation at a median of 8,000,000 JY (100 JY = \$1 US in 2005). The compensation ranged from 20,000 JY to 222,710,251 JY. The highest compensation was ordered to be paid to a 36-year-old woman with an obstetrics-related major injury and the court indicated the injury was causally related to the following 3 cognitive factors: error in judgment, failure of vigilance, and lack of technical competence.

TABLE 2. Specialty Involved in Claims

Specialty	Cases, n (%)
General surgery	27 (10)
Orthopedic surgery	27 (10)
Internal medicine	27 (10)
Obstetrics-gynecology	26 (9)
Neurosurgery	19 (7)
Ear, nose, and throat	18 (7)
Plastic surgery	15 (5)
Psychiatry	14 (5)
Cardiology	13 (5)
Dental care	13 (5)
Ophthalmology	12 (4)
Hematology or oncology	10 (4)
Adult primary care	9 (3)
Pediatrics	8 (3)
Urology	8 (3)
Cardiothoracic surgery	8 (3)
Neurology	5 (2)
Anesthesiology	4 (1)
Physical medicine or rehabilitation	3 (1)
Emergency medicine	2 (1)
Infectious disease	2 (1)
Dermatology	2 (1)
Radiology	1 (<1)
Vascular surgery	1 (<1)

TABLE 3. Contributory Factors to Medical Injury Suggested in Verdicts

Contributory Factor	n (%)
Cognitive factors	
Error in judgment	199 (73)
Failure of vigilance	177 (65)
Lack of technical competence	94 (34)
Lack of knowledge	86 (31)
Failure of memory	5 (2)
System factors	
Poor teamwork	11 (4)
Technology failure	5 (2)
Patient-related factors	87 (32)

NOTE: This table shows frequency and percentage of contributory factors to medical injury suggested in verdicts.

Operative injury was the most frequent reason for claims, followed by delayed diagnosis, medication error, and missed diagnosis. General surgery, orthopedics, internal medicine, and obstetrics/gynecology were the most frequently involved specialties, comprising 30% of all cases (Table 2). The verdicts suggested cognitive factors were the most prevalent factors associated with cases of medical injury: 73% of the injuries were judged to be the result of an error in judgment (Table 3), followed by failure of vigilance (65%), lack of technical competence (34%), and lack of knowledge (31%). Verdicts indicated systemic factors in only a few cases, including poor teamwork in 4% and technology

TABLE 4. Cognitive Factors for Cases With Paid Compensation

Cognitive Factor	Cases With No Compensation (n = 171), n (%)	Cases With Paid Compensation (n = 103), n (%)	Odds Ratio (95% CI)*
Error in judgment	117 (68)	82 (80)	1.9 (1.0-3.4) [†]
Failure of vigilance	111 (65)	66 (64)	1.0 (0.6-1.7)
Failure of memory	2 (1)	3 (3)	2.8 (0.5-18)
Lack of technical competence	58 (34)	36 (35)	1.1 (0.6-1.8)
Lack of knowledge	52 (30)	34 (33)	1.0 (0.6-1.7)

Abbreviation: CI, confidence interval.

*For paid compensation.

[†]P < 0.05

failure in 2%. Patient-related factors were suggested in 32% of the claims.

In a multivariable-adjusted logistic regression analysis of cognitive factors with a potential association with the claims with paid compensation (Table 4), only error in judgment showed a significant association (odds ratio, 1.9; 95% confidence interval [CI], 1.01-3.40). The other four cognitive factors in the model were not associated with these claims. The odds ratio for failure of memory was high (2.8), but this factor was identified by the courts in only 5 cases and was not significantly associated with claims with paid compensation.

Discussion

In this study of closed claims files, we identified 2 important cognitive factors involved in cases of medical injury. Error in judgment was the most common factor, comprising about 70% of all claims, and was significantly associated with cases with paid compensation for medical injury. The second cognitive factor was failure of vigilance, which was found in 65% of the claims. Other cognitive factors, such as lack of technical competence and knowledge or failure of memory, as well as systemic factors (poor teamwork and technology failure) were less frequently found to be causally related to cases with medical injury in the verdicts examined in the study.

Reasons for the low frequency of systemic factors involved in cases of medical injury in our study are unclear. This may be the cultural characteristics such as greater emphasis to working in teams and following rules of an organization in Japan. Another possibility is that plaintiffs might have tended to generate lawsuits in cases with suspected higher frequency of individual physicians' factors in Japan. Moreover, among cognitive factors, lack of technical competence and knowledge or failure of memory was also less frequently related to cases with medical injury in our study compared to those of the previous studies.^{3,11}

The study design of analyzing closed claims files of cases of medical injury is noteworthy for its methodology of error

assessment and provides valuable information on errors related to medical injury.^{3,7} Moreover, the system of court verdicts in Japan based on decisions by a professional judge allows elimination of potential bias from stakeholders (plaintiffs vs. hospitals) involved in cases of medical injury. Thus, probable causes related to adverse events can be determined from a neutral position. Previous studies of medical error have focused on medical record reviews, surveys, and interviews;^{12,13} our study corroborates and extends the findings in these studies that cognitive errors are the most frequent source of medical injury.

Error in judgment is commonly made in the course of decision making in multiple clinical areas. This type of error is referred to recently as cognitive dispositions to respond,¹⁴ which is different from bias or heuristics, since not all heuristics are biased and not all errors in judgments come from bias. There is a well-established value of heuristics in medical diagnosis. Moreover, the properties of this type of error are likely to be distinct from those associated with performance of procedures (lack of technical competence), such as operative injury, which are directly visible and can be prevented through rapid dissemination of information on safety procedures among a medical team. However, the consequences of error in judgment are important for patients, family, and healthcare providers, and these errors are also largely preventable by implementation of educational programs.¹⁵

Possible solutions for improving clinical judgment skills may be derived from recent education theory. The theory provides a means for minimizing errors in judgment through the process of meta-cognition, in which cognitive forcing strategies can be developed through thinking that involves active control over the process of one's own thinking.^{14,15} For example, reflective practice has been suggested to be an important instrument for improving clinical judgment and may particularly improve diagnoses in situations of uncertainty and uniqueness, thereby reducing diagnostic errors.¹⁶ The capability of critical reflection in real-time practice (reflection-in-action) and on our own practice (reflection-on-action) appears to be a key requirement for developing and maintaining medical expertise.^{17,18} For instance, case-based discussion with clinician educators can be an opportunity for enhancing critical thinking skills of medical trainees.

Based on a context-based approach that focuses on the nature of the clinical problem, potential systemic solutions have recently been proposed for reducing errors in judgment.¹ These solutions utilize advanced technology, including symptom-oriented diagnostic decision support, internet search engines for information on possible diagnoses, and automated reminders in electronic health records.^{1,19} Previous studies have shown that long work hours and sleep deprivation can decrease cognitive function, leading to failure of vigilance and increased medical errors,²⁰ and several systemic solutions provide models for avoidance of failure of vigilance. For instance, eliminating extended work shifts and reducing the number of work hours per week was shown to

reduce serious medical errors through increased sleep and decreased failure of vigilance during night work in an intensive care unit.^{21,22} Taking a brief nap during work hours has also been associated with decreased medical errors in a recent study conducted in Japan.²³ Despite the well-known importance of factors of physicians' workloads, our study did not analyze these factors and thus further studies are needed to confirm their importance in Japanese medical practice.

There were also 32% of patient-related factors suggested as contributory factors to medical injury in verdicts of the closed claims. This finding may be also important in planning educational intervention strategies to reduce medical errors. Although our data did not include the relative frequency of components related to these factors, major components of patient-related factors may include age, severity of illnesses, comorbidity, functional status, or mental status. Educational intervention programs may help healthcare providers to evaluate patients with these risk factors and to implement preventive strategies to avoid incidents among these patients.

General surgery, orthopedic surgery, internal medicine, and obstetrics-gynecology were the most frequently involved specialties in our study. The reasons why these specialties were highly involved in the claims are unclear and our study could not analyze these issues. However, these specialties may be related to patients with greater clinical severity and thus they may have subsequently higher risk for receiving claims. Further, physicians in these specialties may be at higher risk for having various errors because of the complexity of care for patients.

Our study has several limitations. First, the closed claims are more likely to represent cases with severe injury.³ Therefore, it is unclear if we can generalize our findings beyond cases with severe injury.³ Second, certain contributory factors may not have been suggested by the verdicts, even though they played a role. Among these potential factors, poor teamwork and communication issues are unlikely to be identified as causative in verdicts, unless the allegation of the plaintiffs documented these issues. Moreover, the Japanese courts did not open the medical records to the public and so we could not analyze the medical records of the cases. Third, we only evaluated closed verdicts given by professional judges of district courts, who are unlikely to be medical experts. However, the closed verdicts underwent an extensive process involving testimony from medical professionals and academic societies. Fourth, we, as investigators, had few members with surgical backgrounds in this study so we might have underestimated issues related to technical competence among the claims. Finally, although a small percentage of closed-claim cases involving team performance were identified in our study, the plaintiffs might have indicated this point to the court claims, since it might have been difficult to describe this issue as a reason for requesting compensations from defendants. Thus, despite a low proportion of team performance involvement in the ver-

dicts, we still believe that poor team performance is a factor related to most medical injuries.

In summary, causal factors obtained from closed claims files suggest the importance of cognitive factors in cases of medical injury. Among the cognitive factors, error in judgment and failure of vigilance were the most frequent. These findings may help leaders of medical schools and hospitals to allocate more resources for research into strategies to improve cognitive performance and thereby ensure patient safety. Further research is needed to better understand the cognitive mechanisms involved in medical errors and to translate this into educational strategies.

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