A comparative analysis of incident reporting lag times in academic medical centres in Japan and the USA

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ABSTRACT

Background Delays in reporting of medical errors may signal deficiencies in the performance of hospital-based incident reporting. We sought to understand the characteristics of hospitals, providers and patient injuries that affect such delays.

Setting and Methods All incident reports filed between May 2004 and August 2005 at the Kyoto University Hospital (KUH) in Japan and the Brigham and Women's Hospital (BWH) in the USA were evaluated. Lag time between each event and the submission of an incident report were computed. Multivariable Poisson regression with overdispersion, to control for previously described confounding factors and identify independent predictors of delays, was used.

Results Unadjusted lag times were significantly longer for physicians than other reporters (3.6 vs 1.8 days, $p<0.0001$), longer for major than minor events (4.1 vs 1.9 days, $p=0.0006$) and longer at KUH than at BWH (3.1 vs 1.0 days, $p<0.0001$). In multivariable analysis, lag times at KUH remained nearly three times longer than at BWH (incidence—rate ratio 2.95, 95% CI 2.84 to 3.06, $p<0.0001$).

Conclusions Lag time provides a novel and useful metric for evaluating the performance of hospital-based incident reporting systems. Across two very different health systems, physicians reported far fewer events, with significant delays compared with other providers. Even after controlling for important confounding factors, lag times at KUH were nearly triple those at BWH, suggesting significant differences in the performance of their reporting systems, potentially attributable to either the ease of online reporting at BWH or to the greater attention to patient safety reporting in that hospital.

Since publication of the Institute of Medicine's report *To Err is Human*,[1] voluntary institutional incident reporting systems have become nearly universal in hospitals in the USA and elsewhere. These systems work to identify errors,[1 2] promote patient safety and provide feedback to staff.[3] Furthermore, they enable physicians and administrators to identify adverse events and near-misses, to understand patterns of safety-compromising errors and to apply their findings to improvement efforts in safety and quality.[4 5]

Incident reporting can be easy and relatively low-cost to introduce in a hospital, but many reporting systems have important shortcomings. They often fail to capture most of the incidents, because of significant under-reporting of medical errors,[6–8] and thus cannot reliably estimate incidence rates for adverse events in any hospital system.[9 10] Physicians are found to be particularly reluctant to report adverse events[9 11 12] and to face substantial barriers to timely reporting.[11 13] They seem especially resistant to the reporting of adverse events to administrators[12] and are often discouraged by a perceived lack of feedback and observable response after the reporting of events. The successful application of incident reporting systems may be substantially undermined by such under-reporting, raising concerns about their capacity to detect critical safety issues. Future efforts to ground safety initiatives on the results of incident reporting will therefore depend on a detailed understanding of the obstacles to prompt, comprehensive disclosure.

We have previously reported the use of lag time between occurrence of an event and submission of an incident report as a surrogate measure of institutional barriers to full reporting of medical errors and adverse events.[14] Whereas simple tallies of incident reports lack both reliable numerators—under-reporting makes the total number of real incidents difficult to evaluate—and well-defined denominators, prolonged reporting lag times likely reveal obstacles to prompt transmission of critical safety information, even among those employees willing to report cases. Lag time, therefore, provides a simple insight into an institution's safety climate and the success of its reporting systems. Instances of delayed reporting offer opportunities for patient safety officers to improve and strengthen their reporting infrastructure.

Furthermore, there are several reasons why reducing reporting delays is desirable. First, timely reporting of an initial incident may allow rapid organisational response and potentially prevention of further harm to the patient involved. Second, the reliability of recall is surely subject to decay over time, so prompt reporting will maximise the likelihood of acquiring complete and accurate details about the event. And third, the practice of delaying reporting is likely to increase the chance that a practitioner will fail to complete reports at all.

Recognising that attitudes towards patient safety and disclosure of medical errors may differ substantially between institutions and cultures,[15 16] in this study we evaluated the performance of incident reporting systems in two major academic medical centres in USA and Japan. We sought to understand characteristics of hospitals, providers and patient injuries that would predict delays in the reporting of hospital-based incidents and suggest targets for improved reporting and increased attention to patient safety concerns in both institutions.

METHODS

This study was approved by the human subjects committee of the Brigham and Women's Hospital's (BWH) and the institutional review board of the Faculty of Medicine, Graduate School of Medicine, Kyoto University.

Hospitals and incident reporting systems

Kyoto University Hospital (KUH) is a tertiary referral centre in the centre of Japan, with 1240 beds, serving approximately 370 000 inpatients and 570 000 outpatients per year. The Patient Safety Division (PSD), established in April 2002, manages patient safety affairs for the entire hospital with a staff that includes a full-time physicians' and a full-time nurses' risk manager. The incident reporting system at KUH, established in April 2000, is voluntary, confidential and non-punitive. Witnesses of events submit paper reports to PSD, primarily by facsimile transmission. PSD staff screen the reports, classify them by standardised guidelines and may request submission of a more detailed second report, if necessary.[14]

BWH is a tertiary referral centre in Boston, Massachusetts, USA, with 747 acute-care inpatient beds, that provides 44 000 inpatient admissions and more than 950 000 ambulatory visits annually. The BWH Risk Management Department administers its incident reporting system and conducts initial reviews and investigations of all reports. The Patient Safety Team (PST), initiated in May 2000,[3] consists of a medical director (30% time), a full-time patient safety manager, a full-time pharmacist and a full-time data manager, and has developed and implemented the online electronic reporting system that has been in use since 2003. The taxonomies, categorisation methods, data forms, goals and principles of the system are similar in both programmes, with data forms that offer opportunity for free text descriptions of events and circumstances.

Data and definition of variables

We collected all incident reports filed in each institution between May 2004 and August 2005. Report data include the date of the event (occurrence date), the date that PST/PSD received the report (reception date), the identity and/or job title of the reporter, and the severity of injury. Injury severity is categorised into a six-level classification scheme at KUH and an 11-level outcome rating at BWH. For purposes of comparison (and in accordance with our previous work[14]), we dichotomised severity into two classes: "major" events were those that resulted in major temporary or permanent disability, death or prolonged hospital stay, and "minor" events with minor injuries or no injury.

We defined lag time as the time between occurrence date and reception date of the primary report. Lag times for weekend events were corrected when necessary, by methods we have described elsewhere.[14]

Statistical methods

We used the STATA software package for statistical analyses. Frequencies were compared by χ^2 tests. Because of its right-skewed distribution, univariable hypothesis testing on lag time was performed with Wilcoxon rank sum tests. To control for known confounders[14] in multivariable modelling, we used Poisson regression with overdispersion.

RESULTS

We identified and reviewed 4102 reports filed at BWH and 3084 reports at KUH during the sample period. Their characteristics are shown in table 1. Only a small minority of reports in each institution were filed by physicians (3.7% at BWH, 5.3% at KUH), but physicians' reports were far more likely to involve major incidents (7.0% vs 0.3% for non-physicians, p<0.0001). Physicians accounted for a slightly higher proportion of reports at KUH than at BWH (5.3% vs 3.7%, p=0.001), but the proportion of reports involving major incidents and the distribution between years was similar between hospitals.

Descriptions of the major incidents reported by physicians are shown in table 2a, and those reported by non-physicians (predominantly clinical nurses) are shown in table 2b. Physicians and non-physicians reported similar number of major events overall (22 vs 21, respectively). Within institutions, however, physicians accounted for a minority of the major events reported at BWH (4/19, 21.1%) but most of the major events at KUH (18/24, 75%; p=0.0004).

The overall mean lag time between occurrence of an incidence and receipt of the report was 1.0 (4.1) days at BWH and 3.1 (4.1) days at KUH (p<0.0001). Unadjusted lag times were significantly longer among physicians than among non-physicians (3.6 (7.1) vs 1.8 (4.0) days, p<0.0001) and longer for major injuries than for minor ones (4.1 (6.2) vs 1.9 (4.2) days, p=0.0006). Lag times did not show any consistent time-related trends nor were they different between years of the sample (p=0.88). These patterns did not differ meaningfully between institutions.

These effects remained consistent in multivariable Poisson regression, as shown in table 3. Even after controlling for profession of reporter and severity of injury, reporting lag times were 2.95 times longer at KUH than at BWH (95% CI 2.84 to 3.06) in table 4.

DISCUSSION

Incident reporting systems are an essential component of hospitals' patient safety promotion efforts.[1 4] In most institutions, they remain the primary—and often only—source for front-line disclosure of serious errors and incidents. Hospital safety officers, therefore, depend heavily on the accuracy, comprehensiveness and timeliness of reports. Because underreporting of errors is an important limitation to strategies that depend on such systems,[6 7 9–11] we need more detailed understanding on how incident reports may best be used to improve patient safety.[17] In this study, as in our previous work,[14] we propose that lag time between incidents and the filing of reports about them provides an additional dimension on which patient safety administrators may evaluate the performance of their reporting systems.

In accordance with a number of previous studies,[9 11 12 14] we find that, among healthcare professionals, physicians account for a markedly small proportion of reports filed. Looking solely at the number or frequency of reports, some might wonder whether these trends are attributable to a greater number of patients or wider variety of patient care tasks assigned to nurses and other

Table 1 Characteristics of incidents

		BWH n=4102	KUH n=3084	p Value*
Profession of reporter	Physician	151 (3.7)	163 (5.3)	0.001
	Non-physician	3951 (96.3)	2921 (94.7)	
Degree of injury	Major	19 (0.5)	24 (0.8)	0.087
	Minor or none	4083 (99.5)	3060 (99.2)	
Year	2004	1933 (47.1)	1414 (45.8)	0.284
	2005	2169 (52.9)	1670 (54.2)	

Data are shown as n (%). Hypothesis testing was performed using Pearson χ^2 tests.
BWH, Brigham and Women's Hospital; KUH, Kyoto University Hospital.

Table 2a Description of major incidents submitted by physicians

	Type of incident	n
KUH (n=18)	Events after invasive or diagnostic procedures	12
	Post-procedure bleeding	(6)
	Perforation of gastrointestinal tract; esophagus, duodenum	(2)
	Pseudoaneurysm	(2)
	Peripheral embolism	(1)
	Accidental removal of hepatic artery catheter	(1)
	Postoperative surgical events	4
	Pulmonary embolism	(3)
	Portal embolism after liver transplantation	(1)
	Medication errors	2
	Wrong frequency	(1)
	Adverse drug reaction	(1)
BWH (n=4)	Events after invasive or diagnostic procedures	1
	Delay in imaging and failure to diagnose	(1)
	Postoperative surgical events	1
	Bleeding; hip replacement	(1)
	Medication errors	1
	Adverse drug reaction	(1)
	Other	1
	Patient found unresponsive	(1)

staff. However, we find that, in addition to their far lower reporting volume, even when physicians do file reports, they take substantially longer to do so, suggesting that physician face important obstacles—likely both internal and external—to swift transmission of critical information. Even accounting for the differences between two very different hospital systems, we find that physician-reporters delay 75% longer than other professionals.

The greatest difference in reporting lag times, however, was seen between the two institutions. Even after controlling for important confounding factors, lag times at KUH were nearly triple those at BWH, suggesting significant differences in the performance of their reporting systems. There are at least two

Table 2b Description of major incidents submitted by non-physicians

	Type of incident	n
KUH (n=6)	Falls	2
	Postoperative surgical events	3
	Pulmonary embolism	(3)
	Medication errors	1
	Adverse drug reaction	(1)
BWH (n=14)	Events after invasive or diagnostic procedures	3
	Post-procedure bleeding	(2)
	Pulmonary embolism	(1)
	Postoperative surgical events	4
	Bleeding	(2)
	Accidental extubation	(2)
	Medication errors	3
	Wrong dose	(1)
	Adverse drug reaction	(2)
	Other	4
	Unwitnessed cardiopulmonary arrest (includes one hospital visitor)	(2)
	Cardiopulmonary arrest	(1)
	Haematemesis in hallway	(1)

Table 3 Factors associated with differences in lag time

		Total	BWH	KUH
Profession of reporter	Physician	3.6 (7.1)	2.8 (8.7)	4.3 (5.2)
	Non-physician	1.8 (4.0)	1.0 (3.8)	3.0 (4.0)
p Value		<0.0001	<0.0001	<0.0001
Severity of injury	Major	4.1 (6.2)	3.1 (6.7)	4.9 (5.8)
	Minor	1.9 (4.2)	1.0 (4.1)	3.0 (4.1)
p Value		0.0006	0.02	0.06
Year	2004	1.9 (3.8)	1.0 (3.7)	3.0 (3.6)
	2005	1.9 (4.5)	1.1 (4.4)	3.1 (4.4)
p Value		0.88	0.19	0.98
Total		1.9 (4.2)	1.0 (4.1)	3.1 (4.1)

BWH, Brigham and Women's Hospital; KUH, Kyoto University Hospital.
Data are shown as mean (SD) in days. Hypothesis testing was performed using Wilcoxon rank sum tests.

possible explanations for this disparity. First, incident reports at BWH were filed electronically through on online submission system that is available throughout the hospital and its affiliates, whereas KUH required hard-copy paper reports during the study period. Perhaps online reporting has the potential to improve reliability of incident reporting systems[18] and to reduce impediments, whether real or perceived, to prompt reporting.

Second, longer reporting lag times could belie differences in institutional attitudes about the importance of patient safety. We have previously seen that institution-wide efforts to promote safety culture may be reflected in improvements in lag time.[14] For example, lag times at KUH before the current study period were affected by the introduction of intensive patient safety training for providers—including direct appeals to strengthen the use of the reporting system—and expansion of the PSD staff in 2002. The following year, overall lag times decreased and the disparity in lag times between physicians and nurses was narrowed. That these improvements did not last into the current study period (2004–2005) suggests that the salience of such safety promotion efforts fades with time. By comparison, the PST at BWH has focused on integrating their reporting systems and safety promotion with the pre-existing clinical and quality infrastructure,[3] as well as developing and maintaining a systematic method for prompt feedback of findings to reporters, perpetuating the influx of information and closing the loop of communication.[19] Perhaps this broad emphasis on the value of safety reporting is reflected in the staff's attention to prompt filing,[20] and the slightly greater proportion of major events reported by non-physicians at BWH might result from cultural differences in perceptions of roles, responsibilities and accountability for safety.

There are important limitations to our study. Because it was merely observational, we cannot exclude the possibility that other important factors explain these trends. For example, if physicians reported events directly to risk managers, bypassing the formal reporting system, we might underestimate their

Table 4 Multivariable Poisson regression evaluating predictors of lag time

Predictor	Category	IRR	95% CI	p Value
Profession	Non-physician	Reference		
	Physician	1.75	1.65 to 1.87	<0.0001
Severity of injury	Minor	Reference		
	Major	1.34	1.15 to 1.56	0.0002
Hospital	BWH	Reference		
	KUH	2.95	2.84 to 3.06	<0.0001

BWH, Brigham and Women's Hospital; IRR, incidence–rate ratio; KUH, Kyoto University Hospital.

frequency of input to the hospital's safety monitoring system. We might also overestimate their lag times if these direct contacts were followed by formal submission at a later time. Furthermore, we do not attempt to account for differences in acuity and other characteristics of patients in the two hospitals, or to differences in staffing levels, administrative infrastructure or malpractice exposure.

Nonetheless, this study illustrates the potential for using lag times in incident reporting as a measure suggestive of differences in performance of reporting systems. Noting that lag times are prolonged in an institution, after adjusting for known confounders, such as profession and injury severity, patient safety administrators can work to understand potential limitations in their system and improve performance and compliance through active safety promotion, feedback of investigations and analyses, and introduction of online reporting or other methods to reduce logistical barriers. Further study of the inter-relationships between institutions' attentiveness to safety improvement, cultural attitudes towards patient safety and the frequency and promptness of incident reporting would meaningfully strengthen these efforts in any health system.

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Competing interests None.

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