ORIGINAL ARTICLE

Lag time in an incident reporting system at a university hospital in Japan

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Background: Delays and underreporting limit the success of hospital incident reporting systems, but little is known about the causes or implications of delayed reporting.
Setting and methods: The authors examined 6880 incident reports filed by physicians and nurses for three years at a national university hospital in Japan and evaluated the lag time between each incident and the submission of a report.
Results: Although physicians and nurses reported nearly equal numbers of events resulting in major injury (32 *v* 31), physicians reported far fewer minor incidents (430 *v* 6387) and far fewer incidents overall (462 *v* 6418). In univariate analyses, lag time was significantly longer for physicians than nurses (3.79 *v* 2.20 days; $p<0.001$). In multivariate analysis, physicians had adjusted reporting lag time 75% longer than nurses ($p<0.001$) and lag time for major injuries was 18% shorter than for minor injuries ($p=0.011$). Adjusted lag time in 2002 and 2004 were 34% longer than in 2003 ($p<0.001$).
Conclusions: Physicians report fewer incidents than nurses and take longer to report them. Quantitative evaluation of lag time may facilitate improvements in incident reporting systems by distinguishing institutional obstacles to physician reporting from physicians' lesser willingness to report.

The Institute of Medicine report ''To err is human'' issued in 1999,[1] called attention to the importance of building a safer healthcare system. It recommended voluntary intra-institutional reporting systems, based on the concept that learning from both adverse events and near misses is essential to improving safety and quality.[2 3] Reporting systems were implemented at hospitals throughout the US to identify errors,[1 4] promote patient safety and provide feedback to staff.[5]

In Japan, attention to patient safety was accelerated by an incident of wrong patient surgery at a university hospital in 1999.[6] As of 1 October 2003, the Health Ministry has mandated four safety measures, including an incident reporting system to analyse adverse events and promote safety measures.[7] Since April 2000, even before the countermeasure by the Japanese Government, Kyoto University Hospital (KUH), a leading teaching university hospital in Japan, has maintained an incident reporting system throughout the institution.

Despite the utility of incident reporting systems, a number of authors have highlighted their shortcomings. First, significant underreporting is common, as voluntary systems identify only a small fraction of medical errors,[8] and therefore, cannot reliably estimate incidence rates of adverse events.[9 10] Second, healthcare professionals, especially physicians, are reluctant to report adverse events,[9 11 12] and face substantial barriers to prompt reporting.[11 13] There appears to be particular resistance by physicians to the reporting of adverse events to administrators.[12]

This study explores factors associated with delays in incident reporting after adverse events and near misses. We report the investigation of a new variable—the lag time between occurrence of an event and submission of an incident report. By evaluating predictors of prolonged lag time, we suggest targets for improving incident reporting.

SETTING AND METHODS

This study was approved by the Institutional Review Board of the Faculty of Medicine, Graduate School of Medicine, Kyoto University.

Kyoto University Hospital and Patient Safety Division

Kyoto University Hospital is a tertiary referral centre in the middle of Japan, serving approximately 370 000 inpatients and 570 000 outpatients annually, with 1240 beds including 1107 general, 80 psychiatric and 53 tuberculosis beds. The patient care staff included 589 physicians—including 122 residents—and 624 nurses in the fiscal year 2003.

The Patient Safety Division (PSD), established in April 2002, manages patient safety affairs for the entire hospital. PSD staff includes both a full-time physicians' and a full-time nurses' risk manager.

Incident reporting system at KUH

With regard to the incident reporting system at KUH, the policy is voluntary, confidential and non-punitive. The procedure is that witnesses of events submit reports to the PSD, after checking whether they are fulfilled by risk managers. The PSD receives these primarily by fax; PSD staff screen the reports, classify them by standardised guidelines and may request submission of a more detailed second report, if necessary. The expectation is that the incident reporting system contributes to patient safety by learning from near misses with perceived heightened potential for harm and serious accidents.

Data and definition of variables

Of 7139 incident reports collected between April 2002 and March 2005, we analysed the 6880 reports filed by physicians and nurses, excluding 259 reports by other hospital employees. Report data include the date of the event (Occurrence Date), the date that the PSD received the first report before screening (Reception Date), the clinical department, ward, and unit of the reporter, and the severity of injury, based on the six-level classification scheme (Level 0 to Level 5) recommended by the Conference of National University Hospitals for Patient Safety.[14]

Abbreviations: KUH, Kyoto University Hospital; PSD, Patient Safety Division

We, however, dichotomised severity into two classes: ''Major'' events with possible disability and prolonged hospitalisation (Level 3b to Level 5) and ''Minor'' events with minor injuries or no injury (Level 0 to Level 3a) in this study.

We defined lag time as the time between Occurrence Date and Reception Date of the primary report. Lag time does not include any time required for review by the risk manager, or any time required for submission of secondary reports. Because reports are not received by the PSD at the weekend, lag time was corrected by subtracting three, two or one day for incidents that occurred on a Friday, Saturday or Sunday, respectively.

Statistical methods

We used the software package STATA (StataCorp. College Station, Texas, USA) for statistical analyses. Variables were analysed by *t* test and analysis of variance. As lag time conforms to a Poisson distribution, we performed multivariate analysis for lag time using Poisson regression with overdispersion.

RESULTS

Table 1 shows characteristics of 6880 incident reports filed at KUH during the study period. Although nurses filed the majority of reports (6418, 93.3%), significantly more of their reports involved minor incidents (6387, 99.5% *v* 430, 93.1%; χ^2 $p<0.001$), whereas physicians and nurses reported similar numbers of major events (32 and 31, respectively). Overall, minor events accounted for 6817 reports (99.1%). The average annual reporting rate was 0.26 reports per physician, compared with 3.43 per nurse.

The mean (standard error) lag time between incident and report acceptance was 2.3 (0.1) days. Mean lag time for physicians was significantly longer than for nurses, both among all cases (3.8 *v* 2.2 days, $p<0.001$), and when stratified by severity of injury (3.8 *v* 2.2 days for minor incidents, $p<0.001$; 3.8 *v* 1.6 days for major incidents, $p = 0.0067$). There was no significant difference in lag time between major and minor incidents in univariate analyses (2.7 *v* 2.3 days respectively, $p = 0.491$).

Incident reports were distributed fairly equally among the three years of the study (fiscal year (FY) 2002: 2311, 33.6%; FY2003: 2526, 36.7%; FY2004: 2043, 29.7%). Mean lag time differed significantly by year ($p<0.001$; see table 2). In pairwise comparisons, lag time in FY2003 (1.9 (0.1) days) was significantly shorter than either FY2002 (2.5 (0.1) days, $p<0.001$) or FY2004 (2.6 (0.1) days, $p<0.001$). There was no difference in lag time between FY2002 and FY2004 ($p = 0.71$), so they were pooled in subsequent analyses.

Results of multivariate Poisson regression are presented in table 3. Controlling for all significant predictors, lag time was 18% shorter for major than minor incidents ($p = 0.011$), 75% longer among physicians than nurses ($p<0.001$), and 34% longer in FY2002/4 than FY2003 ($p<0.001$). Coefficients for interaction terms between profession and severity and between profession and fiscal year were not significant.

Among major injuries, physicians' reports are dominated by procedure-related complications, including bleeding (21.9%), retained foreign bodies (18.8%) and perforation of the gastrointestinal tract (12.5%), whereas most nursing reports relate to postoperative patient care issues (tables 4 and 5). Serious injuries due to patient falls represented 61.3% of nurses' major incidents reported, while physicians reported only one major fall-related injury during the study period (3.1%; $p<0.0001$).

DISCUSSION

Incident reporting systems provide essential information about the performance of, and flaws in, hospitals' patient safety capabilities.[1–4] Recognising their essential role in quality and safety initiatives, such systems were implemented all over the world, including in Japan.[6 7] Unfortunately, the utility of these systems may be undermined by underreporting of errors, raising concerns about the ability of our systems to detect

Table 1 Lag time by profession and degree of injury (n = 6880)

Level of injury	Profession	Total (1213)	Physician (589)	Nurse (624)	p Value* (physician *v* nurse)
Minor	n	6817	430	6387	<0.001
	Mean (SE) (day)	2.3 (0.1)	3.8 (0.5)	2.2 (0.1)	
Major	n	63	32	31	0.0067
	Mean (SE) (day)	2.7 (0.5)	3.8 (0.8)	1.6 (0.4)	
Total	n	6880	462	6418	<0.001
	Mean (SE) (day)	2.3 (0.1)	3.8 (0.5)	2.2 (0.1)	
	Annual reporting rate	1.89	0.26	3.43	<0.001†
p Value* (minor *v* major)		0.491	0.991	0.452	

SE, standard error.
Number of physician is 589 including 310 academic staff and 122 residents. Number of nursing staff is 624.
*Two-tailed *t* test.
†Poisson test for equal rates between physician and nurse.

Table 2 Lag time by fiscal year and profession (n = 6880)

Profession	Fiscal year	All years	2002	2003	2004	p Value*
Physicians	n	462	179	159	124	0.032
	Mean (SE) (day)	3.8 (0.5)	4.6 (1.0)	2.2 (0.4)	4.7 (0.8)	
Nurses	n	6418	2132	2367	1919	<0.0001
	Mean (SE) (day)	2.2 (0.1)	2.3 (0.1)	1.9 (0.1)	2.4 (0.1)	
Total	n	6880	2311	2526	2043	<0.0001
	Mean (SE) (day)	2.3 (0.1)	2.5 (0.1)	1.9 (0.1)	2.6 (0.1)	
p Value†		<0.0001	0.0001	0.338	<0.0001	

SE, standard error.
*Three-sample ANOVA comparing fiscal years.
†Two-sided *t* test comparing physicians and nurses.

Table 3 Results of Poisson regression for predictors of lag time (n = 6880)

	IRR (95% CI)	p Value
Physician*	1.75 (1.67–1.85)	<0.0001
FY2002/4†	1.34 (1.29–1.38)	<0.0001
Major‡	0.82 (0.71–0.96)	0.011

CI, confidence interval; IRR, incidence rate ratio; SE, standard error.
*Reference group nurses.
†Reference group FY2003.
‡Reference group minor.

Table 4 Description of major incidents reported by physicians (n = 32)

Type of incident	n
Specialty treatment and invasive examination related events	16
Bleeding	(7)
Perforation of gastrointestinal tract	(4)
Pleural effusion due to replacing IVH catheter	(1)
Femoral artery pseudoaneurysm	(1)
Foreign body in vessel	(1)
Peripheral embolism after intravascular stenting	(1)
Accidental removal of hepatic artery catheter	(1)
Surgery-related events	13
Foreign body	(6)
Postoperative pulmonary embolism	(3)
Perforation of organ	(2)
Wound infection	(1)
Skin ulcer	(1)
Medication error	2
Fracture due to fall	1

Table 5 Description of major incidents reported by nurses (n = 31)

Type of incident	n
Fracture due to falls	19
Surgery and invasive examination related events	9
Peripheral nerve palsy	(3)
Postoperative pulmonary embolism	(3)
Foreign body	(2)
Perforation of uterus	(1)
Medication error	2
Shock after gastrointestinal endoscopy (possibly due to original disease)	1

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 quick, comprehensive disclosure.

In this study, we have replicated the previous finding that, among healthcare professionals, physicians are particularly reluctant to report adverse events.[9 11 12] Even after accounting for the greater number of nurses than physicians employed at KUH, annual per capita reporting rates were more than 13 times greater for nurses than for physicians. This greater volume may be a function of the greater number of patients, and greater variety of direct patient care tasks attributed to nurses. However, the differences in lag time, rather than just overall reporting volume, suggest that physician underreporting may be an important factor as well. By investigating a novel reporting parameter—the lag time between incident and report—we have further shown that even among physicians who are willing to report cases there remain obstacles to swift transmission of critical information. Over a three-year sample of incident reports, physicians at KUH took 75% longer than nurses to file.

Although this study does not specifically address the underlying causes for differences between disciplines, there are several possible explanations for the lesser participation and slower lag times among physicians. First, physicians' attentiveness to the patient safety climate may simply be less than their nursing counterparts, contributing directly to their lower rates of reporting.[15] Additionally, although the incident reporting system at KUH is technically voluntary, the PSD encourages staff, especially physicians, to submit incident reports when an event has been recognised. Some component of physicians' longer lag times may, therefore, represent the time required for a request from the PSD to then be followed by a response from the physician.

Some component of the nurses' shorter lag times may also be a result of carry-over from an earlier reporting system maintained by the nursing staff before the initiation of a hospital-wide system in 2000. In order to improve physicians' safety proficiency, the PSD implemented intensive patient safety training for staff, including direct appeals to use incident reporting as a means to improve performance, that coincided with the first year of this study, and with increased staffing for the PSD and the reporting system itself after the creation of the PSD in 2002. These measures may have been partly responsible for the significantly shorter lag time—and the narrowing of the difference in lag time between physicians and nurses—during FY2003. Nevertheless, by FY2004, both overall lag times and the gap between physicians and nurses had returned to the baseline levels from FY2002, re-emphasising the message that such initiatives will require continual re-emphasis to be successful over time.

Second, healthcare professionals may be reluctant to report events because of fear of retribution, censure or stigma.[16] O'Connor has also noted the importance of legal implications.[17] Others have argued that fear of malpractice exposure is not a major barrier to reporting for physicians,[13 18] though it may be a significant deterrent for nurses.[18] There is an additional issue particular to the Japanese health system. Japanese healthcare providers are susceptible to criminal prosecution for professional negligence, and physicians may be held responsible for the behaviour of their entire clinical staff. The impact of these policies on practitioners' reporting behaviours is unknown. Embracing a strictly non-punitive approach, the US National Center for Patient Safety fosters a culture of safety in which clinicians may report unsafe situations and close calls without fear of reprisal.[19] This non-punitive system significantly increases rates of reporting,[20] and promotes both rational, efficient safety improvement practices, and a positive culture change toward safety.[21]

Third, physician staffing and workload may contribute to their lesser involvement and longer lag time in incident reporting. Both Evans *et al* and Uribe *et al* have reported that time constraints limit physicians' participation in reporting and documentation of errors.[13 18] Japanese hospital physicians average 66.4 work hours per week,[22] whereas nurses' shiftwork system limits their hours to far fewer. Physicians, especially residents in training, are also more likely than nurses to change hospitals under the medical schools' professional and alumni network system, making them less familiar with the particular reporting systems of their institutions.[23] It is quite easy to imagine that these workforce constraints would reduce the likelihood that physicians will take time to complete incident reports, especially for minor events, and produce longer lag times when they do choose to report. Consideration of lag time

within an incident reporting system may provide insights into these types of institutional barriers that would not be evident from gross reporting rates alone.

We further demonstrated that the severity of injury significantly predicted lag time to report. Incidents involving major injury were reported, on average, nearly 20% sooner than those involving minor injuries as Stanhope *et al* reported,[10] suggesting that the salience of the event may play an important role in a practitioner's sense of the relative urgency of reporting. As to major reported incidents, physicians reported many events related with specialty treatment, invasive examination and surgery. By contrast, nurses reported first falls with fractures and second surgery-related events, because nurses have contact with numerous patients after surgery on nursing units. The absence of major injury associated with the minor incidents should not, however, be understood to mean that these are unimportant events. Rather, many involve the kinds of ''near misses'' that represent critical threats to the safety environment and important targets for safety measures.[24] The finding of delayed reporting of such near misses could provide opportunity for patient safety officers to reinforce the importance of their reporting systems.

Initiatives to secure patient safety and improve the quality of care in Japan and elsewhere will require a variety of countermeasures to be implemented and carried out simultaneously.[23] In this study, we have described the use of a novel variable—the lag time between an event and the incident report—as a useful indicator of both obstacles to reporting and overall climate for patient safety. An understanding of the limitations of our current incident reporting systems is essential in efforts to apply their findings to the development of safety policies and interventions.

CONCLUSION

We have demonstrated the use of lag time in incident reporting as a measure of patient safety climate and the success of reporting systems. Lag times for physicians, and for incidents involving minor injuries are significantly delayed, suggesting that efforts to increase frequency and breadth of reporting should focus first in these areas, in concert with efforts to foster a culture of safety and a non-punitive approach to the management of medical errors.

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