Implementing an Intervention to Improve Physicians' Incident Reporting in the Hospital Setting: A Pilot Study

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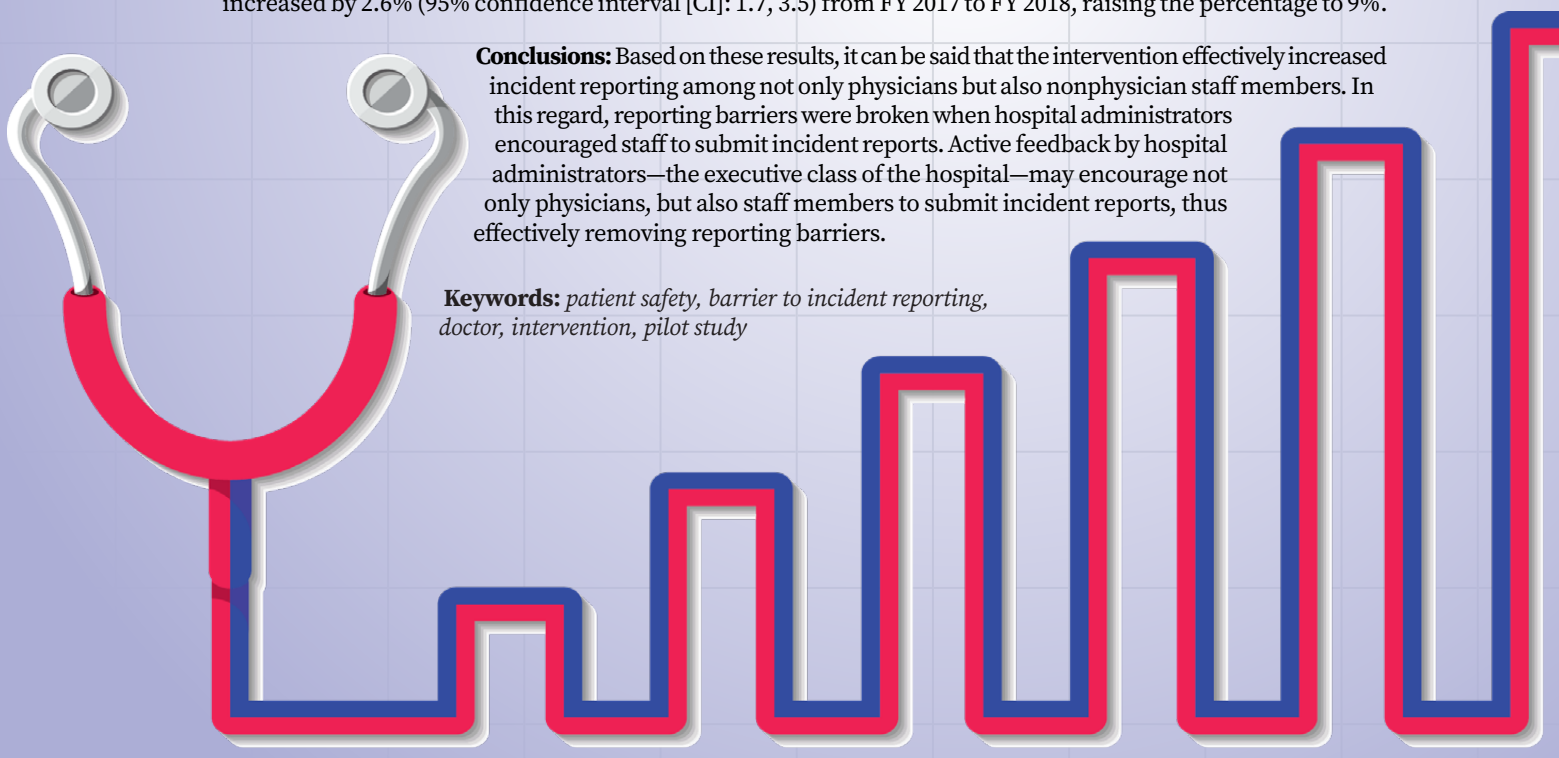
Objectives: To improve patient safety, information regarding errors must be collected. This practice constitutes one of the strategies that hospital managers use to understand the types of errors that occur at their hospitals. This pilot study aimed to evaluate an intervention designed to improve error reporting percentage among physicians.

Methods: The study was conducted at University Hospital A, where data were collected from April 2017 to March 2019. The intervention began in April 2018 and involved the following steps: receiving support and appropriate feedback from the hospital administrator, defining reporting standards, improving the incident reporting system, and having the hospital administrators set clear goals and begin a visualized feedback process. Physicians were the main target for these steps in this study.

Results: The percentage of reports submitted by physicians relative to nonphysicians increased from fiscal year (FY) 2017 to FY 2018, with the largest monthly increase within 2018 occurring in November. Physician reporting was higher in FY 2018 than in FY 2017, with the greatest difference observed for December of the respective FYs ($p < 0.001$, analyzed using Fisher's exact test). The percentage of reports submitted by physicians increased by 2.6% (95% confidence interval [CI]: 1.7, 3.5) from FY 2017 to FY 2018, raising the percentage to 9%.

Conclusions: Based on these results, it can be said that the intervention effectively increased incident reporting among not only physicians but also nonphysician staff members. In this regard, reporting barriers were broken when hospital administrators encouraged staff to submit incident reports. Active feedback by hospital administrators—the executive class of the hospital—may encourage not only physicians, but also staff members to submit incident reports, thus effectively removing reporting barriers.

Keywords: *patient safety, barrier to incident reporting, doctor, intervention, pilot study*



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Background

Fatal accidents resulting from errors range from less than 5% to greater than 30%,[1] with estimates from developed nations suggesting that between 7.5% and 10.4% of patients in acute care settings experience adverse drug events.[2] A pilot study revealed that 11.3% of hospitalized cases experienced adverse events in Japan.[3] Using eight years of medical death-rate data from the United States, patient safety experts at Johns Hopkins University calculated that more than 250,000 deaths per year were due to medical errors.[1] The number of patient deaths caused by adverse events annually was estimated to be between 1,326 and 1,433 in Japan.[4] To improve patient safety, information about incidents is needed. Indeed, collecting this information is one of the strategies that hospital managers use to understand the kinds of errors that occur at their hospitals.

Previous studies have focused on reporting barriers, and some have examined interventions for improving incident reporting rates;[5-10] however, these have been limited. Most of the studies focused on factors hindering reporting behavior. Two studies suggested that organizational barriers (e.g., culture, reporting system, and management behavior/system) and personal barriers (e.g., fear and accountability) hinder reporting behavior.[5,6] Fear of consequences after error reporting is also a major perceived barrier.[6,7] Other factors include the attitude of the administration department regarding legal issues; lack of effective medical error reporting systems, proper reporting forms, and peer support for someone who has committed an error; and lack of knowledge regarding how to report and which error to report.[6,8–10]

The most frequently stated barrier to reporting among physicians and nurses was lack of feedback.[11] Safety culture, whereby an organization puts safety first, includes seven aspects, one of which is leadership.[12] Accountability to senior management is key to the development of a safety culture throughout the organization. To reduce personal fear after reporting an incident, hospital administrators should be involved as a leadership resource. Only a few interventional studies have aimed to increase incident reports.[13,14] In the study by Evans et al.,[13] various incidents were reported by the intervention units during the study period, with an improved reporting rate among physicians from a low baseline. However, the study reported considerable heterogeneity between reporting rates in different types of units, and the lack of physician-initiated reports indicated that feedback was limited to discussions of incidents generated in other areas.[13] The effects of comprehensive interventions should not depend on any particular unit. In Krouss et al.'s quasi-experimental study, real-time education and regular reinforcement were found to increase incident reporting by resident physicians.[14] However, that study's intervention did not target other physicians.

Thus, the current pilot study evaluated an intervention designed to increase the percentage of physicians reporting incidents by removing the barriers to incident reporting. To this end, we strengthened the real-time feedback of hospital managers, including hospital administrators who, as top managers of the hospital, outrank unit heads.

Methods

Study Setting

This study was conducted at University Hospital A in northern Japan from fiscal year (FY) 2017 to FY 2018. The hospital contained approximately 1,160 beds and 2,650 staff members, including 530 physicians (some of whom were dentists), 1,260 nurses, and 80 pharmacists. The hospital used an electronic reporting system that required all staff members to report all types of errors and near misses. Staff members included physicians, nurses, pharmacists, physiotherapists, occupational therapists, speech therapists, and administrative staff members. As such, this study defined the scope of incident reports to include them. The reporting system was operated through a local broadband network within the hospital, with all reports reviewed by the medical safety management department (MSMD).

Operational Definitions

Near miss was defined as a medical error that occurred or was identified before the healthcare service was provided to the patient. Error was defined as a medical error that occurred when a healthcare service was provided to the patient. An incident report was defined as a report describing the events of both near misses and errors.

Quality Improvement Intervention

Randomized control trials are likely to be challenging to conduct in this area, as finding sufficient units to randomize and obtaining suitable control groups can be challenging.[15] This pilot study employed a prospective study design involving comparisons before and after the quality improvement intervention. The intervention examined in this pilot study consisted of four steps, the first of which was implemented in April 2018.

Table 1. Defining Reporting Standards

Part 1: Related to surgery

1. Misidentification of patient, treatment site, method, or usage
2. Items remaining in the body after surgery, such as gauze or needles
3. Unexpected severe bleeding not associated with surgery
4. Infarction, rupture, perforation, or rupture associated with invasive procedure
5. Serious complications associated with surgery
6. Nerve palsy that develops after surgery
7. Blood clotting after surgery
8. Cardiopulmonary arrest or death during surgery
9. Anesthesia accident involving intubation and/or extubation
10. Side effect associated with anesthesia
11. Damage associated with malfunction or corruption
12. Emergency surgery
13. Re-surgery associated with complications
14. Re-surgery during admission or within seven days after discharge
15. Death within 30 days of surgery

Part 2: Other than surgery (treatment, exam, etc.)

1. Unexpected death, cardiopulmonary arrest, or respiratory arrest
2. Unexpected severe bleeding
3. Sudden change in vitals associated with contrast medium, medication, transfusion, or blood product
4. Adverse effects or possible adverse effects to the patient associated with misdiagnosis, negligence, or delayed treatment
5. Severe damage associated with overlooking medical test results
6. Unexpected, prolonged hypo oxygen in a full-term newborn infant
7. Brain damage or fractures associated with falling in hospital
8. Sudden changes in vitals or respiratory arrest associated with aspiration or providing prohibited meals
9. Severe burn associated with treatment
10. Severe side effects or complications associated with treatment, examinations, or rehabilitation
11. Severe damage from pressure ulcer or vascular leakage

Part 3: Others

1. Suicide or suicide attempt by an inpatient
2. Severe complications experienced by an inpatient (brain infraction, heart attack, pulmonary thrombus, or cerebrovascular disease)
3. Violence from a patient
4. Disappearance of an inpatient
5. Stolen or lost patient baggage
6. Bringing dangerous goods to the hospital or experiencing suffocation due to foreign matter inside the hospital
7. Accidental burning or explosion

Step 1: Support and appropriate feedback as a leadership resource from the hospital administrator throughout FY 2018

The hospital director and deputy director related to the MSMD asserted that incident reports are crucial for hospital administration and do not entail personal liability after reporting. The deputy director (also one of the risk managers) explained the importance of incident reporting for preventing similar incidents during a risk-manager meeting (which was attended by the department leaders of patient safety). He explained that staff members who report an incident would not receive inappropriate feedback from their supervisors. This was also established as a hospital rule and listed in the patient safety manual.

Step 2: Define reporting standards beginning in April 2018

The patient safety manual used at University Hospital A required staff to report all incidents (e.g., medication errors and surgery-related errors). However, there were no standards for submitting incident reports. Therefore, we collaborated with the MSMD members to define reporting standards for 33 topics; we identified references related to adverse events,[3] used the Clavien-Dindo classification for complications,[16] and investigated the reporting standards of several hospitals on their websites. The topics were related primarily to physicians' incident reports, as these topics included severe cases related to patient safety. As shown in **Table 1**, reporting standards were distributed across three categories: Part 1 was related to surgery, Part 2 was related to medical events other than surgery, and Part 3 included all other events. These reporting standards were then described in the safety manual and announced during a patient safety meeting attended by approximately 120 risk managers, who were then required to work as departmental educators. Monthly meetings were held with the risk managers, who reported their experiences regarding this process.

Step 3: Improvements to reporting system since September 2018

University Hospital A uses its own electronic reporting system. However, clinical staff members asked the MSMD to improve this system because the reporting forms were considered too complex. A previous study suggested an appropriate reporting format with a single-page layout.[11] The MSMD has an independent, expert-trained department consisting of three nurses and one physician, and when there is information missing on incident reports, they can contact the reporter to obtain it. We therefore offered optional inputs on the form rather than required inputs. (We changed the form from a descriptive input form to multiple-choice and pull-down answers, which made it easier to enter the information. These efforts were aimed at alleviating the burden on incident reporters.) These improvements reduced the time usually needed to complete one report from 20 to 5–10 minutes. The MSMD announced improvements and ways to use this system in the risk managers' meeting, which was also useful for renotifying them about ways to access and use it.

Step 4: Visualized feedback implemented by the hospital administrator for the chiefs of the clinical departments since October 2018

The MSMD prepared and published monthly documents concerning the submission status of incident reports from physicians inside the hospital, which the hospital director referred to when meeting with representative chief physicians of the clinical departments. The monthly documents included the number of incident reports from physicians from each department and a description of severe cases. Severe cases were included to discuss prevention policies as part of the hospital's risk management.

Data Source and Analysis

The MSMD collected data from April 2017 to March 2019. In this context, the administrator of individual information deleted personal identifiers, such as patient names, identification numbers, and names of hospital staff members. Data were then provided to the study researchers. Collected data included the following variables: reporting date (year/month/day), related personnel's occupations, impact on patient outcomes due to the event (near miss or error), and type of report (e.g., medication errors, transfusion errors). Differences in the percentage of reports submitted by physicians before and after the intervention each month were estimated; the corresponding confidence intervals (CIs) were constructed using the Newcombe method[17] and compared using chi-square test or Fisher's exact test as appropriate. All analyses were performed using SAS statistical software, version 9.4 (SAS Institute, Cary, NC).

Ethical Approval

The MSMD collected incident reports for the hospital administration. In this retrospective observational study, we analyzed these secondary data collected by the MSMD. The study was approved by the ethics committees at University A (Approval number: MH2018-073). We obtained comprehensive agreements from participating hospital staff members and posted an official notice on the hospital's website from September 30 to October 31, 2018. Moreover, participants could refuse the use of their data during the recruitment period. The trials registry identification number for this study was UMIN-CTR (UMIN000041087), and the date of registration July 13, 2020 (retrospectively registered).

Results

Characteristics of Incident Reports Between FY 2017 and FY 2018

Table 2 shows the characteristics of incident reports between FY 2017 and FY 2018. Among reports by nonphysicians, those involving drugs were the most frequently reported, and for physicians, the most common reports were about treatments or procedures. The number of drug incident reports by nonphysicians increased from FY 2017 to FY 2018. The incident types reported were also different between FY 2017 and FY 2018. More near misses were reported by both nonphysicians and physicians in FY 2018 than in FY 2017.

Intervention Term and Reporting Numbers

Table 3 shows the numbers and percentages of incident reports by nonphysicians and physicians, with side-by-side comparisons for FY 2017 and FY 2018. **Appendix 1** shows the numbers only in a graph format. Before conducting the intervention (FY 2017), physicians typically submitted around 30 to 40 reports per month, with the lowest number in December and January (24 each; **Table 3**). The lowest overall number of physician-submitted reports (14) occurred in April of FY 2018, which was the same month the risk managers held their first meeting to present new reporting standards for distribution to staff members. Subsequently, reporting numbers increased (FY 2017 mean = 33.3 and FY 2018 mean = 53.4, $p = 0.002$ by Student's

Table 2. Characteristics of Incident Reporting Between FY 2017 and FY 2018

	By nonphysicians				By physicians			
	FY 2017 N=5,875 n (%)	FY 2018 N=6,505 n (%)	Difference (95% CI)	p-value	FY 2017 N=400 n (%)	FY 2018 N=641 n (%)	Difference (95% CI)	p-value
Kinds of incident reports								
Drug	1,580 (26.9)	1,788 (27.5)	0.6 (-1.0 to 2.2)	0.459	35 (8.8)	80 (12.5)	3.7 (-0.2 to 7.4)	0.062
Drainage tube	1,227 (20.9)	1,165 (17.9)	-3.0 (-4.4 to -1.6)	< 0.001	22 (5.5)	24 (3.7)	-1.8 (-4.7 to 0.8)	0.18
Treatment/ procedure	694 (11.8)	707 (10.9)	-0.9 (-2.1 to 0.2)	0.098	236 (59.0)	303 (47.3)	-11.7 (-17.8 to -5.5)	< 0.001
Nursing care	793 (13.5)	899 (13.8)	0.3 (-0.9 to 1.5)	0.602	10 (2.5)	10 (1.6)	-0.9 (-3.1 to 0.8)	0.283
Examination	499 (8.5)	524 (8.1)	-0.4 (-1.4 to 0.5)	0.376	28 (7.0)	53 (8.3)	1.3 (-2.2 to 4.5)	0.457
Medical device, etc.	278 (4.7)	298 (4.6)	-0.2 (-0.9 to 0.6)	0.691	23 (5.8)	41 (6.4)	0.6 (-2.5 to 3.5)	0.673
Blood transfusion	44 (0.7)	66 (1.0)	0.3 (-0.1 to 0.6)	0.116	3 (0.8)	8 (1.2)	0.5 (-1.1 to 1.8)	0.445
Others	760 (12.9)	1,058 (16.3)	3.3 (2.1 to 4.6)	< 0.001	43 (10.8)	122 (19.0)	8.3 (3.8 to 12.5)	< 0.001
Incident's impact on patients								
Near miss	728 (12.4)	1,130 (17.4)	5.0 (3.7 to 6.2)	< 0.001	16 (4.0)	106 (16.5)	12.5 (8.9 to 16.0)	< 0.001
Error	5,147 (87.6)	5,375 (82.6)	-5.0 (-6.2 to -3.7)	< 0.001	384 (96.0)	535 (83.5)	-12.5 (-16.0 to -8.9)	< 0.001

Differences from FY 2017 to FY 2018 were estimated by nonphysicians and physicians and compared using the chi-square test. CI: confidence interval.

Table 3. Number and Percentage of Incident Reports by Nonphysicians and Physicians

	FY 2017			FY 2018				
	All n	By non-physicians n (%)	By physicians n (%)	All n	By non-physicians n (%)	By physicians n (%)	Difference by physicians (95% CI)	p value
Apr	524	487 (92.9)	37 (7.1)	346	332 (96.0)	14 (4.0)	−3.0 (−6.0, 0.2)	0.064
May	532	494 (92.9)	38 (7.1)	507	477 (94.1)	30 (5.9)	−1.2 (−4.3, 1.8)	0.425
Jun	588	552 (93.9)	36 (6.1)	596	545 (91.4)	51 (8.6)	2.4 (−0.6, 5.5)	0.108
Jul	534	492 (92.1)	42 (7.9)	599	548 (91.5)	51 (8.5)	0.6 (−2.6, 3.9)	0.691
Aug	503	469 (93.2)	34 (6.8)	616	580 (94.2)	36 (5.8)	−0.9 (−3.9, 1.9)	0.529
Sep	497	467 (94.0)	30 (6.0)	599	552 (92.2)	47 (7.8)	1.8 (−1.3, 4.8)	0.243
Oct	600	563 (93.8)	37 (6.2)	744	684 (91.9)	60 (8.1)	1.9 (−0.9, 4.6)	0.181
Nov	528	498 (94.3)	30 (5.7)	604	532 (88.1)	72 (11.9)	6.2 (2.9, 9.5)	<0.001
Dec	410	386 (94.1)	24 (5.9)	634	555 (87.5)	79 (12.5)	6.6 (3.0, 10.0)	<0.001
Jan	582	558 (95.9)	24 (4.1)	612	550 (89.9)	62 (10.1)	6.0 (3.1, 9.0)	<0.001
Feb	483	447 (92.5)	36 (7.5)	569	500 (87.9)	69 (12.1)	4.7 (1.0, 8.2)	0.012
Mar	494	462 (93.5)	32 (6.5)	720	650 (90.3)	70 (9.7)	3.2 (0.1, 6.3)	0.045
Sum	**6,275**	**5,875 (93.6)**	**400 (6.4)**	**7,146**	**6,505 (91.0)**	**641 (9.0)**	**2.6 (1.7, 3.5)**	**<0.001**

Differences in the percentage of reports submitted by nonphysicians and physicians from FY 2017 to FY 2018 were estimated per month and compared using the chi-square test. CI: confidence interval.

t-test). Next, improvements to the incident reporting system were officially released in October, which was also when the hospital director initiated the visualized feedback process among physicians. The effect of the visualized feedback process led to an increase in the percentages of incident reports submitted by physicians; this percentage increased to 11.9% of all reports by November of FY 2018. In particular, the highest monthly percentage of physician-submitted reports (12.5%) was seen in December.

The monthly differences in the percentage of reports attributed to physicians (FY 2018 minus FY 2017) were 6.2% for November (95% CI: 2.9, 9.5; $p < 0.001$), 6.6% for December (95% CI: 3.0, 10.0; $p < 0.001$), 6.0% for January (95% CI: 3.1, 9.0; $p < 0.001$), 4.7% for February (95% CI: 1.0, 8.2; $p = 0.012$), and 3.2% for March (95% CI: 0.1, 6.3; $p = 0.045$). Sensitivity analysis for data with November–March time frame after the intervention is illustrated in **Appendix 2**, which demonstrates a similar trend with **Table 2**.

Discussion

Our pilot intervention was associated with an increase in the number and percentage of incident reports submitted by physicians. Comparison of FY 2017 and FY 2018 revealed that the number of incident reports submitted by both physicians and nonphysicians increased.

Physicians tended to report far fewer minor incidents than major ones,[18,19] but the number of near-miss reports submitted increased, from 16 in FY 2017 to 106 in FY 2018. The reasons for underreporting may include lack of knowledge, which includes information on how to report errors, what should be reported, and what kinds of errors to report.[10,20] Although reporting standards focused on severe cases related to treatments/procedures and drugs, the reporting standards led physicians to realize what kinds of errors to report, including minor incidents. Physicians reported incidents even in near-miss events or when the patient had minor injuries.

The percentage of reports submitted by physicians increased by 2.6 percentage points (95% CI: 1.7, 3.5) from FY 2017 to FY 2018, raising the percentage to 9%. As per the intervention, the reporting criteria were defined; staff members were informed about which incidents should be reported and the MSMD could easily educate staff accordingly. Staff members were also pleased that incident reporting times were reduced. The announcement of the reporting standards in our intervention increased physicians' and nonphysicians' knowledge about efficient reporting systems, which in turn led to an increase in the number of incident reports. As the percentage of reports from physicians increased, the percentage of incident reports from nonphysicians decreased, but the number of incident reports from both physicians and nonphysicians increased. The intervention of steps 1 to 4 might have a spillover effect for both physicians and nonphysicians.

The pilot intervention also entailed visualized feedback provided on a monthly basis (Step 3). However, effective safety feedback depends on not only publicizing the percentage of incident reports but also timely, visible, and repeatable corrective actions and quality improvement processes.[12] With regard to having hospital administrators provide support and feedback, previous studies have also shown that patient safety managers can effectively reduce the fear of reporting.[21] Most physicians believe that a reduction in medical errors should be a national priority, but they also believe that fear of medical malpractice is a barrier to reporting errors, and that greater legal safeguards are necessary for the success of mandatory reporting systems.[20,22] Further, this study's intervention involved hospital managers, including the hospital director and deputy director. It seemed that staff members did not feel that there was inappropriate feedback, but instead might have felt safe because the hospital would protect them.

Limitations and Implications

The present study has several limitations. First, we used two years of data; thus, we could not evaluate long-term effects using quality improvement methods. More data need to be collected continuously to assess the long-term effects of the intervention. Second, this study was conducted in a single university hospital in Japan, which could have caused selection bias. Third, this study's primary outcome was the number of incident reports from physicians. We did not measure other reporting barriers such as non-blaming, nonpunitive, and non-fearful learning culture.[5,23] We need to investigate the safety culture among organization members. Despite these limitations, this study confirmed that involving the executive department of a hospital is useful for implementing an intervention. Indeed, this department should facilitate hospital leadership by encouraging and rewarding staff members when they report adverse and near-miss events. Hence, we did not evaluate factors related to reporting barriers, including non-blaming, nonpunitive, and non-fearful learning cultures.[23,24]

Conclusion

This pilot study examined an intervention that helped remove incident reporting barriers to increase patient safety. The measures included the establishment of 1) peer support/appropriate feedback from hospital administrators, 2) clear reporting standards, 3) an effective medical error reporting system, and 4) feedback on what actions are/were taken. A before- and after-intervention comparison revealed that all incident reporting percentages increased (i.e., from physicians and all other staff members). Hospital administrators also encouraged staff members to submit incident reports, thus effectively removing reporting barriers. We conclude that involving senior hospital administrators in healthcare policies will help shape a safety culture.

Declarations

Consent for Publication

Not applicable.

Availability of Data and Materials

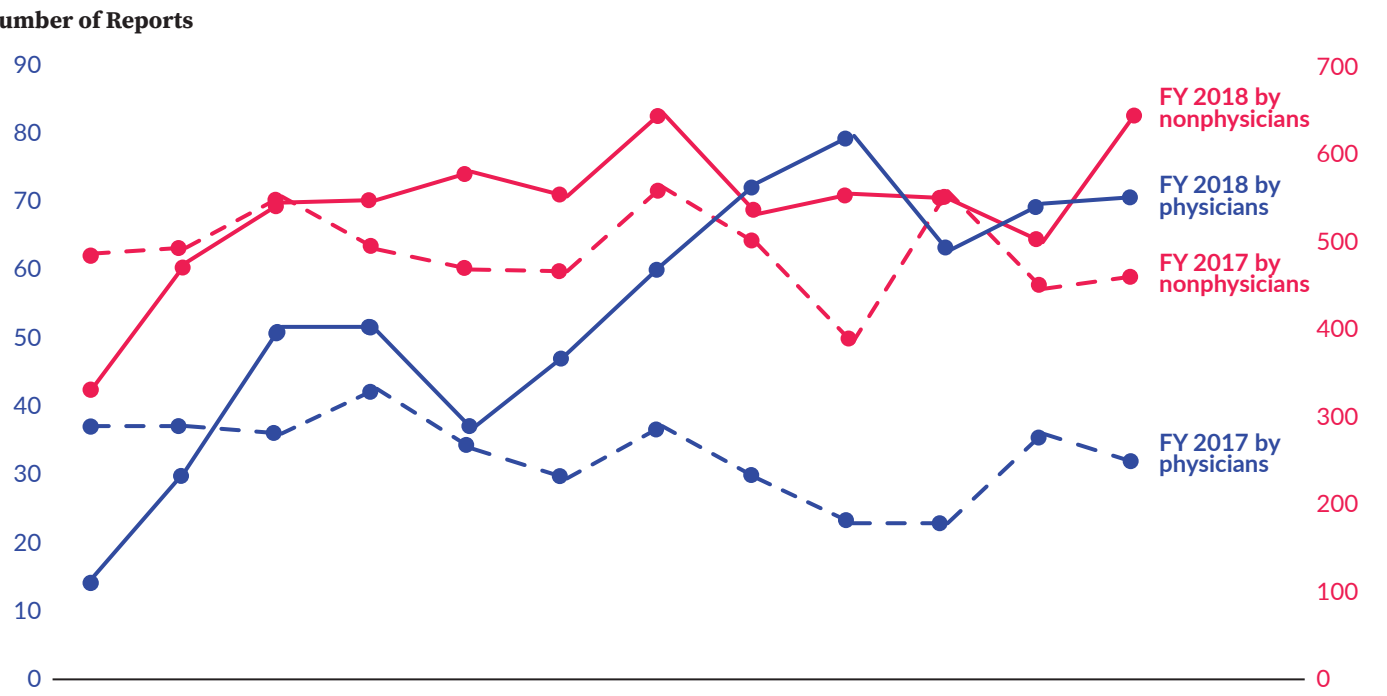
The dataset generated and analyzed during the current study is not publicly available. The dataset was permitted to be used within this study by the ethics committees at University A as the dataset had information from the field study and clinical staff. However, the dataset is available from the corresponding author on reasonable request.

References

1. Makary MA, Daniel M. Medical Error—The Third Leading Cause of Death in the US. *BMJ.* 2016 May;3:353. Also available: https://doi.org/10.1136/bmj.i2139

2. World Health Organization. Summary of the Evidence on Patient Safety: Implications for Research. Research Priority Setting Working Group of the World Alliance for Patient Safety.

Appendix 1. Trend of the Number of Incident Reports by Nonphysicians and Physicians



Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
37	38	36	42	34	30	37	30	24	24	36	32	FY17 physicians
14	30	51	51	36	47	60	72	79	62	69	70	FY18 physicians
487	494	552	492	469	467	563	498	386	558	447	462	FY17 nonphysicians
332	477	545	548	580	552	648	532	555	550	500	650	FY18 nonphysicians

Appendix 2. Sensitivity Analysis for Data With November–March Time Frame After Intervention

	By nonphysicians				By physicians			
	FY 2017 N=2,351 n (%)	FY 2018 N=2,787 n (%)	Difference (95% CI)	p-value	FY 2017 N=148 n (%)	FY 2018 N=352 n (%)	Difference (95% CI)	p-value
Kinds of incident reports								
Drug	630 (26.8)	782 (28.1)	1.3 (-1.2 to 3.7)	0.313	13 (8.8)	50 (14.2)	5.4 (-1.1 to 10.8)	0.095
Drainage tube	500 (21.3)	516 (18.5)	-2.8 (-5.0 to -0.6)	0.014	9 (6.1)	11 (3.1)	-3.0 (-8.2 to 0.8)	0.124
Treatment/ procedure	268 (11.4)	296 (10.6)	-0.8 (-2.5 to 0.9)	0.374	80 (54.1)	164 (46.6)	-7.5 (-16.8 to 2.1)	0.128
Nursing care	337 (14.3)	371 (13.3)	-1.0 (-2.9 to 0.9)	0.289	3 (2.0)	4 (1.1)	-0.9 (-4.7 to 1.3)	0.428 +
Examination	199 (8.5)	235 (8.4)	0.0 (-1.6 to 1.5)	0.967	12 (8.1)	34 (9.7)	1.6 (-4.6 to 6.5)	0.584
Medical device, etc.	115 (4.9)	121 (4.3)	-0.5 (-1.7 to 0.6)	0.348	11 (7.4)	17 (4.8)	-2.6 (-8.3 to 1.7)	0.248
Blood transfusion	18 (0.8)	30 (1.1)	0.3 (-0.2 to 0.8)	0.249	1 (0.7)	5 (1.4)	0.7 (-2.4 to 2.7)	0.675 +
Others	284 (12.1)	436 (15.6)	3.6 (1.7 to 5.4)	< 0.001	17 (11.5)	67 (19.0)	7.5 (0.3 to 13.6)	0.039
Incident's impact on patients								
Near miss	353 (15.0)	500 (17.9)	2.9 (0.9 to 4.9)	0.005	6 (4.1)	65 (18.5)	14.4 (8.6 to 19.3)	< 0.001
Error	1,998 (85.0)	2,287 (82.1)	-2.9 (-4.9 to -0.9)	0.005	140 (94.6)	287 (81.5)	-13.1 (-18.2 to -6.9)	< 0.001

Differences from FY 2017 to FY 2018 were estimated by nonphysicians and physicians and compared using the chi-square test or the Fisher's exact test (+) as appropriate.
CI: confidence interval.

[Internet]. 2008 [accessed 2020 May 28]. Available: https://www.who.int/patientsafety/information_centre/20080523_Summary_of_the_evidence_on_patient_safety.pdf.

3. Ikeda S, Kobayashi M, Kaneko T, et al. Identification of Adverse Events in Inpatients: Results of a Preliminary Survey in Japan. *Asian Pac J Dis Manag.* 2010;4(2):49-53. Also available: https://doi.org/10.7223/apjdm.4.49

4. Fujita S, Iida S, Nagai Y, et al. Estimation of the Number of Patient Deaths Recognized by a Medical Practitioner as Caused by Adverse Events in Hospitals in Japan. *Medicine.* 2017 Sep;96(39):1-5. Also available: https://doi.org/10.1097/MD.0000000000008128

5. Vrbnjak D, Denieffe S, O'Gorman C, et al. Barriers to Reporting Medication Errors and Near Misses Among Nurses: A Systematic Review. *Int J Nurs Stud.* 2016 Nov;63:162-78. Also available: https://doi.org/10.1016/j.ijnurstu.2016.08.019

6. Mirsadeghi A, Pazokian M. Barriers to Reporting Medication Errors in Iran: A Systematic Review. *Int J Med Rev.* 2015;2(4):317-21.

7. Yung HP, Yu S, Chu C, et al. Nurses' Attitudes and Perceived Barrier to the Reporting of Medication Administration Errors. *J Nurs Manag.* 2016 Jul;24(5):580-8. Also available: https://doi.org/10.1111/jonm.12360

8. Soydemir D, Intepeler S, Mert H. Barriers to Medical Error Reporting for Physicians and Nurses. *West J Nurs Res.* 2016 Oct;39(10):1348-63. Also available: https://doi.org/10.1177/0193945916671934

9. Poorolajal J, Rezaie S, Aghighi N. Barriers to Medical Error Reporting. *Int J Prev Med.* 2015 Oct;6(1):97. Also available: https://doi.org/10.4103/2008-7802.166680

10. Kaldjian LC, Jones EW, Wu BJ, et al. Reporting Medical Errors to Improve Patient Safety: A Survey of Physicians in Teaching Hospitals. *Arch Intern Med.* 2008;168(1):40-6. Also available: https://doi.org/10.1001/archinternmed.2007.12

11. Evans SM, Berry JG, Smith BJ, et al. Attitudes and Barriers to Incident Reporting: A Collaborative Hospital Study. *Qual Saf Health Care.* 2006 Feb;15(1):39-43. Also available: https://doi.org/10.1136/qshc.2004.012559

12. Sammer CE, Lykens K, Singh KP, et al. What is Patient Safety Culture? A Review of the Literature. *J Nurs Scholarsh.* 2010 Jun;42(2):156-65. Also available: https://doi.org/10.1111/j.1547-5069.2009.01330.x

13. Evans SM, Smith BJ, Esterman A, et al. Evaluation of an Intervention Aimed at Improving Voluntary Incident Reporting in Hospitals. *Qual Saf Health Care.* 2007 Jun;16(3):169-75. Also available: https://doi.org/10.1136/qshc.2006.019349

14. Krouss, M., Alshaikh, J., Croft, L., & Morgan, D. J. (2019). Improving Incident Reporting Among Physician Trainees. *J Patient Saf.* 2019;15(4):308-310. Also available: https://doi.org/10.1097/PTS.0000000000000325

15. Parmelli E, Flodgren G, Fraser SG, et al. Interventions to Increase Clinical Incident Reporting in Health Care. *Cochrane Database Syst Rev.* 2012 Aug;8(8):CD005609. Also available: https://doi.org/10.1002/14651858.CD005609.pub2

16. The Clavien-Dindo Classification. [Internet]. [accessed 2020 July 6]. Available: https://www.assessurgery.com/clavien-dindo-classification/

17. Newcombe RG. Interval Estimation for the Difference Between Independent Proportions: Comparison of Eleven Methods. *Stat Med.* 1998 Apr;17(8):873-90. Also available: https://doi.org/10.1002/(SICI)1097-0258(19980430)17:8<873::AID-SIM779>3.0.CO;2-I

18. Hirose M, Regenbogen ES, Lipsitz S, et al. Lag Time in an Incident Reporting System at a University Hospital in Japan. *Qual Saf Health Care.* 2007 Apr;16(2):101-4. Also available: https://doi.org/10.1136/qshc.2006.019851

19. Smith KS, Harris KM, Potters L, et al. Physician Attitudes and Practices Related to Voluntary Error and Near-miss Reporting. *J Oncol Pract.* 2014 Sep;10(5):350-7. Also available: https://doi.org/10.1200/JOP.2013.001353

20. Rishoej RM, Hallas J, Juel Kjeldsen L, et al. Likelihood of Reporting Medication Errors in Hospitalized Children: A Survey of Nurses and Physicians. *Ther Adv Drug Saf.* 2018 Mar;9(3):179-92. Also available: https://doi.org/10.1177/2042098617746053

21. Vrbnjak D, Denieffe S, O'Gorman C, et al. Barriers to Reporting Medication Errors and Near Misses Among Nurses: A Systematic Review. *Int J Nurs Stud.* 2016 Nov;63:162-78. Also available: https://doi.org/10.1016/j.ijnurstu.2016.08.019

22. Robinson RA, Hohmann BK, Rifkin IJ, et al. Physician and Public Opinions on Quality of Health Care and the Problem of Medical Errors. *Arch Intern Med.* 2002 Oct;162(19):2186-90. Also available: https://doi.org/10.1001/archinte.162.19.2186

23. Nieva VF, Sorra J. Safety Culture Assessment: A Tool for Improving Patient Safety in Healthcare Organizations. *Qual Saf Health Care.* 2003 Dec;12(2):17-23. Also available: https://doi.org/10.1136/qhc.12.suppl_2.ii17

24. Benn J, Koutantji M, Wallace L, et al. Feedback from Incident Reporting: Information and Action to Improve Patient Safety. *BMJ Qual Saf.* 2009;18(1):11-21. Also available: https://doi.org/10.1136/qshc.2007.024166

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