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Brief communication (Original)

Identifying adverse events in hospitalized patients using global trigger tool in Thailand

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Background: Hospital incidence reporting system has limitation on sensitivity and underreport in detecting the adverse events thus under report them. Trigger tool may provide a more simplified review process for detecting adverse events in a developing country setting**.**
Objectives: To evaluate the effectiveness of the trigger tool on identifying adverse events in Thai hospitalized patients, and to classify the events by the patient safety goals.
Materials and methods: A cross-sectional medical record review was conducted to identify adverse events in hospitalized patients at King Chulalongkorn Memorial Hospital during January 2 2008**,** using the Global Trigger Tool (GTT) by Institute for Healthcare Improvement. Adverse events, severity rating, and preventability were determined by reviewer teams. Types of adverse events were described according to the Patient Safety Goals of Thailand.
Results: Five hundred seventy six medical records were reviewed. The total patient-days were 4,460 days. Two hundred thirty six adverse events were detected with a mean rate of 41.0 events per 100 patients or 50.4 events per 1,000 patient-days. One hundred twenty five events (53%) were temporary harm, while 122 (51.7%) were preventable. Regarding the category of adverse event, 75 (31.8%) were related to patient care process, 48 (20.3%) were in safe surgery and 42 (17.8%) were in medication and blood safety.
Conclusion: Adverse events using the GTT detected more events than previous reports. Most events had low severity and were preventable. Most events were related to prevention of complications, safe surgery, and medication safety. Assessment of validity is needed before using GTT in medical service.

Keywords: Adverse events, global trigger tool, patient safety goals.

Patient safety is always crucial for every healthcare provider. According to studies from developed countries, adverse events occurred in 4-17% of hospitalized patients [1-5]. In Thailand, healthcare providers have had a long history of patient safety experience in hospital management. Recently, the Institute of Hospital Quality Improvement and Accreditation (HA-Thailand) gathered patient safety practices from the WHO Global Patient Safety Challenges and Patient Safety Solutions (previously, National Patient Safety Goals) to be the new Patient Safety Goals (SIMPLE) [6]. This has been extensively applied to hospitals in Thailand.

Risk management processes of most hospitals depend mainly on incidence reporting system. This system has limitation regarding the sensitivity and underreport of adverse events. Most incidences identify only medical errors, which are frequently unrelated to injuries to the patients [7]. These factors make the incidence reporting system under-identify patient's adverse events, particularly the significant ones [8, 9]. Harvard Medical Practice Study (HMPS) has been used to measure the adverse events as a retrospective double-staged medical record review, though it has a high physician workload and lack of consistency [8, 10].

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Recently, a new method, called "trigger tool", has been constructed to detect adverse events more efficiently. Resar et al. [11] have demonstrated that this method could detect more events that are adverse. In Thailand, by gathering trigger tools from previous studies, the Institute for Healthcare Improvement (IHI) developed their Global Trigger Tool (GTT) with aim at measurement of effectiveness of hospital patient safety program. However, no study has been investigated regarding the feasibility of using this tool in Thai healthcare system whose content is different from that of the United States. This study was designed to evaluate the effectiveness of GTT in identifying adverse events in hospitalized patients in Thailand and classifying the events according to SIMPLE.

Material and methods

The study was approved by Ethics Committee of the Faculty of Medicine, Chulalongkorn University. A cross-sectional medical record review was conducted to identify adverse events in hospitalized patients using the GTT designed by IHI (Available on http://www.IHI.org). The target population included hospitalized patients in a selected tertiary-care teaching hospital in Bangkok. The study patients were discharged from five major departments (Obstetrics-Gynecology, Surgery, Internal Medicine, Pediatrics and Orthopedics) between January 1 and 31, 2008. The sample was 576 medical records selected using the systematic random-sampling technique. The inclusion criteria were patient's length of stay of at least 24 hours, duration after discharge of more than 30 days, and closed records.

Adverse events were defined as unintended physical injuries, caused by medical care, which was divided into five levels as follows: severity-rating E, F, G, H, and I (see **Table 2**). Assuming that reviewers' judgment would not be interfered over time, an assessment of preventability was added for each adverse event. The degree of preventability was scored in four levels:

Level 1: unpreventable,

Level 2: unlikely to prevent (less than 50% chance),

Level 3: likely to prevent (more than 50% chance),

Level 4: preventable.

The reviewer's teams consisted of two registered nurses. The records were reviewed for the presence of triggers. If a trigger was found, the focus review would determine whether an adverse event had occurred. In each record, it was possible to find more than one trigger and also more than one adverse event. Any adverse event was determined by each reviewer strictly regarding to the definition mentioned. The physician consultant was provided to assist the reviewers' decision.

Data analysis

Descriptive statistics were used to express the patient characteristics and number/type of adverse events according to the SIMPLE (see **Table 3**). The rate of adverse events was calculated per 100 patients and per 1,000 patient-days. Independent from the consensus process, determination of adverse event by two nurse-reviewers was assessed for inter-rater reliability using Cohen's Kappa statistics.

Results

Five hundred seventy six medical records were selected and reviewed. The total patient-day was 4,460 days. **Table 1** shows the characteristics of patients reviewed from the medical records. We note that the highest number of patients was admitted to the Department of Surgery.

In identifying the adverse events using the GTT, 776 triggers were identified. **Figure 1** shows the algorithm and number of result of each process of review. We note that an inter-rater reliability of two reviewers using the GTT was very good in Cohen's Kappa statistics (K=0.86, 95%CI: 0.81-0.90).

The adverse events were categorized by severity according to the preventability level. **Table 2** shows number of each level of preventability. It is likely that 122 adverse events (51.7%) were preventable while 81 (34.3%) were not.

The adverse events classified by the Patient Safety Goals (SIMPLE) were shown in **Table 3.** The most frequent types of adverse event were in the category P (31.8%) followed by S (20.3%), and M (17.8%).

Table 1. Patient characteristics.

Characteristic	Subgroup	Number of cases	Percent
Sex	Male	221	38.4
	Female	355	61.6
Age (year)	< 1	108	18.8
	1 – 14	46	8.0
	15 – 29	89	15.5
	30 – 44	107	18.6
	45 – 59	89	15.5
	> 60	137	23.8
Admission status	Acute	326	56.6
	Appointment	250	43.4
Department of service	Obstetric-Gynecology	140	24.3
	Surgery	154	26.7
	Medicine	113	19.6
	Pediatrics	148	25.7
	Orthopedics	21	3.6
Length of Stay (day)	Mean (95% CI)	7.7 (6.5 -9.0)	
	Median (Q1-Q4)	4.0 (2.0 -7.0)	

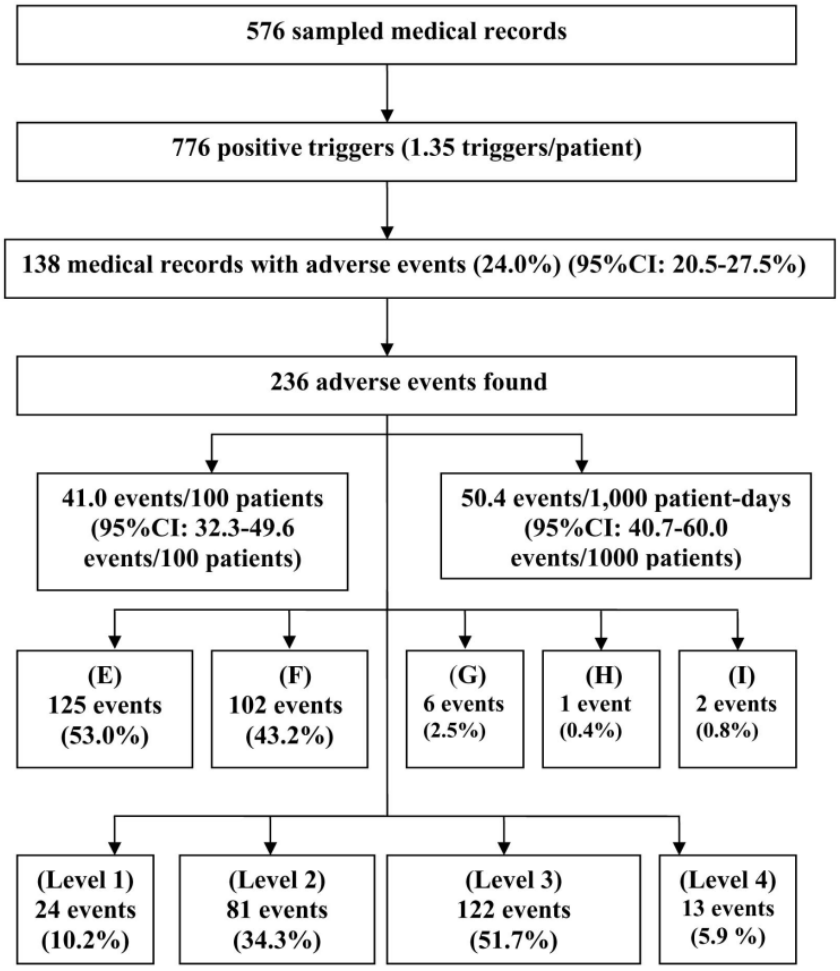

Fig. 1 Number of result in each process of review. E, F, G, H, and I indicate severity-rating.

Table 2. Adverse events by severity-rating according to preventability level.

		Preventability level				
		1	**2**	**3**	**4**	**Total**
Severity-rating	E	8	37	66	12	123
	F	14	37	51	2	104
	G	1	5	0	0	6
	H	0	1	0	0	1
	I	0	1	1	0	2
Total		23	81	118	14	236

Table 3. Adverse events classification by Patient Safety Goals **(**SIMPLE).

	Patient Safety Goals (SIMPLE)	**Amount**	**Percent**
S	***Safe surgery***	***48***	***20.3***
S1	Surgical site infection (SSI) prevention	5	2.1
S2	Safe anesthesia	7	3.0
S3	Safe surgical team	9	3.8
S3.1	Correct procedure at correct body site	4	1.7
S3.2	Surgical safety checklist	23	9.7
I	***Infection control***	***40***	***16.9***
I1	Hand hygiene/clean hand	8	3.4
I2	Prevention of healthcare associated infection	14	5.9
I2.1	Catheter-associated urinary tract infection (CAUTI) prevention	8	3.4
I2.2	Ventilator-associated pneumonia (VAP) prevention	6	2.5
I2.3	Central line infection prevention	4	1.7
M	***Medication and blood safety***	***42***	***17.8***
M1	Safe from adverse drug events (ADE)	31	13.1
M1.1	Control of concentrated electrolyte solutions	0	0
M1.2	Improve the safety of high-alert drug	4	1.7
M2	Safe from medication error	1	0.4
M2.1	Look-alike sound-alike medication names	0	0
M3	Medication reconciliation/assuring medication accuracy at transition in care	0	0
M4	Blood safety	6	2.5
P	***Patient care processes***	***75***	***31.8***
P1	Patients identification	0	0
P2	Communication	0	0
P2.1	Effective communication	0	0
P2.2	Communication during patient care handovers	0	0
P2.3	Communicating critical test results	0	0
P2.4	Verbal or telephone order/communication	0	0
P2.5	Abbreviations, acronyms, symbols and dose designation	0	0
P3	Proper diagnosis	14	5.9
P4	Preventing common complications	53	22.5
P4.1	Preventing pressure ulcers	5	2.1
P4.2	Preventing patient falls	3	1.3
L	***Line, tube and catheter***	***4***	***1.6***
L1	Avoiding catheter and tubing misconnections	4	1.6
E	***Emergency response***	***27***	***11.4***
E1	Response to the deteriorating patient/ Rapid response team (RRT)	3	1.3
E2	Sepsis	0	0
E3	Acute coronary syndrome	2	8.0
E4	Maternal and neonatal morbidity	22	9.3

Discussion

The present study showed that adverse events identified by GTT attained up to 41.0 events per 100 patients or 50.4 events per 1,000 patient-days. This indicates that 24.0% patients have at least one adverse event. In the IHI study by Griffin FA et al. [12], approximately 30-35% of patients had adverse events, which is a little higher than our level. This might be due to different lengths of stay and different diseaserelated group of patients. Rozich JD et al. [14] studied the adverse events in Thailand using HMPS technique. Compared with their result, the present level of adverse events are four times higher. Even if the adverse events are excluded for E category of severity-rating, our obtained rate of adverse events is still double of Rozich et al. result [14]. This might be due to the greater capability of the GTT to identify adverse events. Our rate of adverse events is consistent with previous reports using trigger tool studies where the rate of adverse events is as high as 24-74% of hospitalized patients [14-16].

In the present study, the inter-rater reliability between the two reviewers for detection of adverse events was high (K=0.86). This indicates that GTT provides lower variability than the screener in HMPS done in United States (K = 0.61) [1], Australia (K = 0.67) [2], and Canada (K = 0.70) [5]. This might be a reflection of explicitness of triggers in GTT more than screening criteria in HMPS.

Our preventable adverse events (58%), including the adverse events in level 3 and 4, were greater than previous HMPS studies (36-51%) [1-5]. Subgroup analysis of severity E shows that most events (63.4%) were preventable. These indicate that GTT might be capable of detecting preventable adverse events, particularly in those with less severity.

In our study according to the SIMPLE, only one-fifth of adverse events were directly related to surgery. This is different from previous reports from US [1], Australia [2], and Canada [5], which have more surgery-related adverse events. In our analysis, most adverse events related with non-surgery came from prevention of common complications, safe from adverse drug events (ADE) and maternal/neonatal morbidity. However, it must be noted that distribution of SIMPLE type of adverse events has some limitation for lack of information (usually not written in medical records).

Let us mention about the limitation of the present study. Firstly, since the present study is of retrospective nature, information bias might occur. For example, lack of information about human errors might lead reviewer's decision to "preventability". Most unrecorded verbal communication errors are important information to determine causation. Secondly, the GTT are designed primarily for quality improvement, not for research work. Therefore, some assessment bias has to be considered. When the GTT is used, protocol that is more rigid is required to improve the content validity. Assessment of medical record is also required to ensure conformation of patients' information. Moreover, GTT was designed in US healthcare context, which might not be applicable totally for Thai healthcare system. Finally, we did not have the goal standard to verify the validity of the GTT in measuring adverse events. Since GTT has different definition of adverse events and process of adverse events assessment from HMPS's ones, we cannot use the goal standard for detection of adverse events by HMPS.

In conclusion, our cross-sectional study revealed more adverse events than other studies in the past. Our inter-rater reliability was very good. Most adverse events detected had low severity and were preventable, which were mostly related to prevention of complications, safe surgery, and medication safety. For lack of current goal standard, validity testing is needed before using this tool in the medical service.

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