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Risk and Preventability of Adverse Events at a Finnish Tertiary Hospital Using Modified Global Trigger Tool

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ABSTRACT

Introduction:
The present study was conducted to evaluate the risk and preventability of adverse events (AEs) at a 600-bed tertiary hospital in Kuopio, Finland.

Materials and Methods:
The review of patient records was organized using the Global Trigger Tool developed by the Institute for Healthcare Improvement modified in order to emphasize the patient's point of view. A bimonthly random sample of hospital charts was selected within October 2014 to April 2016. The association with the AEs of the factors, such as patient age, gender, emergency versus elective admission, polypharmacy, nursing care intensity raw points, and categorized reasons for arrival, was investigated in this study. A binary logistic regression model was employed to evaluate the risk of AEs.

Results:
There were 140 AEs/1000 patient days and 91 AEs/100 admissions. Overall, 46% (n=305) of hospital admissions were reported with an AE. Nursing care intensity raw points affected the incidence of AEs (OR: 1.238, P<0.001). Moreover, polypharmacy (OR: 2.897, P=0.001) and nursing care intensity (OR: 1.158, P=0.008) predicted preventable AEs. The incidence of all and preventable AEs was significantly influenced by the age group (≥65 years vs. younger; OR: 2.303, P<0.001; OR: 1.825, P=0.030) and nursing care intensity in internal medicine/pulmonology or oncology ward (OR: 1.255, P=0.044; OR: 1.330, P=0.016).

Conclusion:
By focusing on the patient's point of view, there was a high number of AEs in the study population. The risk of AE was affected by the age group ≥ 65 years and high nursing care intensity, especially in internal medicine/pulmonology and oncology wards. Efforts should be focused on these patients for the improvement of patient safety.

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Introduction

Ensuring patient and client safety in practice is a part of the responsibility of service providers. The objective of the new patient and client safety strategy 2017-2021 in Finland is that "the treatment, care, and services provided for people promote their physical, mental, and social wellbeing and cause harm as slight as possible" (1).

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Although healthcare personnel are professional and committed and their activities are regulated, patient safety incidents can only be minimized with comprehensive quality and safety management.

The prevention of incidents that cause human suffering also reduces costs (1-3). At least one adverse event (AE) occurs in 10-33% of hospital admissions in Nordic countries (4-9). At present, the estimates of harm in Finland are mainly based on international studies (10-11).

Many measures have already been implemented for the improvement of patient safety, such as achievements in patient safety culture. How to systematically well measure AEs to learn from is one of the next steps and how to benefit from these AEs results in patient care via leadership (12-14).

Better patient safety is important to all patients; however, in the present study, it was firstly decided to identify the patients with higher risks of AEs in our hospital to work toward the improvement of their safety. Overall, if the personnel are to be more effective in their work, it is required to minimize the harm to patients and costs these harms can bring to hospitals and societies.

The current study aimed to obtain the basic rate, category, and severity of the identified AEs in a Finnish tertiary hospital, identify the factors associated with AEs, especially preventable ones, and how to improve organization after these findings.

A new approach that focuses on the patient's point of view was emphasized in this study. It was hypothesized that many preventable AEs could be observed when focusing on the patient's point of view and these are especially noticed while treating elderly patients with polypharmacy.

Materials and Methods

Study design

This was a baseline study of AEs in a tertiary hospital, including a retrospective record review of all discharged adults within October 2014 and April 2016. The AE is a patient safety incident that causes harm to the patient. To achieve a comprehensive picture of the level of AEs, he Global Trigger Tool (GTT) approach was used developed by the Institute for Healthcare Improvement (IHI), which can supplement incident reporting (15). The GTT uses trigger words that are identified, and the case is closely studied for AEs. The method is a robust approach to identify AEs in hospital patients and can be modified (16), and it may be even 19 times more sensitive than voluntary reporting notification system (17).

It has been stated that the GTT detects events that would have gone unnoticed by other standard methods (e.g., voluntary incident reports and pharmacy interventions) (18-20).

A recent systematic review suggests using preventability scores for priority setting, as well as reframing the GTT purpose to understand and characterize AEs rather than just counting them (21). Although it is not in the original GTT method to count AEs that are due to omission, lack of obviously required treatment, or organizational faults, these were considered in this modified GTT study to identify the overall picture from the patient's point of view, since these are often real harm to the patient.

The AE was regarded as preventable in the GTT method in case AE was preventable with 50% or more likelihood as in GTT studies in Sweden (6). In addition, clear psychological harm was recognized if such occurred because this is considered in the new patient and client safety strategy in Finland.

In order to investigate the risk factors of AEs, the collected data included patient age, gender, emergency/elective admission to the hospital, possible treatment in the intensive care unit during the hospital stay, possible polypharmacy (i.e., the use of three or more medications), highest nursing intensity (NI) raw score (22), or categorized reasons for arrival in the hospital. The NI consist of the evaluation of planning and coordinating nursing care from six points of view, including 1) breathing, blood circulation, and symptoms of a disease, 2) nutrition and medication, 3) personal hygiene and secretion, 4) activity, sleep, and rest, 5) teaching, as well as guidance in care and follow-up care, and 6) emotional support. The nursing care activities can vary in each area of evaluation from 1-4

points leading to the total number of points from 6-24 raw points, where 6 points mean the minimal need for care and 24 points the maximal need for care. This classification is a part of daily work, and NI can be observed in each patient report of the visit. The arrival groups were formed following the hospital organizational divisions or combination of subdivisions; accordingly, there would be only some and as few as possible overall arrival groups. The arrival groups were 1) internal medicine, pulmonary diseases, and oncology, 2) dermatology/otorhinolaryngology/ophthalmology, 3) obstetrics and gynecology, 4) cardiology, including thorax and cardiovascular surgery, 5) neurology and neurosurgery, and 6) other surgeries, such as abdominal and orthopedics surgeries.

Study setting and sampling

The study was performed in a 600-bed tertiary hospital with over 4,000 personnel in Eastern Finland. The patient records were randomly selected twice a month from the patient data registry. At each session, 20 patient records were sampled, and the first 10 eligible subjects were randomized in the study. Immediately after the selection, the cases were studied in the same week. Following the IHI guidelines, the exclusion criteria were the patients less than 18 years upon arrival to the hospital, primarily admitted for psychiatric or rehabilitation care, or subjects with a length of stay less than 24 h. The whole hospitalization was reviewed, including patient days at all departments, not only the index department.

Data collection

The study group consisted of a GTT team, with one physician and four registered trained nurses who were selected through application and interview. The review of the patient data was performed in two stages. The two nurses went through the patient records at first separately and then together. The GTT developed by IHI contains six modules of grouping the triggers. The modules are Cares, Medication, Surgical, Intensive Care, Perinatal, and Emergency Department. All patient records were reviewed for the triggers in all modules if applicable. The used triggers are presented in Supplement 1.

In the second stage, the physician together with the nurses went through the cases to clarify the classification of triggers and AEs, as well as their preventability, and categorize patient harm. The results were recorded in the SPSS software (version 24.0) online. The harms were assigned in the following five categories:

Category E: Temporary harm to the patient and required intervention

Category F: Temporary harm to the patient and required immediate or prolonged hospitalization

Category G: Permanent patient harm

Category H: Required intervention to sustain life

Category I: Patient mortality

Statistical analysis

The data on AEs were presented in three ways, including AEs/1,000 patient days, AEs/100 admissions, and percentage of admissions with an AE. Then, the data were present by type of AEs in different modules, level of harm in each category (E to I), and preventability of AEs. In addition, the risk of AEs was illustrated using the statistical analysis of the binary logistic regression model by SPSS software (version 24.0).

The ORs for AEs were calculated in the regression model.

The patients with and without AEs or preventable AEs were studied in all cases and separately in subjects ≥ 65 and < 65 years in different modules. In data analysis, the Mann-Whitney U test was employed for continuous variables, and the Chi-square test/Fisher`s exact test was used for categorical variables to compare the basic patient characteristics between the groups. P-value less than 0.05 was considered statistically significant.

Ethical considerations

The study complied with the principles of the Declaration of Helsinki and was approved by the Ethics Committee of our hospital.

Results

The current study was carried out on a total of 305 patients, including 151 males and 154 females. The mean age of the participants was 59 years (age range: 18-97 years) at the initiation of the hospital stay.

Out of 305 patients, 55% (n=167) of them were admitted to the emergency department; however, other subjects had an elective appointment with the doctor in the hospital. The NI raw score (6-24 points) varied from 11 to 24, with a mean value of 16.4±2.6. There were only 12 patients whose NI were missing (<4%), and these subjects were not analyzed for this reason. In terms of other variables, no values were missing. More than half (59%, n=181) of the patients were reported with the use of three or more different continuous medications upon arrival to the hospital. Table 1 tabulates the patient characteristics with and without AEs in all subjects and cases with preventable and nonpreventable AEs. The total numbers of triggers and AEs in the study population are presented in Figure 1.

There were 140 AEs / 1000 patient days and 91 AEs / 100 admissions. In this study, 46% of the hospital admissions were reported with an AE. Out of 279 AEs, 115 cases were preventable AEs. None of the AEs in the present study population belonged to category I, which entails patient mortality.

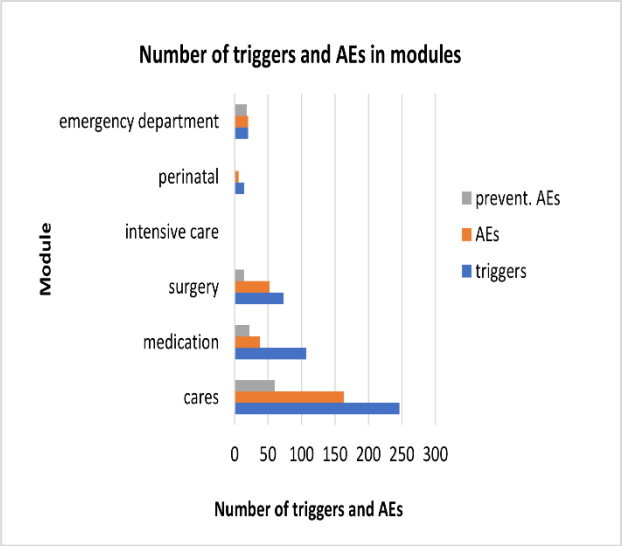

Figure 1: All triggers, adverse events and preventable adverse events in the six modules of the study population.

Table 1: Patient characteristics with and without adverse events, as well as preventable and nonpreventable adverse events, in study groups in 2014-2016

Variable		All patients (n=305)	Patients with AE (n=141)	Patients without AE (n=164)	P-value (between groups with and without AEs)	Patients with preventable AEs (n=70)	Patients with nonpreventable AEs (n=71)	P-value (between preventable and nonpreventable AEs)
Age (years)		59.2±18.7	63.3±18.6	55.6±18.1	<0.001	65.6±17.6	61.0±19.3	0.242
Gender (F/M) n (%)		154 (50%) / 151	68 (48%) / 73	86 (52%) / 78	0.463	30 (43%) / 40	38 (54%) / 33	0.205
Acute/by appointment n (%)		167 (55%) / 138	79 (56%) / 62	88 (54%) / 76	0.678	44 (63%) / 26	35 (49%) / 36	0.105
Treatment in intensive care unit/not in intensive care unit n (%)		28 (9%) / 277	17 (12%) / 124	11 (7%) / 153	0.107	10 (14%) / 60	7 (10%) / 64	0.420
Number and percentage of patients in arrival groups 1-6* n (%)	1 2 3 4 5 6	56 (18%) 19 (6%) 43 (14%) 45 (15%) 49 (16%) 93 (30%)	31(22%) 7(5%) 16 (11%) 30 (21%) 19 (13%) 38 (27%)	25 (15%) 12 (7%) 27 (16%) 15 (9%) 30 (18%) 55 (34%)	0.018	21 (30%) 5 (7%) 5 (7%) 11 (16%) 14 (20%) 14 (20%)	10 (14%) 2 (3%) 11 (15%) 19 (27%) 5 (7%) 24 (34%)	0.006
Nursing care intensity raw points		16.4±2.6	17.1±2.8	15.8±2.2	<0.001	17.3±2.9	16.9±2.5	0.413
Polypharmacy/ no polypharmacy n (%)		181 (59%) /124	97 (69%) / 44	84 (51%) / 80	0.002	54 (77%) / 16	43 (61%) / 28	0.034

AE: Adverse event

The numbers are presented as mean±standard deviation.

*The groups of reasons for arrival are as follows:

1: Internal medicine, including pulmonary diseases and oncology wards

2: Dermatology/Otorhinolaryngology/Ophthalmology wards

3: Obstetrics and gynecology wards

4: Cardiology ward, including thoracic and cardiovascular surgery

5: Neurology and neurosurgery wards

6: Other surgeries, including abdominal and orthopedics surgeries

The binary logistic regression model was used to identify if age, gender, polypharmacy, NI, acute or elective arrival at the hospital, or treatment in the intensive care unit influenced the incidence and preventability of AEs. All these variables were used for the adjustment of the model. Age affected the incidence of AEs (OR: 1.023, P<0.001, 95% CI: 1.010-1.036) but not after all the variables were in the model using the entering method. In the fully adjusted model, only NI affected the incidence of AEs (OR: 1.193, P=0.002, 95% CI: 1.068-1.332). In the case of using the forward method, NI (OR: 1.238, P<0.001, 95% CI: 1.122-1.367) and age (OR: 1.018, P=0.008, 95% CI: 1.005-1.032) influenced the incidence of AEs. In the evaluation of the preventable AEs, age affected the incidence of these AEs, (OR: 1.027, P=0.001, 95% CI: 1.010-1.043) but not after the adjustment for all the variables. In the binary logistic model, polypharmacy (OR: 2.897, P=0.001, 95% CI: 1.563-5.368) and NI (OR: 1.158, P=0.008, 95% CI: 1.039-1.290) significantly influenced the incidence of preventable AEs. In the comparison of those patients with preventable AEs to those with nonpreventable AEs, age did not affect the type of AEs. In this comparison, the arrival group of the patient affected the type of AEs (P=0.003), and polypharmacy was also significant in this regard (P=0.030). The incidence of AEs was significantly higher in patients ≥ 65 years than that reported for those < 65 years (P<0.001). Polypharmacy, NI, and number of patients in different arrival groups differed significantly between these age groups (P<0.001, P=0.002, and P<0.001, respectively). In the binary logistic model, the incidence of AEs was significantly influenced by the age group (≥65 year vs. younger; P<0.001, OR: 2.303, 95% CI: 1.454-3.647), and this effect remained while adjusting by the age group, NI, and polypharmacy (P=0.004, OR 2.029, 95% CI: 1.250-3.293). In the assessment of the preventable AEs, age group had an effect on the incidence of preventable AEs (P=0.030, OR: 1.825, 95% CI: 1.061-3.141). In the case of adjusting by the age group, NI, and polypharmacy, the effect of the age group on the incidence of preventable AEs was not significant (the effect of polypharmacy and NI was stronger).Most common findings of modules

Cares

In the Cares module, 66% (n=201) of the patients had no AEs at all (Table.2). Furthermore, 85% (n=260) of the subjects had no preventable AEs in this module. The most usual AEs (n=45) were returned to the hospital within 30 days of discharge 24% of which were preventable. Afterward, there were other care-related AEs (n=28; 61% preventable), hospital-associated infection (n=18; 28% preventable), and hemoglobin decreasing ≥ 25% during hospital stay (n=16; 19% preventable).

Other AEs, though minor in number, but ≥ 50% preventable, were falling (n=9; 67% preventable), decubitus ulcers (n=7; 71% preventable), and using binding belts for the patient (n=6; 67% preventable). Other care-related AEs were lack of control or remarks missing in the patient records, lack of communication between the patient and personnel, canceling the operation when the patient arrived or was prepared for it, and ignoring the new symptoms of the patient.

Medication

In the Medication module, 90% (n=273) of the patients had no AEs at all. Only 36% (n=38/107) of the triggers in this module were considered AEs (Table 2) 58% of which were considered preventable. Most AEs in this group were unplanned stop of medication (n=10; 80% preventable), anti-emetic medication (n=8; nonpreventable), oversedation/hypotension (n=8; 75% preventable), or other medication-related AEs (n=4, all preventable), in which for instance the medication was not updated, the patient received another patient's medication, or the patient's dose of medication was incorrect or high.

Surgical

In the Surgical module, 15% (n=46) of the patients had all the triggers (Table 2). The most frequently observed triggers were postoperative complications (25/73), re-operation (12), and intra or postoperative X-ray (11). Almost every trigger (n=23, 17% preventable; n=11, 18% preventable, n=9, 44% preventable, respectively) was

reported as an AE. The most serious AEs (n=5) were noticed for postoperative complications, elevation of cardiac troponins, and postoperative treatment in the intensive care unit. None of the AEs for the elevation of cardiac troponins were preventable.

Perinatal

There were six AEs in this module for bleeding over 500 ml (normal vaginal delivery) or over 1,500 ml (cesarean section, n=2), postpartum medication (n=1), and general anesthesia (n=3). The most serious AE(category H, n=1) occurred for general anesthesia.

In this module, the only preventable AE was also for general anesthesia.

Emergency Department

In this module, there were 20 triggers, most of which were related to treatment duration over 6 h in the emergency department. In addition, all triggers were considered to be AEs. All the AEs caused temporary harm at most. Table 2 tabulates that 90% of the AEs are preventable.

Intensive Care

No triggers were observed in the Intensive Care module.

Table 2: Findings of triggers and seriousness of adverse events in six modules in 2014-2016

Number of patients (n=305)		Modules						All
		Cares	Medication	Surgical	Perinatal	Emergency Dep.*	Intensive Care	305
Patients with triggers n (%)		144(47%)	86(28%)	46(15%)	9(3%)	19(6%)	0	196(64%)
Identified triggers for each module (% of all triggers)		246(53%)	107(23%)	73(16%)	14(3%)	20(4%)	0	460
Patients with single trigger n (% of patients with triggers)		81(56%)	70(81%)	26(57%)	4(45%)	18(95%)	0	82(42%)
Patients with two triggers n (% as above-mentioned)		42(29%)	12(14%)	14(30%)	5(56%)	1(5%)	0	51(26%)
Patients with ≥three triggers n (% as above-mentioned)		21(15%)	4(5%)	6(13%)	0	0	0	63(32%)
Patients with AEs n (%)		104(34%)	32(10%)	32(10%)	6(2%)	19(6%)	0	141(46%)
Triggers with AEs n (% of triggers)		163(66%)	38(36%)	52(71%)	6(43%)	20(100%)	0	279(61%)
Preventable AEs n (% of AEs)		60(37%)	22(58%)	14(27%)	1(17%)	18(90%)	0	115 (41%)
Categories of harm	E	70	19	13	2	19	0	123
	F	91	19	34	3	1	0	148
	G	2	0	4	0	0	0	6
	H	0	0	1	1	0	0	2
	I	0	0	0	0	0	0	0

AE: Adverse event *Dep.: Department For categories E-I see data collection.

Risk of adverse event

The present study demonstrated the type of patient with the most significant risk of an AE and preventable AE. In the group of the subjects admitted to the internal medicine, pulmonary diseases, or oncology wards, 55% of the patients were reported with AEs. In the cardiology group, including thoracic and cardiovascular surgery, 67% of the participants had AEs (the highest percentage of the arrival groups). In the binary logistic model, the risk of an AE in internal medicine, pulmonary diseases, or oncology wards was 1.255 (CI: 1.006-1.565, P=0.044) while adjusting for age, gender, and NI score. The corresponding risk of a preventable AE was 1.330 (CI: 1.055-1.676, P=0.016; Table 3). The nursing care intensity raw score significantly influenced the risk of an AE, which was also true for abdominal surgery and orthopedics wards, as well as for obstetrics and gynecology wards. With a similar adjustment, the NI score was not a risk factor in the cardiology group. After the investigation of all patient groups, NI significantly influenced the risk of AEs (OR: 1.203, 95% CI: 1.086-1.332, P<0.001). With a similar adjustment, the NI score was not a risk factor in the cardiology group. After the investigation of all patient groups, NI significantly influenced the risk of AEs

(OR: 1.203, 95% CI: 1.086-1.332, P<0.001).Age was not significant in this setting (P=0.071). In the comparison of the patients ≥ 65 years to those < 65 years, the risk of AEs was significantly affected by the age group (P<0.001, OR: 2.303). The conservative medical admission groups of internal medicine, pulmonary diseases, and oncology had the highest risk of preventable AEs in this study, especially in case of the inclusion of NI in the model; however, in general, the age over 65 years highlighted the risks of AEs.

Table 3: Odds ratio for adverse events when adjusting for age, gender, nursing care intensity raw points, and polypharmacy in different arrival groups in study population

Arrival groups of patients**	Adjusted variables	OR for AE (95% CI) *OR for preventable AE	P-value
Arrival group 1 Internal medicine, including pulmonary diseases and oncology wards	Age	1.011 (CI: 0.981-1.042)	0.466
		*1.009 (CI: 0.969-1.051)	0.653
	Gender	1.537 (CI: 0.466-5.068)	0.480
		*0.708 (CI: 0.198-2.533)	0.595
	NI	1.255 (CI: 1.006-1.565)	0.044
		*1.330 (CI: 1.055-1.676)	0.016
	Polypharmacy	1.116 (CI: 0.208-5.984)	0.898
		*1.663 (CI: 0.221-12.492)	0.621
Arrival group 2 Dermatology/ Otorhinolaryngology/ Ophthalmology wards	Age	1.009 (CI: 0.949-1.073)	0.781
		*1.013 (CI: 0.949-1.080)	0.705
	Gender	0.000	0.999
		*0.000	0.999
	NI	0.527 (CI: 0.196-1.416)	0.204
		*0.716 (CI: 0.259-1.982)	0.520
	Polypharmacy	4.628E+10	0.999
		*9066307449	0.999
Arrival group 3 Obstetrics and gynecology wards	Age	1.078 (CI: 0.996-1.167)	0.062
		*1.033 (CI: 0.932-1.145)	0.535
	Gender	-	
	NI	1.487 (CI: 1.045-2.117)	0.028
		*1.521 (CI: 0.961-2.408)	0.073
	Polypharmacy	1.956 (CI: 0.056-68.756)	0.712
		*4.372 (CI: 0.024-789.730)	0.578
Arrival group 4 Cardiology ward, including thoracic and cardiovascular surgery	Age	1.041 (CI: 0.970-1.117)	0.264
		*1.053 (CI: 0.965-1.148)	0.245
	Gender	0.714 (CI: 0.164-3.110)	0.653
		*1.571 (CI: 0.321-7.683)	0.577
	NI	1.159 (CI: 0.837-1.604)	0.374
		*0.689 (CI: 0.459-1.034)	0.072
	Polypharmacy	0.460 (CI: 0.038-5.505)	0.539
		*457129670.9	0.999
Arrival group 5 Neurology and neurosurgery wards	Age	1.043 (CI: 0.976-1.114)	0.212
		*1.008 (CI: 0.946-1.073)	0.808
	Gender	0.252 (CI: 0.056-1.141)	0.074
		*0.409 (CI: 0.090-1.856)	0.246
	NI	1.157 (CI: 0.853-1.570)	0.347
		*1.108 (CI: 0.829-1.480)	0.489
	Polypharmacy	0.822 (CI: 0.201-3.367)	0.785
		*1.965 (CI: 0.453-8.535)	0.367
Arrival group 6 Other surgeries, including abdominal and orthopedics surgeries	Age	0.995 (CI: 0.963-1.029)	0.785
		*0.984 (CI: 0.941-1.029)	0.485
	Gender	0.858 (CI: 0.339-2.176)	0.748
		*1.095 (CI: 0.317-3.779)	0.886
	NI	1.246 (CI: 1.002-1.549)	0.047
		*1.204 (CI: 0.908-1.597)	0.197
	Polypharmacy	1.107 (CI: 0.356-3.448)	0.860
		*1.578 (CI: 0.326-7.653)	0.571

AE: Adverse event NI: Nursing intensity

Discussion

In this study, there were a great number of AEs. Out of all hospital admissions, 46% of the cases had an AE. Moreover, the high number of preventable AEs in the study population, 41% of all 279 AEs, and 23% of all admissions required careful analysis. In earlier reports from Nordic hospitals (6), 50-70% of all AEs have been demonstrated as preventable. The rates of AEs in general inpatient GTT studies have varied within the range of 7-40% (21).

The estimates of the preventability of AEs have differed from 51.5-93.3% (20,23-28).In the present study, the GTT was modified with an emphasis on the patient's point of view. This is in line with the hospital strategy to provide the patients with effective treatment in order to improve their course of care. This is also in agreement with the Finnish patient and client safety strategy. The risk of overall AE was affected by higher age and nursing care intensity raw score. The risk of preventable AEs was determined by those same variables and polypharmacy. The risk of preventable AEs was the highest among the elderly patients ≥ 65 years admitted to the internal medicine, pulmonary diseases, or oncology wards with a high nursing care intensity score. The seriousness of harm to patients was most frequently related to category F, which is similar to the results of Norwegian studies (8).In our public hospital, the patients often have many diseases and medications, and their stay in the different wards is limited to the minimum length.

In addition, the patients are discharged to home care centers or rehabilitation centers as soon as possible. As most AEs were observed in the Cares and Medication modules, these should be prioritized for programs to improve patient safety in our hospital. The patient flow still requires to be improved in the Emergency Department. Streamlining the care also provides resources for patient safety. In the future, outcome registries can be helpful in the development of. The patients should probably be investigated more frequently from the patient's view in this flow, and a key is to improve the links between different places, such as home care, nursing homes, primary care and the different specialties taking part in the patient's care. With the aging population in Finland (29), this need becomes more obvious and should be planned for. Putting more effort into planning and leading the changes would be good for the aging population and their patient safety.

In the present study, it was observed that bedside nursing prevented AEs in many cases. Centralized bedside nursing has already become a theme to be improved in the studied hospital. Subunits have been started in certain wards where the nurses care for 1-2 patients. The organization of these nurses is centralized in the hospital, and the results of these subunits are analyzed as a single unit. It is believed that concrete patient safety programs can improve the condition that is the prevention of patient falls or pressure ulcers that can lead to good treatment culture in hospitals. It is also useful for smaller teams or units to regularly go through patient safety reports to learn from.

Older people tend to be reported more frequently with polypharmacy, which can raise possibilities for medication errors. In earlier reports, older age (5,9) and longer hospital stay (5,9,25,26) have been associated with the occurrence of AEs. Furthermore, clinical pharmacy needs to be improved, since it can improve the safety of medication when directed to key targets, such as putting more effort to discuss with the patients about their medication, what medication the patient has been using when arrived, and if there are high-risk medications, such as anticoagulant, antiplatelet, diuretic, and sedative or anti-diabetic medications.

The polypharmacy itself and symptoms regarding the side effects of medications could be better noted. This could mean new insights in resourcing and emphasizing the most urgent needs to improve the situation. In a study carried out by Härkänen et al. in 2015 (30), the risk of AEs increased with the increased number of used medications. Automatic data processing can be developed in the future so that alarms in patient records are more easily triggered with polypharmacy and its possible problems. Moreover, the safety control of patient medications requires to be more frequently

exerted. According to the findings of the current study, the sudden stop of medication and oversedation or hypotension were among the most common AEs, 75-80% of which were preventable.

The nursing care intensity was shown to have an effect on AEs and preventable AEs. This result is consistent with the findings of Fagerström et al. in their recent observational study (31). This also suggests the need for more resources in the development of hospital administration in addition to the daily patient care process. It seems that patients in conservative medical and oncological wards have more AEs and preventable AEs than those reported for other specialties in the current studied hospital.

Patient care in these wards has multiple medical and social aspects, and the patients often have many diseases that need to be treated or considered at the same time. In previous studies, there has been an effort to develop the GTT, especially from the viewpoint of oncological patients, since they are prone to AEs during their changing treatment (32).

Patient safety strategy is improved by working together with patients. In the present study, the subjects were not asked about their opinions; however, the judgment was based on professionals assessing patient records from the perspective of patient quality of care and safety. The patients are also valuable in giving opinions and participating in patient safety development. Patients need to be encouraged to take part in this development, as shown in a study conducted by Sahlström et al. (33).

Digitalization in patient care should also be evaluated in advance from patient safety view. There were several limitations in the present study. Working conditions and competency of the personnel were not examined in this study; however, the competency of the personnel has been always checked according to the national registry. One may think that the expert team that went through the patient data records could be considered not only a strength but also a limitation because the team remained the same the whole time. In this study, the nurse pairs were changed, and it was required to consult other specialists when necessary. In addition, it is suggested to carry out future studies with a larger sample size. Nonetheless, this is the first study using GTT analysis in the investigated hospital.

Conclusion

The results of the present study showed that hospitals need to more frequently streamline their operations, improve data transfer, and have a closer look at patient flows and courses of care. Patient safety continues to be an everyday priority in the hospital, and information transfer needs to reach all the parts that the patient is in contact with. Moreover, elderly patients and their caregivers should be sufficiently informed during the patient course of care. New elements could be considered while planning the resources and examining the personnel well-being at work.

At least, the resources require to be regularly checked in this regard. Hospitals can also improve other targets of action, such as clinical pharmacy, to enhance patient safety. The organizational leaders should be aware of these GTT findings to plan for the development of patient safety in the hospital.

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