

## REVIEW

# Reporting and responding to patient safety incidents based on data from hospitals' reporting systems: A systematic review

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## ABSTRACT

**Objective:** This review summarizes and synthesizes the evidence on follow-up activities regarding patient safety incidents reported in hospitals.

**Methods:** Peer-reviewed papers were retrieved with electronic searches from CINAHL, Web of Science, PubMed and Scopus databases and with manual searches in most relevant journals and in the reference lists of included studies, limiting searches to papers published in English between 2014 and 2018. A systematic review was conducted in adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement. Two authors extracted the data following a predefined extraction form.

**Results:** All together 16 studies were selected for analysis. All studies described incidents and gave insight into problems, risks and unsafe situations which were responded to with recommended improvements. Recommended improvements in response to incidents involved guidelines, staff training, technical improvements and general safety improvements. Only five studies reported feedback and knowledge dissemination activities, referring to meetings, written support and visual support.

**Conclusions:** Limited research has described the systematic use of report outcomes for knowledge application in organizations. However, the development of patient safety requires that reported incidents are responded to by knowledge application within feedback and knowledge dissemination activities. Therefore, healthcare professionals need to have sufficient competences in patient safety, and more research is needed on the content and effectiveness of the responding activities.

**Key Words:** Patient safety, Hospital incident reporting, Feedback, Knowledge dissemination, Systematic review

## 1. INTRODUCTION

Patient safety reporting systems aim to achieve safe care and treatment by providing knowledge for organizational learning and development. Guidelines for developing reporting systems<sup>[1]</sup> and key concepts with recommended terms<sup>[2]</sup> were provided by the World Health Organization (WHO) over 10

years ago. However, the use of such systems in hospitals remains highly variable.<sup>[3,4]</sup> Hospitals use different definitions for terms like “incident”, “error” or “complication”, the systems are not working as instruments for desired changes, and the checklist criteria provided by the WHO are often not fulfilled.<sup>[4]</sup>

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Even though considerable efforts have been made in the last decade, progress has been slower than originally anticipated.<sup>[5]</sup> Although hospitals rely on reporting systems to collect information for patient safety improvements, information about reported incidents sometimes remains inaccessible to the staff responsible for policy changes.<sup>[6]</sup> Moreover, some reporters doubt that the incidents they have reported are investigated at all.<sup>[7]</sup>

Following the WHO checklist criteria,<sup>[1]</sup> a systematic approach to implementing a patient safety incident reporting system in an organization requires safe and blame-free reporting and timely expert analysis, but also a capacity to respond. It means that the system must have the resources to generate responses, like feedback to the reporter and to the organization, and to disseminate knowledge about findings and recommendations,<sup>[1]</sup> which in turn initiates trust and learning in an organization.<sup>[4,7]</sup> A responsive and confidential learning environment increases staff engagement and disclosure of incidents.<sup>[1]</sup>

In previous research, increasing attention has been paid to investigating reporting trends, barriers and practices<sup>[8,9]</sup> and

to the implementation of blame-free reporting culture.<sup>[10]</sup> Less interest has focused on the organization of feedback<sup>[4]</sup> and knowledge dissemination to encourage the application of knowledge and organizational learning.<sup>[4,7]</sup> At a time when the healthcare environment is changing, reorganizing and more actively involving patients and their relatives, it needs to become more responsive and open to learning. Researchers believe that emphasizing a more robust approach to knowledge sharing is necessary for faster implementation of reporting systems' learning input.<sup>[5,7]</sup>

In previous systematic reviews, patient safety incident reporting systems have been investigated for their utility in clinical risk management, implementation quality, and influence on organizational learning.<sup>[3,4,7]</sup> However, there is no up to date overview of how follow-ups, including recommended improvement actions, feedback and knowledge dissemination regarding incidents, have been reported in previous studies. Therefore, the aim of this review is to identify and summarize the latest evidence of reported follow-up actions regarding patient safety incidents reported in hospitals. This knowledge can be used in hospitals to prevent new incidents from occurring.

**Table 1.** Literature search results in four databases

Database	Search terms combination	Items
<b>CINAHL</b> Limitations: English, years 2014–2018, peer-reviewed, abstract available, research article, field tags ([TI], [AB], [TX])	“patient safety”[AB] AND (“reporting system”[AB] OR “electronic * system”[AB] OR “incident system”[AB] OR “critical incident system” [AB] OR “incident * reporting system”[AB] OR “learning system”[AB] OR “event * system”[AB] OR “sentinel event * system”[AB] OR “monitoring system”[AB] OR “quality system”[AB] OR “deviation reporting system”[AB] OR “error* reporting”[AB] OR reporting[AB]) AND hospital [TX]	175
<b>Web of Science</b> Limitations: English, years 2014–2018, field tags ([Topic], [TI]), document type: article	“patient safety”[Topic] AND (“reporting system”[TI] OR “electronic * system”[TI] OR “incident system”[TI] OR “critical incident system”[TI] OR “incident * reporting system”[TI] OR “learning system”[TI] OR “event * system”[TI] OR “sentinel event * system”[TI] OR “monitoring system”[TI] OR “quality system”[TI] OR “deviation reporting system”[TI] OR “error * reporting”[TI] OR reporting[TI]) AND (hospital [Topic] OR “hospital * setting”[Topic])	249
<b>PubMed</b> Limitations: years 2014–2018, journal article, field tags ([TI/AB]), MeSH terms [MeSH]	“patient safety” (MeSH terms) AND (“reporting system”[TI/AB] OR “electronic * system”[TI/AB] OR “incident system”[TI/AB] OR “critical incident system”[TI/AB] OR “incident * reporting system”[TI/AB] OR “learning system”[TI/AB] OR “event * system”[TI/AB] OR “sentinel event * system”[TI/AB] OR “monitoring system”[TI/AB] OR “quality system”[TI/AB] OR “deviation reporting system”[TI/AB] OR “error * reporting”[TI/AB] OR reporting[TI/AB]) AND hospital [MeSH]	141
<b>Scopus</b> Limitations: years 2014–2018, article, field tags ([TI], [AB]), access type: all	“patient safety”[AB] AND (“reporting system”[TI] OR “electronic * system”[TI] OR “incident system”[TI] OR “critical incident system”[TI] OR “incident * reporting system”[TI] OR “learning system”[TI] OR “event * system”[TI] OR “sentinel event * system”[TI] OR “monitoring system”[TI] OR “quality system”[TI] OR “deviation reporting system”[TI] OR “error * reporting”[TI] OR reporting[TI]) AND (hospital [AB] OR “hospital * setting”[AB])	101
<b>Sum of results</b>		<b>666</b>

## 2. METHODS

### 2.1 Study design and search strategy

We conducted a systematic review to identify, select and synthesize data from original studies.<sup>[11, 12]</sup> We carried out both electronic and manual searches for previous literature. Electronic searches were made in four databases: CINAHL, Web of Science, PubMed and Scopus. The search terms were “patient safety” and “reporting systems” and their synonyms and combinations. We conducted searches for scientific, peer-reviewed papers which had been published in English between the years 2014–2018. The document type had to be a research paper (see Table 1). We carried out manual searches for the reference lists of included studies and for four most relevant high-quality journals using the same year limitations and inclusion and exclusion criteria: BMJ Quality

and Safety, Journal of Patient Safety, The Joint Commission Journal on Quality and Patient Safety and The International Journal for Quality in Health Care.

### 2.2 Study selection

We selected papers based on their titles, abstracts and full texts using predetermined inclusion and exclusion criteria. The papers included reported incidents and follow-up actions in hospitals. Such follow-ups outlined recommended improvements, feedback about the findings based on data analysis or recommendations made, and knowledge dissemination about the findings and recommendations in an organization. We excluded papers which focused on patient-reported incident systems, on network, regional or national level reporting systems, on education or consultation interventions, and on staff competence development.

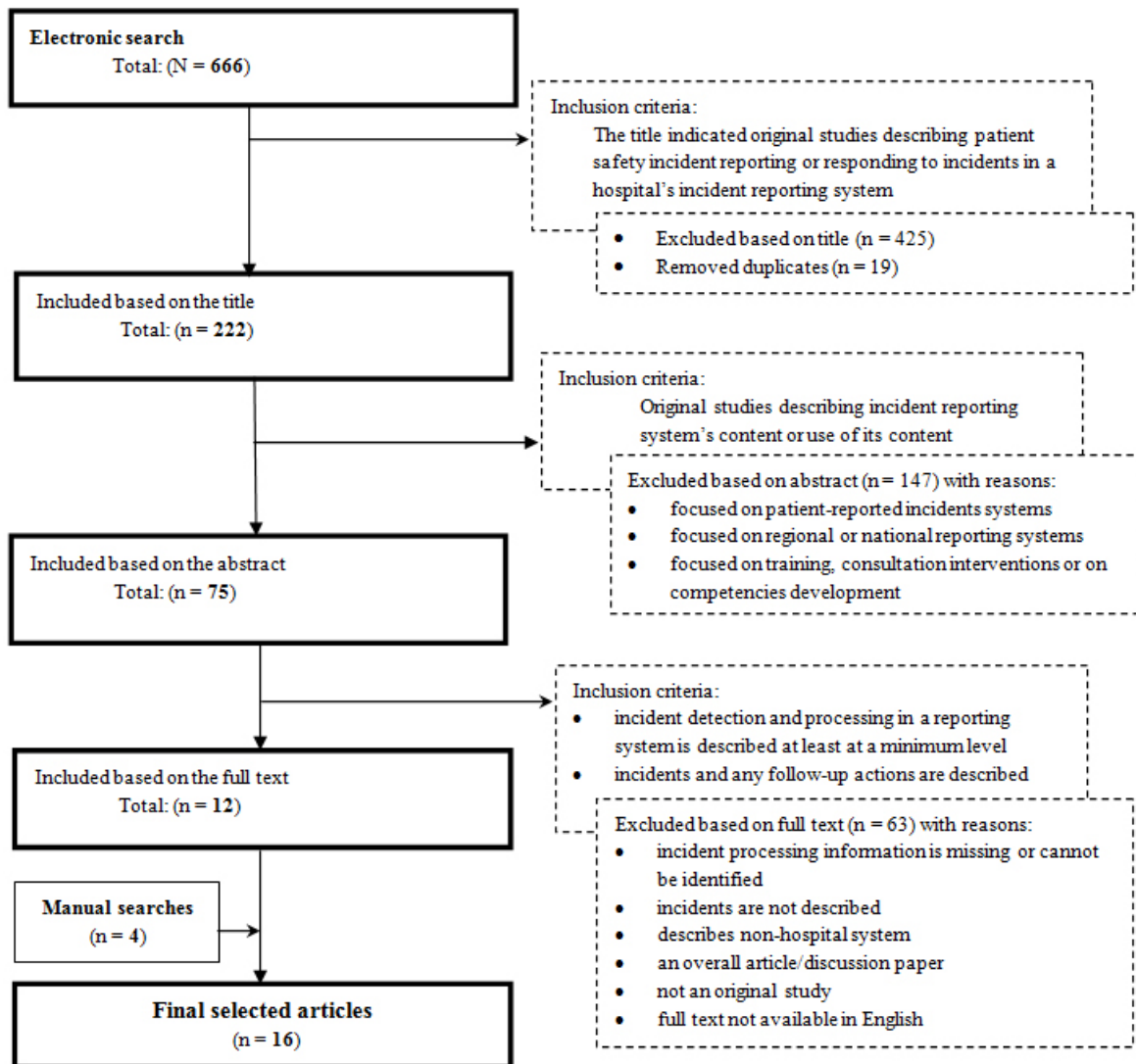


Figure 1. Study selection flow diagram

The electronic searches generated 666 citations, and 222 items were selected based on their titles. We removed the duplicates ( $n = 19$ ), and based on abstracts, we selected 75 items. In reviewing the full texts, we excluded 63 papers and selected 12. Finally, we made manual searches in reference lists of the included studies and in four journals. As a result, four more papers were selected (see Figure 1). Sixteen ( $n = 16$ ) papers were included in the final analysis.<sup>[13–28]</sup>

We conducted the study selections with three researchers independently examining each paper phase by phase. Discussions were held to compare the selections, and in the case of disagreement, the decision about inclusion or exclusion was carried out through consensus.

### 2.3 Study quality

We evaluated the quality of the included papers with the Mixed Method Appraisal Tool (MMAT) designed for critical appraisal stage specifically for reviews that include qualitative, quantitative and mixed methods studies.<sup>[29]</sup> The aim of the quality appraisal was to evaluate the methodological quality of the original studies, and all papers were included. Based on the quality appraisal, all of the qualitative studies ( $n = 2$ ) received maximum points (7/7) and all of the quantitative studies ( $n = 11$ ) received five points out of seven. The mixed method studies ( $n = 3$ ) received eight to 10 out of 12 (see Table 2). The main weaknesses concerned sample representativeness and data completeness in quantitative studies, and the methodological rationale in mixed method studies. Two authors evaluated the papers independently and in disagreements, we discussed to reach consensus.

### 2.4 Data extraction and analysis

First, we extracted data based on the included papers' authors, countries, study aims and methods. Then we extracted and categorized the results of the original papers by following the reporting systems' characteristics and details regarding the form of reporting and types of incidents reported, the subjects who were reporting incidents, and the general processing procedure. Second, we extracted the data following a predefined extraction form based on the World Health Organization guidelines "WHO Draft Guidelines for Adverse Event Reporting and Learning Systems".<sup>[1]</sup>

We extracted the incidents reported in papers by their content and quantified them into main categories which covered all incidents reported in the original papers. Then we extracted the follow-ups, such as recommended improvements and corrective changes already made based on the recommendations, and we categorized them in accordance with the examples given in the papers. We detected other follow-ups like feedback and knowledge dissemination. For these,

we searched for expressions describing feedback as sharing findings, whether about the data analysis results or about the recommendations based on data analysis. We searched for expressions describing knowledge dissemination as sharing findings about the lessons learned and recommendations made for systemic changes.

The authors read the papers independently, and one author (E.U.) extracted the data into tables. After that, all tabulated findings were discussed and confirmed by the research group. The results are presented in the results section in decreasing order, with those most frequently described presented first.

### 2.5 Characteristics of the selected studies

All sixteen studies used document analysis based on data extracted from incident reporting systems, three out of sixteen additionally data from root cause analysis summaries. Twelve studies out of sixteen were single-centre studies (see Table 2). In nine studies, the reporting systems were electronic, in three on paper, in one both electronic and on paper, and in three, this characteristic was not reported. In nine studies, the reporter could remain anonymous, in four non-anonymous, in one study both were possible, and in two studies this information was not reported. In fourteen studies, incident reports were expected from all staff members, in two studies the corresponding information was missing (see Table 3).

Eight studies investigated the safety incidents generally, and hospital departments or clinical fields were not distinguished. All other studies focused on some specific safety incidents, such as two on anaesthetic care incidents, two on perioperative field incidents, one on intensive care incidents, one on paediatric anaesthesiology care incidents and two on incidents related to older patients. Four of the studies were made in the United States, three in Finland, two in the Netherlands, one each from Pakistan, Saudi Arabia, Australia, Italy, Spain, Singapore and Taiwan (see Table 2).

## 3. RESULTS

### 3.1 Reported incidents

Four kinds of incidents emerged from the sixteen papers. Fifteen papers reported medication-related incidents, thirteen reported work organization-related incidents, eleven reported communication-related incidents and eleven reported technology-related incidents (see Table 3).

Medication-related incidents were incidents with failures in medication administration principles. This include incidents involving the wrong medication,<sup>[15,20,24,27]</sup> patient,<sup>[15,20]</sup> dose,<sup>[13,15,20,21,24]</sup> time<sup>[20]</sup> or route<sup>[14,15,20]</sup> and medicine administered with the wrong speed<sup>[15,24,27]</sup> or not administered

at all.<sup>[15,19,21]</sup> Three studies reported adverse drug events and reactions (side effect/interaction) as medication-related incidents.<sup>[13,18,27]</sup> Medication-related incidents were the highest-rated<sup>[14,19,24]</sup> or second highest-rated concern<sup>[20,21,26,27]</sup> in

seven studies out of twelve. Five studies reported general trends in medication-related incidents without describing them in detail.<sup>[16-18,22,25]</sup>

**Table 2.** Summary of aims, methods and quality appraisal according to MMAT<sup>[29]</sup> in 16 papers reviewed

Author, Year, Country [ref] Quality Appraisal Scores	Aim	Methods
Abbasi et al. 2018, Pakistan, <sup>[13]</sup> 5/7	To analyse critical incident reports specific to <u>paediatric patients in the department of anaesthesiology</u> , to see the trends of type of incidents and patient population. To re-evaluate the value of the program.	<u>Data:</u> Retrospective document analysis of reports (n = 451), one university hospital. <u>Analysis methods:</u> descriptive statistics.
Arabi et al. 2016, Saudi Arabia <sup>[14]</sup> 5/7	To assess the impact of the system implemented in the <u>intensive care department</u> for incident reports management and system development, to highlight the process of review and analysis.	<u>Data:</u> Retrospective document analysis of reports (n = 1,719) from pre- (n = 192) and post-intervention (n = 1,527) periods, additionally administrative data, one hospital. <u>Analysis methods:</u> Run charts. T-test or chi-square as appropriate for comparing pre- and post-intervention periods.
Häkkinen et al. 2017, Finland <sup>[15]</sup> 7/7	To describe ways of preventing <u>medication administration errors</u> in hospitals, based on reporters' views expressed in medication administration incident reports.	<u>Data:</u> Retrospective document analysis of reports' free-text descriptions (n = 1,012), two hospitals (one university and one central hospital). <u>Analysis methods:</u> descriptive statistics, inductive content analysis.
Heideveld-Chevalking et al. 2014, the Netherlands <sup>[16]</sup> 5/7	To explore the number, nature and causes of voluntarily reported <u>perioperative field incidents in the operating department</u> .	<u>Data:</u> Retrospective document analysis of reports (n = 2,563), one university hospital. <u>Analysis methods:</u> descriptive statistics.
Hooker et al. 2018, the Netherlands <sup>[17]</sup> 5/7	To examine if clustering of root causes of <u>sentinel events</u> can contribute to improvement of healthcare and patient safety by identifying vulnerabilities and patterns of failure factors of an organization.	<u>Data:</u> Retrospective document analysis of reports (n = 21) cross-sectional review, one hospital. <u>Analysis methods:</u> descriptive statistics and frequency tables.
Kellogg et al 2017, United States <sup>[18]</sup> 9/12	To examine the types of solutions proposed in root cause analysis conducted for <u>adverse events</u> , to determine a taxonomy and the number of solution types.	<u>Data:</u> Retrospective document analysis of reports with root cause analyses (n = 302), one tertiary care medical centre. <u>Analysis methods:</u> qualitative thematic analysis complemented by quantitative analysis.
Kinnunen-Luovi et al. 2014, Finland <sup>[19]</sup> 10/12	To describe the <u>safety incidents involving confused and forgetful older patients</u> in specialised care settings (internal medicine departments).	<u>Data:</u> Retrospective document analysis of reports (n = 75), one university hospital. <u>Analysis methods:</u> qualitative content analysis complemented by quantitative analysis.
Mansah et al. 2014, Australia <sup>[20]</sup> 8/12	To identify <u>the most common errors and adverse events among older hospitalized patients</u> , to identify the contributing factors and to examine recommendations made by an expert review panel.	<u>Data:</u> Retrospective document analysis of reports (n = 643), one tertiary metropolitan hospital. <u>Analysis methods:</u> qualitative content analysis and quantitative descriptive statistics.
Mansfield et al. 2015, United States <sup>[21]</sup> 5/7	To <u>classify safety risk based on special taxonomy</u> (conceptual model of risk), to quantify key risk attributes for providing insights into improvement strategies.	<u>Data:</u> Retrospective document analysis of reports (n = 17,253), several healthcare settings including hospitals and medical centres. <u>Analysis methods:</u> descriptive and analytical statistics.
McKaig et al. 2014, United States <sup>[22]</sup> 5/7	To evaluate the impact of a reengineered approach to <u>medication error reporting</u> , including quality improvement initiatives developed from the analysis of reports.	<u>Data:</u> A quasi-experimental interrupted time series with segmented regression design (pre- and post-implementation periods). Document analysis of reports (n = 2,355), one medical centre. <u>Analysis methods:</u> descriptive statistics, multiple linear regression analysis along with 95% CI, Student's t-test and chi-square test.
Moccia et al. 2017, Italy <sup>[23]</sup> 5/7	To develop an effective and reactive methodology to manage an unexpected increase of <u>adverse events in the operating rooms</u>	<u>Data:</u> Retrospective document analysis of reports (n = 85) and real-time observations, one hospital. <u>Analysis methods:</u> descriptive and analytical statistics, qualitative narrative analysis.
Neily et al. 2018, United States <sup>[24]</sup> 5/7	To provide in-depth information on reported <u>anaesthesia-related adverse events</u> with root causes and suggested actions for improvement. To recommend actions based on human factors engineering principles to prevent similar incidents from happening in the future.	<u>Data:</u> Retrospective document analysis of reports (n = 36), over 130 hospitals. <u>Analysis methods:</u> descriptive statistics.
Pitkänen et al. 2016, Finland <sup>[25]</sup> 7/7	To explore <u>suggestions to improve medication safety</u> reported in hospitals.	<u>Data:</u> Retrospective document analysis of reports' open-ended records (n = 2,004), three hospitals (one university and two regional hospitals). <u>Analysis methods:</u> inductive content analysis.
Ramirez et al. 2018, Spain <sup>[26]</sup> 5/7	To assess which implemented improvement actions related to the reported incidents were effective in reducing <u>near-misses or adverse events</u> .	<u>Data:</u> Prospective real-time observations, document analysis of reports (n = 1,983) one university hospital. <u>Analysis methods:</u> descriptive statistics, Pearson or Spearman correlation coefficient, Chi-squared test. Fisher exact test, OR and 95% CI values, multivariate analysis, logistic regression and univariate analysis.
Saito et al. 2015, Singapore <sup>[27]</sup> 5/7	To study and evaluate the incidence and spectrum of <u>critical incidents in anaesthetic care</u> , risk factors for incidents, the contributing factors, minimising factors and corrective measures.	<u>Data:</u> Prospective observational study, document analysis of incidents (n = 379), one university hospital department. <u>Analysis methods:</u> descriptive statistics and odds ratios (with 95% confidence intervals).
Yang et al. 2017, Taiwan <sup>[28]</sup> 5/7	To determine the incidence rate of <u>intra-hospital transportation-related events</u> and to investigate the modes of human failures and unsafe acts identified.	<u>Data:</u> Retrospective document analysis of reports (n = 206), one university hospital. <u>Analysis methods:</u> descriptive statistics, multivariate analysis, Pearson's $\chi^2$ test.

**Table 3.** Summary of the systems' characteristics and synthesized results (n = 16)

Author, Year [ref]	Systems characteristics				Outcome		
	Form/ confidentiality	Reporting details Type of incident	Reporter	Processing procedure	Incident categories	Recommended improvements	Feedback and knowledge dissemination
Abbasi et al. 2018 <sup>[13]</sup>	Paper/ Anonymous	Critical incident, event	Medical and paramedical staff	Reviewed and re-analysed by two consultant anaesthetists	<ul style="list-style-type: none"> <li>• Technology-related</li> <li>• Work organization-related</li> <li>• Medication-related</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Staff training</li> <li>• Technical improvements</li> <li>• General safety improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Written support</li> </ul>
Arabi et al. 2016 <sup>[14]</sup>	Electronic/ Non-anonymous	Undesired event, incident, near-miss	All employees	Reviewed by the Quality Management Department and the nurse manager of the involved unit	<ul style="list-style-type: none"> <li>• Medication-related</li> <li>• Work organization-related</li> <li>• Communication-related</li> <li>• Technology-related</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Staff training</li> <li>• Technical improvements</li> <li>• General safety improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Written support</li> <li>• Reporter's debriefing</li> </ul>
Häkänen et al. 2017 <sup>[15]</sup>	Electronic/ Anonymous	Safety incident	All staff members	Systematic analysis by hospital's administrators or by trained supervisors	<ul style="list-style-type: none"> <li>• Exclusively medication-related (only medication administration incidents were investigated)</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Staff training</li> </ul>	N/R
Heideveld-Chevalking et al. 2014 <sup>[16]</sup>	Electronic/ Non-anonymous	Incident, adverse event, near-miss event	All employees	Reviewed and discussed by the Operating Room Incident Reporting Committee (ORIRC)	<ul style="list-style-type: none"> <li>• Communication-related</li> <li>• Technology-related</li> <li>• Work organization-related</li> <li>• Medication-related</li> </ul>	<ul style="list-style-type: none"> <li>• Staff training</li> </ul>	N/R
Hooker et al. 2018 <sup>[17]</sup>	N/I/Anonymous	Incident, adverse event, sentinel event	All employees	Reviewed by the Board of directors, who consult experts and classify incidents	<ul style="list-style-type: none"> <li>• Communication-related</li> <li>• Work organization-related</li> <li>• Medication-related</li> <li>• Technology-related</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Staff training</li> <li>• General safety improvements</li> </ul>	N/R
Kellogg et al. 2017 <sup>[18]</sup>	N/I/N/I	Adverse event, undesirable development in an individual patient's condition	N/I	Reviewed within the special team (Root Cause Analysis team).	<ul style="list-style-type: none"> <li>• Work organization-related</li> <li>• Communication-related</li> <li>• Medication-related</li> <li>• Technology-related</li> </ul>	<ul style="list-style-type: none"> <li>• Staff training</li> <li>• Guidelines</li> <li>• General safety improvements</li> </ul>	N/R
Kinnunen-Luovi et al. 2014 <sup>[19]</sup>	Electronic/ Anonymous	Safety incident	All staff members	Systematic analysis by hospital's administrators or by trained supervisors	<ul style="list-style-type: none"> <li>• Medication-related</li> <li>• Communication-related</li> <li>• Work organization-related</li> </ul>	<ul style="list-style-type: none"> <li>• General safety improvements</li> </ul>	N/R
Mansah et al. 2014 <sup>[20]</sup>	N/I/N/I	Adverse event, error, incident	clinicians	Investigated and recommendations provided by health facilities' expert review panels.	<ul style="list-style-type: none"> <li>• Communication-related</li> <li>• Medication-related</li> <li>• Work organization-related</li> <li>• Technology-related</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Staff training</li> <li>• General safety improvements</li> </ul>	N/R
Mansfield et al. 2015 <sup>[21]</sup>	Electronic/ Non-anonymous	Any type of safety risk, safety incident, near-miss	All employees	Case-by-case analysis and response made by Patient Safety Department and operational leaders	<ul style="list-style-type: none"> <li>• Communication-related</li> <li>• Medication-related</li> <li>• Technology-related</li> <li>• Work organization-related</li> </ul>	<ul style="list-style-type: none"> <li>• Technical improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Written support</li> </ul>
McKaig et al. 2014 <sup>[22]</sup>	Electronic/ Anonymous	Error, medication error, event, near-miss	All staff members	Peer reviewed by managers of the involved departments	<ul style="list-style-type: none"> <li>• Exclusively medication-related (only general trends and severity were investigated)</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Staff training</li> <li>• Technical improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Visual support</li> <li>• Meetings</li> <li>• Written support</li> </ul>
Moccia et al. 2017 <sup>[23]</sup>	Paper/ Anonymous	Safety incident, adverse event, sentinel event	N/I	Analysed by the Hospital risk management (RM) team	<ul style="list-style-type: none"> <li>• Communication-related</li> <li>• Work organization-related</li> <li>• Medication-related</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• General safety improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Written support</li> <li>• Meetings</li> <li>• Visual support</li> </ul>
Neily et al. 2018 <sup>[24]</sup>	Electronic or paper-based/ Anonymous or non-anonymous	Error, adverse event	All healthcare professionals	Reviewed at the local facility by the patient safety managers	<ul style="list-style-type: none"> <li>• Medication-related</li> <li>• Work organization-related</li> <li>• Communication-related</li> <li>• Technology-related</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Staff training</li> <li>• Technical improvements</li> </ul>	N/R
Pitkänen et al. 2016 <sup>[25]</sup>	Electronic/ Anonymous	Safety incident	All staff members	Systematic analysis by hospital's administrators or by trained supervisors	<ul style="list-style-type: none"> <li>• Exclusively medication-related (only suggestions to improve medication-related incidents were investigated and reported)</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Staff training</li> <li>• Technical improvements</li> <li>• General safety improvements</li> </ul>	N/R
Ramirez et al. 2018 <sup>[26]</sup>	Electronic/ Anonymous	Safety incident, adverse event, near-miss	All staff members	Reviewed by report managers, sent for analysis to the local clinical safety leaders of the nursing unit and the medical service involved	<ul style="list-style-type: none"> <li>• Work organization-related</li> <li>• Medication-related</li> <li>• Communication-related</li> <li>• Technology-related</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Staff training</li> <li>• Technical improvements</li> <li>• General safety improvements</li> </ul>	N/R
Saito et al. 2015 <sup>[27]</sup>	Paper/ Non-anonymous	Critical incident, near-miss	All healthcare professionals	Reviewed by the study team	<ul style="list-style-type: none"> <li>• Work organization-related</li> <li>• Medication-related</li> <li>• Technology-related</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Staff training</li> <li>• General safety improvements</li> </ul>	N/R
Yang et al. 2017 <sup>[28]</sup>	Electronic/ Anonymous	Patient safety event, incident, no-harm event, near-miss	All staff members	Verified, collected and initiated necessary improvement activities by the Centre for Quality Management	<ul style="list-style-type: none"> <li>• Work organization-related</li> <li>• Communication-related</li> <li>• Technology-related</li> </ul>	<ul style="list-style-type: none"> <li>• Guidelines</li> <li>• Technical improvements</li> </ul>	N/R

Note. N/I – No Information; N/R – Not Reported; – Variation in reporting by single hospital systems (over 130 hospitals)

Work organization-related incidents were incidents in which staff made mistakes with planning tasks or did not complete a task at all. The reasons described included failure to check,<sup>[13, 18, 23, 27, 28]</sup> a weak fit between the training and task<sup>[13, 14, 17, 20, 24, 27]</sup> and lack of coordination when everyone thought that someone else had completed the task.<sup>[17]</sup> Staff failure to follow procedure guidelines or manage an escalated care situation and situations in which a patients' condition, behaviour or characteristics were beyond the control of staff<sup>[16, 19]</sup> led to incidents like inadequate patient care or coordination,<sup>[20, 21]</sup> falls,<sup>[14, 19–21]</sup> food aspiration<sup>[21]</sup> or tissue injuries<sup>[19]</sup> and death.<sup>[20]</sup>

Communication-related incidents were described as involving inadequate documentation, communication failures and information gaps. They were caused by human factors such as hasty behaviour by staff, staff fatigue or forgetting to document or pass on information.<sup>[16, 18–21, 23, 24]</sup> Staff who did not know the guidelines caused faulty monitoring, treatment or procedures.<sup>[16, 18, 20, 28]</sup> Mistakes were made with patient identification or verification<sup>[14, 17, 18, 20, 26]</sup> and with obtaining a patient's informed consent.<sup>[14, 23, 24, 26]</sup> For example, a blank informed consent form was signed by a patient, or no anaesthesia or surgical consent forms were signed at all, which resulted in the cancellation of a procedure, or a procedure was completed without documented patient consent.

Technology-related incidents were connected with the equipment, technics or facility. Incidents were caused by equipment or equipment malfunctioning<sup>[14, 17, 18, 26, 27]</sup> or because the staff had made mistakes in their use.<sup>[16, 21, 27]</sup> In several studies, the cause of the incident was that the equipment or accessory was not available<sup>[13, 16, 24, 28]</sup> or not properly placed (bedrails not being in place),<sup>[20]</sup> or the manufacturer's instructions were unclear.<sup>[24]</sup> In one study, environmental and facility malfunctions during intra-hospital transport resulted in incidents.<sup>[28]</sup>

### 3.2 Follow-ups as recommended improvements

Four categories summarize the recommended improvements reported in the sixteen selected papers. Guidelines were recommended in thirteen studies, staff training in twelve, general safety improvements in ten and technical improvements in eight papers (see Table 3).

Guidelines described activities for compiling new guidelines, protocols or checklists and for developing, updating or making available existing ones. Such guidelines covered, for example, medication processes related to storing,<sup>[24]</sup> prescribing,<sup>[20, 22, 26]</sup> dispensing,<sup>[22]</sup> administering<sup>[13–15, 20, 24–26]</sup> and monitoring.<sup>[13, 22]</sup> New protocols were developed for reorganizing workflow<sup>[15, 18, 20, 24–28]</sup> and communication princi-

ples,<sup>[17, 18, 20]</sup> including documentation.<sup>[15, 17, 20, 22–26]</sup> Checklists and protocols for safety and better coordination of patient care and treatment were described, for example, in relation to anaesthetic care,<sup>[24, 27]</sup> surgery<sup>[18, 26]</sup> and paediatric care.<sup>[13]</sup>

Staff training included training staff in specific skills like airway-related problems management,<sup>[13, 24]</sup> cardiopulmonary resuscitation<sup>[26]</sup> and other critical situations,<sup>[18, 24, 27]</sup> as well general medication management processes,<sup>[15, 20, 25]</sup> communication skills,<sup>[20, 24, 26]</sup> teamwork,<sup>[20, 24, 27]</sup> general safety behaviour<sup>[14, 17, 18, 20]</sup> and quality of care,<sup>[16]</sup> guidelines adherence<sup>[17, 18, 20, 24, 25]</sup> and incident reporting skills.<sup>[22]</sup> Two studies also reported special orientation training for new staff members.<sup>[25, 26]</sup>

Technical improvements involved actions for making essential equipment or accessories available or adopting new advanced technology or modern systems. Such improvement actions meant, for example, ensuring the availability of sevoflurane vaporizers, pediatric oxygen saturation probes<sup>[13]</sup> and tube holders,<sup>[14]</sup> as well as withdrawing and replacing problematic, faulty, or unsuitable equipment.<sup>[14, 26]</sup> Adopting new accessories and systems for improving patient safety was reported, such as an enhanced patient identification system,<sup>[28]</sup> identification bracelets<sup>[25, 26]</sup> and traceable surgical material.<sup>[26]</sup> Different kinds of new technology or systems usage were also recommended. These included advanced infusion pumps,<sup>[24, 26]</sup> bar-code scan systems,<sup>[21, 24]</sup> a computerized medication order entry system,<sup>[21, 22]</sup> an electronic prescribing system,<sup>[26]</sup> a patient glycemic monitoring system<sup>[21]</sup> and advanced technology to monitor high-risk patients for anesthesia.<sup>[24]</sup>

General safety improvements included recommendations for better patient monitoring and general safety. Improvements for better monitoring involved, for example, transparent drapes,<sup>[13]</sup> rooms for follow-up patients,<sup>[26]</sup> special solutions for monitoring confused older patients<sup>[19, 20]</sup> and increased staff resources.<sup>[25–27]</sup> For general safety, regular audits to examine the safety behaviour of departments<sup>[17, 23, 25]</sup> and discussions of safety incidents in a multi-professional setting<sup>[18, 25]</sup> were recommended.

### 3.3 Follow-ups for information sharing and knowledge application

Feedback, understood as an act of sharing information about the findings from data analysis, recommended improvements or improvements already made, was reported in five papers (see Table 3). The studies reported details about the recipients of feedback<sup>[13, 14, 21–23]</sup> and when<sup>[21–23]</sup> and in what form<sup>[13, 14, 21–23]</sup> it was given. In two studies, feedback was

provided to limited groups of people, specifically to all staff members of involved units,<sup>[13,14]</sup> and in three studies, it was provided to the whole organization.<sup>[21-23]</sup> Individual feedback, such as debriefing of incident reporters, was reported in one study.<sup>[14]</sup> The frequency of feedback was reported; for example, it was reported as given annually,<sup>[22]</sup> quarterly,<sup>[21]</sup> or immediately after the event.<sup>[23]</sup>

Knowledge dissemination was reported in five papers and included spreading information about the incidents and about the recommended improvements (see Table 3). The frequency of knowledge dissemination events was reported in three studies; it occurred annually,<sup>[22]</sup> quarterly<sup>[21]</sup> or instantly,<sup>[23]</sup> in accordance with the events or the ways that the information was shared.

The feedback and knowledge dissemination methods reported in the studies were meetings, written support and visual support. At the meetings, as well in forums and public fair events, feedback was provided about the recommended improvements or corrective actions which already had been made.<sup>[14]</sup> Knowledge dissemination was organized through reviewing and discussing incidents, establishing quality improvement projects<sup>[13]</sup> and developing action plans or strategies for quality improvement.<sup>[13,14]</sup> Written support was provided with electronic letters, which were provided as meeting memos<sup>[13,23]</sup> or as summaries for managers with key findings from the in-depth analysis,<sup>[21]</sup> as alerts about potential safety problems<sup>[23]</sup> or as agreed-upon rules, policies or changes.<sup>[14]</sup> It was also provided in the form of hospital newsletters<sup>[21]</sup> with featured lessons and findings from the reporting system that were spread to demonstrate that the safety reports were regularly analysed and used for improvements. Visual support was provided either in the form of plenary sessions about progressive steps in safety development<sup>[23]</sup> or in the form of stories, whether as descriptions or short videos of incidents<sup>[22]</sup> presented by healthcare professionals, about how the safety issue was noticed and investigated and how improvement actions were developed.

## 4. DISCUSSION

This review provided new evidence of follow-up activities regarding safety incidents reported in hospitals. Although a system's capacity to respond to reported incidents with follow-ups is considered to be an important factor that affects reporting practices as well as the application of knowledge and safety improvements in an organization,<sup>[1]</sup> no other systematic review has focused on follow-ups in a whole.

Based on this review, previous studies show that patient safety incidents were reported by all types of employees and about a wide range of adverse situations. The safety

incident reporting systems vary and are both electronic and paper-based, compiled as anonymous or non-anonymous. All sixteen studies reported on recommended improvements or on changes already made. Feedback and knowledge dissemination activities were reported only in five studies. Feedback was provided, whether individually, to groups of people or to the whole organization, and knowledge dissemination about the incidents and recommended improvements was organized in ways similar to the feedback. The feedback and knowledge dissemination tools used for knowledge application were meetings, written support and visual support.

### 4.1 Identifying the incidents as input to improvements

Medication-related incidents were the most frequently reported type of incidents. This is comparable to a recent review in which medication-related incidents were the second most common type of intra-hospital adverse events.<sup>[30]</sup> Some differences in the findings of our review can be attributed to the inclusion of prior studies with a wider scope of reporting that did not restrict their focus to only include adverse events incidents, free of which focus only on medication-related incidents.<sup>[15,22,25]</sup> The frequency of medication-related incident reporting may also indicate that medication-related incidents are relatively easy to report on and understand compared to some other incident types. Our results correlate with previous findings<sup>[4,7,31]</sup> that demonstrate healthcare professionals' increased awareness of medication-related incidents as potentially dangerous errors in the medication management process.

Recommendations for medication safety were focused on medication management processes, including workflow organization improvement as well as staff training, technical and information technology improvements and a multi-professional approach. Such improvements have also been reported in previous review findings,<sup>[32]</sup> and they indicate the need for standardized practices, better adherence to guidelines and continuous development of staff competences in patient safety and medication-related incident reporting. As hospitals remain places with high-risk situations (as in the case of emergencies) and with complicated clinical scenarios, the WHO has also provided a report to outline the medication incident problem and suggests key strategies for improving this worrisome situation.<sup>[33]</sup> Such an initiative can help to increase professional as well as public awareness and further emphasize the need to use incident reporting for the benefit of safety.

Work organization and communication-related incidents share some similar aspects which make them quite difficult to distinguish from each other. Still, to our understanding, work organization incidents are more like failures in planning and



doing connected with basic competences, skills and proper training. Communication incidents instead indicate shortcomings in staff behaviour caused mainly by haste, fatigue or indifference. Such incidents are often interrelated as they are both directly connected with human factors. They have also been reported in previous research as a major concern for patient safety, and they indicate the need for improvements in staff training, standardization of procedures and safety culture.<sup>[3,5]</sup>

The recommended improvements for work organization and communication-related incidents were mostly focused on standardisation of workflows, communication principles, documentation and care coordination specific to different clinical fields. The need for human factor development and better management was supported with staff training and with different technical solutions. Such improvements have also been described in previous reviews<sup>[3,4]</sup> and were supported by regular meetings and written aids or forms.

Technology-related incidents are reported in our findings the least, but they were the main concern in one paper.<sup>[13]</sup> They mainly indicate insufficient or problematic equipment and clearly signal the need for improvements, such as providing units with proper equipment. Previous studies indicate that incident reporting systems could be the only places where technology-related incidents can be found, as patients' medical records are not considered to be the correct place for reporting such problems.<sup>[7]</sup> Thus, it is possible that of the various incident types, the number of technology-related incident reports is the most proportional to the real number of such incidents.

The recommended improvements related to technology-related incidents were mainly technical in our findings, as they were in previous review findings.<sup>[4]</sup> Suggestions for technical improvements included replacing problematic, faulty or unsuitable equipment and ensuring that essential equipment or accessories are available for care and monitoring. Unlike in previous reviews, our study findings included recommendations for staff safety behaviour training<sup>[16-18,20,27]</sup> with a particular focus of preventing the misuse of the equipment.

In our review, the included studies all describe some kind of improvements based on the incidents reported, which is similar to one previous review<sup>[3]</sup> and quite different from another, in which less than half of studies reported improvements.<sup>[4]</sup> This highlights the fact that incident reporting remains an important source of input for improvements, as long as the reports provide rich qualitative data on the incident and its contexts and are analysed in a timely and professional man-

ner.

#### 4.2 Responding with follow-ups to enable learning

Our review identified follow-ups such as feedback and knowledge dissemination only in five studies. This finding is similar to those of the review that detected that feedback was reported only in less than half of the studies.<sup>[4]</sup> We found that feedback and knowledge dissemination methods for knowledge application in the studies include joint meetings, forums and public fair events for discussions and staff involvement in quality development, and that they were augmented with different written and visual support forms. To some extent all those methods have been identified in previous studies, which found that they preferably occur as regular events varying from daily feedback to once per month.<sup>[4]</sup> However, only three of our included studies reported some regularity, whether immediate, quarterly or annual.<sup>[21-23]</sup>

Feedback is essential for supporting and encouraging staff learning,<sup>[3,4,7]</sup> but a lack of constructive feedback hinders the willingness to report<sup>[34]</sup> and probably has a negative influence on learning. As indicated in one included study, the number of reported incidents goes up after departmental presentations and then gradually declines.<sup>[13]</sup> Therefore, reflective learning requires regular feedback. Still, in our review, learning from incidents and knowledge application is clearly detected only in two studies. In one study, quality improvement projects were selected during staff meetings,<sup>[13]</sup> which showed the involvement of staff in improvements and therefore staff opportunities for learning. In another study, improvements in compliance with surgical guidelines were reported after staff responsible for safety observed surgical procedures and gave feedback to surgical personnel about their findings.<sup>[23]</sup>

We acknowledge that feedback or knowledge dissemination may already be built into recommended improvements, such as staff training or guidelines.<sup>[18]</sup> Still, only clearly reported information can be considered as evidence and more research on follow-up mechanisms and methods is needed for deeper understanding.

Based on our review we would like to suggest hospitals strengthen the utilization of their existing systems with the following improvement measures:

- Ensure that the benefits of incident reporting will be continues and visible to all level of staff in the organization.
- Provide systematic feedback to the whole organization.
- Ensure education and resources for incident reporting

and responding.

- Implement a system of sharing information about the lessons learned.
- Standardize the implementation of recommendations and the follow-up activities.

#### 4.3 Limitations of this review

One potential limitation<sup>[12]</sup> of our review may be that we searched only for peer-reviewed papers. The use of grey literature would have strengthened our review. We limited searches for the years from 2014 to 2018 because the searches in previous reviews were carried out until the year 2014. To cover a broad search area, we conducted searches electronically as well as manually and selected studies with three researchers working independently phase by phase. To ensure the review quality, one author extracted all the data based on the predefined extraction form, but findings were discussed and confirmed by the research group. As the included studies used multiple definitions for reporting systems, incidents and follow-up actions, it was challenging to compare study results and to find coherent descriptions for the key findings.

## 5. CONCLUSIONS

This study shows that patient safety incident reporting is an established practice in health care, but research focused on systematic feedback and knowledge dissemination is still scarce. The most frequently studied methods of feedback and knowledge dissemination are meetings, written support and oral support. However, in addition to the need to identify incidents in hospitals, the dissemination of knowledge is crucial when developing patient safety practices. In the future, more attention must be paid to finding the most suitable and effective feedback and knowledge dissemination methods in hospitals. This requires a robust safety culture and sufficient competences of health care staff related to patient safety, but it also necessitates more research on the content and effectiveness of responding activities within such systems.

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## CONFLICTS OF INTEREST DISCLOSURE

The authors declare they have no conflicts of interest.

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