**Critical incident reporting in hospitals: a systematic review**

Studies summary

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| **Authors, Year, Country** | **Characteristics/Types of incidents** | **Consequences of incidences/ patient harm** | **Contributing factors** | **Reporter (who reports?)/**  **Incident rates (e.g., per 1000 patient days, report rate)** | **Actions taken (communication/ improvement cycle/ lessons learned)** |
| Tuttle et al.  2004, USA | Medication/ infusion 40%  Adverse clinical events 30%  Falls 24%  Administrative 5%  Other 1% | Unknown 8% not coded  Unsafe condition 6% A  Near miss 10% B  Reached patient, but no harm 54% C  Temporary harm 21% E  Permanent harm 1% G | Human 49%  Patient 25%  don’t know 11%  System 5%  Environmental 4%  Equipment 3%  others 3% | Nurse 69%  Administrative/ manager 13%  Pharmacist 3%  Licensed practical nurse 3%  Physician 2%  Nurse practitioner 1%  Other 9%/  2843 CIs among estimated 38,000 inpatients, 325,000 outpatients, 86,000 emergency patients annually *(0.6%)* | New measures with 13 examples e.g.:  -Product evaluation and education on use of electrosurgical units.  - Evaluation of disposable tracheostomy tubes  - Correct coding to distinguish faulty equipment from operator errors |
| Missbach-Kroll et al.  2005, Switzer-land | Medication 36% | Near miss 13% B  Reversible damage with partially Extended hospitalization 22% F  No consequence 66% C | Inattention 53%  Violation of rule 23%  Lack of communication 18%  Excess of work 11%  Faulty operation, wrong assessment, wrong indication 10%  misunderstanding 10%  mix-up 10%  others 18% | N.S./  424 CI of 24,320 inpatients *(1.7%)* | New measures with 8 examples e.g.:  - new labeling scheme for pharmaceuticals  - new labeling concept for drug cabinets |
| Nakajima et al.  2005, Japan | Medication 46.6%  Lines and tubes 19.9%  Falls and slips 13.7%  Therapeutics and procedures 3.3%  Clinical Laboratory tests 1.7%  Medical devices and equipment 1.6%  Meals 1.5%  Blood transfusion 1.4%  Radiology and endoscopy 1.3%  Surgery and anesthesia 0.8%  Patient or family complaints 0.8%  Exposure control 0.5%  Rehabilitation therapy 0.4%  Others 6.6% | N.S. | Clinical process and system 57%  Interservice communication 29.8%  Supervision 15.1%  Patient education 9.9%  Medical device and equipment management system 5%  Health information  management 3.4%  Patient management system 2.8%  Work load and shifts 2.1%  Hospital information system 1.9%  Work environment 1.9% | Nurse or midwife 84.7%  Physician 10.2%  Pharmacist 2.3%  Radiologist 0.8%  Lab technician 0.7%  Physical, occupational, or speech Therapist 0.6%  Administrator 0.4%  Dietician 0.1%  Others 0.4%  /N.S. | Improvement actions for high-risk issues, patient safety seminars, staff education e.g.  - Elimination of a ‘‘look alike’’ drug,  - Change in drug searching method for computer prescription  - Error detecting system for blood transfusion |
| Rose et al.  2005, Switzer-land | N.S. | No action necessary 53% B  Need for therapy / intervention 41% D  Severe or life-threatening condition has Occurred / or could have occurred 6% F | Human error 49.5%  Organization 24.9%  Infrastructure 10.8%  Technical difficulties 6.2%  Other 8.6% | N.S./  N.S. | 203 improvement measures |
| Ashcroft et al. 2006, United Kingdom | Administration 46.5%  Prescribing 38.8%  Dispensing or supply of Medication 14.7% | N.S. | N.S. | Pharmacists 51.9%  Nursing staff 37.6%  Doctors 9.1%  Others 0.4%  Not stated 1%/ *~ (0.7 medical CI per 1000 patient days* | N.S. |
| Choy et al. 2006, Malaysia | Prolonged stay 21.3%  Cardiac arrest 19%  Reintubation 11.5%  Cancelation of case 6.3%  Myocardial ischemia 6.3%  Fail intubation 5.2%  Airway injury 3.4%  Bronchospasm 3.4%  Medication error 3.4%  Adverse drug reaction 2.9%  Equipment failure 2.3%  Aspiration 1.1%  Misplaced blood form 0.6%  Blood transfusion error 0.6%  Unplanned to operation theater 0.6%  Adverse Tx 0.6%  Adverse outcome for procedure 0.6%  Unplanned return to operation theater 1.7%  Others 9.2% | N.S. | N.S. | N.S./  N.S. | N.S. |
| Huebler et al. 2005, Germany | Airway management 50.6% Infusion management 14.8% Cardiovascular system 12.4%  RA-catheter “single shot” Management 11.3%  Patient positioning 6.2%  Transfusion management 6.2% RA-catheter management 3.1%  Vascular puncture management 3.7%  Acid-base metabolism 1.9%  Allergic adverse reaction 0.6%  Haemostasis management 0.6%  Neurological adverse reaction 0% | N.S. | Work organization: e.g.,  Lack of experience 22.8%,  Loss of information 13%, Communication 11.1%, Supervision 8.6%,  Inaccessibility of staff 2.5%  Training deficits:  e.g., Misjudgment of the situation 26.5%,  Medication 21.6%  Insufficient education 17.3%,  Procedure/ algorithm 16.7%,  Difficult anatomical conditions 5.6%  Human factors: e.g.,  Lack of attention 42%  Shift organization 14.2% | N.S./  N.S. | New measures with examples e.g.,  - Mandatory marking of tube systems  - Mark of regional anesthesia catheters  - Checklist MRT |
| Milch et al. 2006, USA | Nonmedication-related clinical events 34% e.g., laboratory 34%, transfusion related 10%  Medication/infusion events 33% e.g., wrong dose 16%, omitted drug 16%  Falls 13%  Administrative events 13% e.g., discharge process 25%, documentation 13%  Others 6% | Near miss 12.5% B  No harm 67% B  Temporary harm 32% E (of which 4% resulted in major treatment F, Permanent or life-threatening harm 0.8% G), Death 0.4% I | N.S. | Registered nurse 47%  Pharmacist, pharmacy technician 16%  Laboratory technician 10%  Clerks/ secretary staff 10%  Licensed practical nurse, nursing assistant 3%  Physician 1.4%/ (9 to 95, median 35)  Medical errors and AEs per 1000 patient days,  *(Mean 36.3 medical errors and AE per 1000 inpatient days)*  a patient event occurred in approximately 10% of admissions | N.S. |
| Chacko et al. 2007, India | Line-related incidents 21.8%  Drug-related errors e.g., missed dose, wrong dose 15%  Dislodgements e.g., central venous catheters, chest drains 11.1% | No adverse outcome 88.6% C  Minor physiological change 6.4% D  Major physiological change 3.6% F  Death 1.4% I | N.S. | N.S./  34 incidents per 1000 patient days or 280 CI among 1918 admissions *(14.6%)* | Introduction of several new practices and new monitoring system |
| Grant et al. 2007, USA | Medication 39.2%  Laboratory 9.4%  Equipment 11.4%  Procedural problems 9.4%  Skin care/breakdown Patient 6.6%  Patient transit 1.5%  Isolation 0.9%  Patient identification 1%  Unplanned extubation 2.9%  Feeding problems 0.8%  Blood products 1.3%  Nosocomial infection 0.3%  Patient falls 0.2% | N.S. | N.S. | Registered nurse 64%  Nurse practitioner 9%  Physician 8%  Patient care technician 5%  Respiratory therapist 2%  Pharmacist 2%  Unknown 8%/  103 patient safety reports per 1000 PICU patient days and 54 traditional event reports per 1000 PICU patient days | N.S. |
| Nuckols et al. 2007 (study 1), USA | Medications 45.3%  Operations 18.5%  Therapeutic 9.7%  Diagnostic 9.6%  Miscellaneous 7.4%  Procedures 6.2%  Falls 1.5%  Anesthesia 1%  Neonatal 0.2 | No harm 0.8% B  Minor or moderate % C  Severe 1.9 F  Death 2.8 I  Unknown 16.5% not coded  Did not rate harm or injury 47.9% not coded | N.S. | Nurse 88%  Physician 1.9%  Other 8.9%  Unknown 1.3%/  17 incidents per 1000 patient-days | N.S. |
| Nuckols et al. 2008 (study 2), USA | N.S. | N.S. | Patient factors 32% e.g., illness 61%, behavior 24%  System factors 32% e.g., personnel management 52%, physical environment 49%, Task 24%  Provider factors 46% e.g., skill-based errors 52%, intentional violations 29%, rule- based mistakes 15%, knowledge-based mistakes 9.4% | N.S./  N.S. | N.S. |
| Hart et al. 2008, Germany | Medication >50%  Care and monitoring 25%  Diagnostics and invasive therapy 15% | No outcome 65% C  Minor outcome 26% D  Serious outcome/not foreseeable 9% F | Medication errors 35%  Breaches of regulations 24%  Communication 12%  Documentation 15%  Equipment/materials 4%  Organization 9%  Others 2% | Nurse 73%  Medical specialist 17%  Physician 10%/  N.S. | 10 General measures and 9 specific measures with examples e.g.  separate placement of confusion-prone drugs, training for new physicians and nursing staff |
| Rowin et al. 2008, USA | Adverse clinical 36.55% Medication/Infusion 29.22  Administrative 17.26%  Fall 12.83%  Others 4.15% | Unsafe environment 16.57% A  Near miss 12.07% B  No harm 47.73% C  Temporary harm 19.35% E  Permanent harm 3.69% F  Near death 0.24% H  Death 0.33% I | N.S. | Nurse 45.3%  Physician 1.1%  Other 53.6%/  36.5 reports per 1000 patient days | N.S. |
| Zingg et al. 2008, Switzer-land | Treatment 46%  Preventive e.g., failure to provide indicated prophylactic treatment 17.3%  Diagnostic 12.9%  Communication 9.4%  Equipment failure 2.9%  Other system failure 11.5% | No effect 13.7% B Transient effect, unnoticed by the patient 55.4% C  Transient, full recovery 29.5% E  Potentially permanent but no disabling damage 1.4% F  Potentially permanent disabling damage 14.4% G  Death 11.5% I | Task/technology factors 48.2% Team factors 43.2% Organizational/management factors 36.7%  Work environment factors 31.7%  Individual (staff) factors 28.1%  Patient factors 12.9%  Institutional context 2.2% | Nurse 82.7%  Physician 17.3%/  139 CIs among 9785 inpatients *(1.4%)*,  1 CI for every 70 patients treated,  1.6 CI reports per 1000 patient days. | N.S. |
| Levtzion-Korach et al. 2009, USA | Laboratory specimen/ test 30.4%  Medication/ IV safety 17.2%  Fall 10.9%  Blood/ blood product 10.2%  Surgery/ procedure 7.5%  Skin/tissue 5%  ID/documents/ consent 4.1%  Care/service coordination 3.1%  Environment 2.8%  Line/ tube 2.3%  Diagnostic/ test 1.9%  Diagnosis/ treatment 1.9% Adverse drug reaction 1.3%  Maternal/ childbirth 0.1%  Airway management 0.9% | Near misses 24% B  Event with no harm 60.7% C  Event with temporary harm 14.3% E  Events with permanent harm 0.4% G  Death 0.1% I | N.S. | Physician 2.9%/  19.7 reports per 1000 inpatient days,  0.09 reports per admission | New measures with 7 examples e.g., a nurse-to-nurse checkup for IV pump settings to the nursing handoff report, needleless IV access devices in use were easily unclamped, new emergency help call system was installed in the ED radiology suite |
| Reid et al. 2009, USA | Error related to procedures/ treatment/ test 30%  Medication error 26%  Fall 10%  Care coordination/ records 3%  Equipment/ supplies 3%  Adverse drug reaction 2%  Transfusion 2%  Behavior 2%  Skin integrity 2%  Other/ miscellaneous 14% | N.S. | N.S. | N.S./  25,300 error reports among 215,263 admissions (11.8%) | N.S. |
| Berghäus-er et al. 2010, Germany | Medication 60.6%  Technical errors 13%  Human errors 26.4% | No harm ca. 4% B  Could reach patient ca. 6% B  Reach patient, no harm ca. 71% C  Monitoring, no harm 15.9% D  Harm, no permanent damage 3.2% E | N.S. | Nurses 52.7%  Physician 26.6%  Undisclosed 20.7%/  3.8 reports per 1000 patient days | New measures e.g.,  standardized work instructions, new labeling of pharmaceuticals |
| Welters et al. 2011, United Kingdom | Equipment 30%  Clinical practice 22.8%  Pharmaceuticals 21.1%  Administration 18.9%  Health and safety hazards 7.2% | N.S. | N.S. | N.S./  N.S. | N.S. |
| Rakha et al. 2012, United Kingdom | Booking-related incidents 48.8% Machine/processing-relate 23.2%  Cytology-related 8.7%  Staff accident 7.2%  Specimen reporting 5.8%  Post mortem-related 2.1%  Communication 1.9%  MDT-related incidents 0.3%  Others 1.9% | Catastrophic 0%  Major 14.4% G  Moderate 26.2% E  Minor 49.5% C  Insignificant 9.9% B | N.S. | N.S./  N.S. | N.S. |
| Scharein et al. 2013, Switzer-land | Drug-related 63.3%  In the context of an intervention  10.7%  Mixing up patients 5.5%  In the context of chemo- or radiotherapy 5.5%  Bleeding complications 2.9% Problem of apparatus/computer 2.2%  In the context of a clinical trial 0.9%  Not categorizable 18.4% | N.S. | Human error 56.4%  Communication problems 25.7%  Documentation 15.4%  Stress/ multitasking/ diversion 14.5%  Machine and computer problems 6.1%  Shortage of staff 4.6%  Excessive labor/ tiredness 1.3%  Not categorizable 6.1% | N.S./  N.S. | N.S. |
| Wan et al. 2013, Singapore | Airway and respiratory events 69.7%  Cardiovascular events 9.4% Equipment-related events 7.3%  Pharmacological events 4%  Iatrogenic events 3.3% Procedural complications 3.1%  Metabolic events 0.6%  Neurological events 0.4%  Other events 1.5%  Death 0.4% | N.S. | N.S. | N.S./  2519 CI of 75,331 anesthetics (3.3%) | Critical incidents are discussed during regular departmental meetings e.g., change of pharmaceutical labels |
| Heideveld- Cheval-king et al. 2014, Nether-lands | Communication 27.2%  Equipment 22.8%  Treatment 17.9%  Others 13.5%  Medication and blood products 11%  Diagnostics 7.5% | Catastrophic 0.1% I  Very serious 3% G  Serious 7.3% E  Marginally serious 14.8% D  None 74.8% B | Human factors 68.2% e.g., SOP not followed 16.2, mistake/forgotten 15.4%, communication problem 11.5%  Organizational 23.1% e.g., SOP not available 5%, culture of workplace 2.6% high workload 2.6%  Technical 2% e.g., broken equipment 1.4%, wrong design 0.6%  Patient-related 2.9% e.g., patient condition 0.4%, patient behavior 0.4%  Others 3.7% | Anesthesia, operating room and recovery nurses 37%  Ward nurses 31%  Physician 17%  Administrative personnel 5%  Others 6%  Unmentioned 3%/  2563 CIs among 67,360 operations *(3.8%)* | N.S. |
| Huckels-Baumgart et al. 2014, Switzer-land | Medication errors 44.7% e.g.,  wrong dose/ strength or frequency 27.5%, omitted medicine or dose 16.9%, wrong dosage 14.6%, wrong drug 3.3%,  wrong formulation or presentation 10%, wrong patient 7.7% contraindication 4.2%,  wrong route 2.6%, wrong storage 1.2%, wrong dispensing label/ instruction 1.1%, adverse drug reaction 0.6%, expired medicine 0.3% | Circumstance or events that had capacity to cause error 0.3% A  Error did not reach patient 15.4% B  Error reached patient but caused no harm 75.6% C  Error reached patient and required monitoring to confirm no harm or intervention to preclude harm 8.8% D | Staff inattention 60.5%  Work conditions (heavy workload, time pressure, staff shortages, team composition) 31.4%  Lack of training (skills) 17.7% Communication problem (team, patient) 9.2%  Work environment (space, noise) 5.8% | N.S./  N.S. | New measures with 5 examples e.g., “four eyes principle” and “six rights” during medication administration, barcode–assisted medication administration |
| Härkänenet al. 2015, Finland | N.S. | No harm to patients 65.7% B  Mild harm 15.6% D  Moderate harm 2.4% E  Severe harm 0.3% E  Not known 16% (not coded) | N.S. | Registered nurses 82.6%  Practical nurses 6.6%  Pharmacists 5.4%  Physician 2.5%  Examination personnel 0.7%  Students 0.7%  Other professionals 1.5%  7.1 CI per 1000 patient days/  3 medical CIs per 1000 patient days | N.S. |
| Mansouri et al. 2015, USA | Diagnostic test orders 28%  Medication/ IV safety 17.6%  Service coordination 11.9%  ID/ documentation/ consent 11.7%  Adverse drug reaction 6.8%  Infection control 4.4%  Employee general incident 3.6%  Fall 3.5%  Safety/security/conduct 3.2%  Diagnosis/treatment 3.1%  Environmental/ equipment 2.4%  Line/tube 1.4%  Skin/tissue 0.7%  Surgery/procedure 0.2% | No harm – did not reach patient 46% B  No harm – did reach patient 36% C  Temporary or minor harm/ damage 18% E  Permanent or major harm/ damage 0% G  Death 0% I | N.S. | N.S./  1717 CIs from 881,194 emergency radiology examinations  (0.19%) | N.S. |
| Saito et al. 2015, Singapore | Airway problems 55.7%  Pharmacology problems 14.5%  Cardiac problems 14.2%  Anesthetic circuit 2.1%  Other equipment 6.6%  Other problems 6.9% | Death 2.1% I  Unplanned high dependency or intensive care unit admission 11.1% H  Major morbidity 5.8% G  Intermediate morbidity 5.8% E  Minor morbidity 23.8% E  No adverse final outcome 52.2% B | Sick patient 29.3%  Error of judgement 23.2%  Faulty technique 14.8%  Surgical team contribution 14.5%  Inadequate preoperative  assessment/preparation 6.9%  Distraction 6.1%  Communication problems 4.8%  Inexperience 4.5%  Failure to check equipment 3.2%  Haste 2.9%  Pressure to proceed 1.6%  Other factors 11.1% | N.S./  379 CIs among 44,915 anesthetics  (0,84%) | Measures and new regulations with examples e.g., implementation a pre-induction checklist, training with simulators for all trainees |
| Gottems et al. 2016, Brazil | Blood/ hemoderivative 50.2% Medical devices/ medical Equipment 16.3%  Patient accident 14.8% Intravenous medication fluid 10%  Clinical process/ procedure 5.3%  Clinical management 1% Infections associated to health care 0.5%  Behavior 0.5%  Documentation 0%  Nutrition 0%  Oxygen/ gas/ vapor 0%  Infrastructure/ building/ facilities 0%  Resources/ organizational management 0% | No damage 20.1% C  Slight damage 62.7% E  Moderate damage 14.3% E  Severe damage 2.9% G  Death 0% I | N.S. | Nurse 26.3%  Doctor 5.7%  Professional ombudsman 2.4%  Nursing technician 2.4%  Physiotherapist 1.4%  Pharmacist 1%  Not informed 60.8%/  N.S. | N.S. |
| Lee et al. 2016, South Korea | Respiratory 55.5%  Cardiovascular 26.2%  Pharmacological 7%  Equipment 6.1%  Others 5.2% | N.S. | Human factors (58.5%) | N.S./  229 CI among 49,373 cases (0.5%) | N.S. |
| Mansouri et al. 2016, USA | Diagnostic test orders 34.3%  Service 12.2%  Adverse drug reaction 10.3%  Medication/ IV safety 9.8%  ID/ documentation/ consent 7.2%  Safety/Security/ conduct 3.5%  Infection control 3.1%  Fall 3.0%  Surgery/ procedure 2.9%  Line/ tube 2.8%  Diagnosis/ treatment 2.4%  Environment/ equipment 2.3%  Skin/ tissue 1.3% | No harm – did not reach patient 48.5% B  No harm – did reach the patient 35.2% C  Temporary or minor harm/ damage 15.5% E  Permanent or major harm/ damage 0.6% G  Death 0.2% I | N.S. | N.S./  10,224 CI among 4,324,208 radiology examinations  (0.23%) | N.S. |
| Wagner et al. 2016, Nether-lands | Medication 29.1%  Material and equipment 14.6%  Collaboration between units 14.5%  Diagnosis and treatment 12.0%  Collaboration with (resident) physician 10.3%  Protocols and regulations 5.8%  Incorrect data and substitutions 5.5%  Others 8.2% | N.S. | Human 70.2 e.g., task planning and execution 36.9%, external 31.3%, Verification 13.4%  Organizational 17.3% e.g., external 31.7%, culture 19.8%, management priorities 19.2%  Technical 6.9%  Patient related/other 5.6% | N.S./  N.S. | N.S. |
| Askarian et al. 2017, Iran | Laboratory ≈ 33%  Patient care ≈ 32%  Medication ≈ 13%  Diagnosis and treatment ≈ 8%  Surgical and procedural ≈ 5%  Radiology ≈ 2%  Products and devices ≈ 2%  Physical environment ≈ 1%  Security ≈ 1% | No harm 67.8% B  Near misses 19.8% B  Harmful events 12.4% E  Disability or death 8% G and I | Negligent inattention 39.5%  Nursing care failure 17.8%  Lack of knowledge 11.5%  Insufficient physician care 9.8%  Fatigue 6.4%  Manpower deficiency 6.2%  Crowded departments 4%  Non-observance of principles of infection control 3.5%  Incorrect or delayed diagnosis 1.1%  Unavailability of shift physician 0.2% | Nurse 56.36%  Administrative personnel 6.77%  Personnel of pharmacy and medical equipment 1.69%  Student 1.55%  Physician 14.05%  Paraclinical staff 14.57%  Others 5%/  6 reports per 1000 inpatient days, 2.7 for every 100 admissions | N.S. |
| Kuper-sztych-Hagege et al. 2017, France | N.S. | No consequences 29.8% B  Transient harm 39.5% E  Injury 9.6% F  Suffering 9.6% F  Disease (without sequelae) 7.9% F  Disease (with sequelae) 0.9% G  Disability 0.9% G  Death 1.9% I | Human 42.3% e.g., experience 9.1%, error in planned action 7.7%  Technical 13.5% e.g., technical skill 8,2%  Organizational 13.9% e.g., system failure 10.1%  Environmental 26.4% e.g., patient background 22.6%  No factors identified 3.8% | N.S./  114 CI among 15,792 anesthesia procedures *(0.72%)* | N.S. |
| Luebke et al. 2017, Germany | N.S. | N.S. | Communication 22.8%  Personal factors 20.3%  Organization (personal/work load) 19%  Team factors (team work) 12.7%  Training 6.3%  Medication 5.1%  Technical equipment 5.1%  Context of the institution 3.8% | Physician 50.3%  Nurse 38%  Others 11.7%/  163 CIs in 4 years with estimated 21,000 outpatient and around 5,000 inpatient procedures *(0.14%)* | Introduction of 92 Standard Operating Procedures |
| Tricarico et al. 2017, Italy | General Adverse events 57.9%  Patient falls 25.5%  Medication Adverse events 16.6% | N.S. | N.S. | Nurse 52.7%  Physician 24.8%  Other 17.5%  Unknown 5% /  12.9 Incident reports per 1000 patient days | N.S. |
| Jamsa et al. 2018, Finland | Medication 37.4%  Information transfer and handling, communication 23.3%  Laboratory, imaging, or other tests 17.6%  Other treatment or monitoring 8.2%  Medical equipment 5.7%  Accident 4.5%  Others 4.1%  Violence 2.0%  Asepsis/hygiene 1.7%  Invasive procedure 1.4%  Surgical operation 1.1%  Diagnosis 0.7%  Radiotherapy 0.5%  Not known 0.2%  First aid environment 0.1% | Non-serious 98.9% C  Serious 1.1% F | Not known 25.3%  Handling of procedures 19.2%  Communication and information transfer 17.7%  No contributing factors, normal situation 13.9%  Environment, facilities, resources 11.3%  Training, orientation and skills 7.8%  Patient and relatives 4.3%  Medical device and equipment 3.9%  Teamwork 3.2%  Organization, management 0.8%  Medication 0.5% | Nurse 72.5%  Physician 5%  Undisclosed 22.5% /  N.S. | Procedures were updated and new guidelines created. Additionally, extra training was provided for the personnel or new equipment were purchased. |
| Ramirez et al. 2018, Spain | Surgical procedure 22.94%  Medication or vaccine 14.42%  Care and monitoring of the  patient 11.8%  Diagnostic test 7.01%  Therapeutic procedure 6.72% Continuity of care 5.84%  Other 5.11%  Infrastructure 4.67%  Medical device, equipment or furniture 3.94%  Organizational management/ citations 3.94%  Patient identification 3.8%  Clinical documentation/ information/informed consent 3.51%  Clinical evaluation/ diagnosis 2.19%  Patient accident 1.31%  Infection related to health care 1.17%  Preventive activities 1.02%  Blood and blood product 0.58% | Near miss:  Circumstances or events with the capacity to cause error 29.51% A  An error reached the patient, but caused no harm 24.96% C  An error occurred, but it is impossible to know the damage 14.61% B  An error that could have caused harm, but did not reach the patient 12.86% B  An error occurred that reached the patient and required monitoring to confirm that it resulted in no harm 8.07% D  AE:  The patient presented temporary injury that required medical intervention 6.05% F  Intervention has been required to maintain patient’s life 1.17% H  The patient has specified or prolonged hospitalization 1.17% F  The incident could have been related to the death of the patient 1.02% I  The patient presented permanent damage 0.58% G | Training and learning 37.22%  Organizational and strategic factors 28.55%  Task (protocols) 14.65%  Equipment and devices 12.41%  Communication between professionals 11.06%  Teamwork 8.67%  No factors were found 5.98%  Environment working conditions 4.04%  Patient factors 0.45%  Individual professional factors 0.3%  Others 0.3% | Nurse 63%  Physician 24%  Nursing assistant 5%  Medical resident 4%  Other 4%/  N.S. | 1635 improvement measures with examples. The mean of the improvement measures was 1.34 per patient safety incident, with 1774 related (contributing or latent) factors |
| Snyder et al. 2018, USA | Delay in care 33.9%  Infiltration 18.6%  Lack of communication 6.2%  Deviation from standard  procedure 4.6%  Incorrectly performed/ wrong test 3.5%  Adverse drug reaction 2.6%  Fall 2.2%  Safety policy violation 1.9%  Wrong patient 1.5%  Quality control issue 1.1%  MRI-metal object 1.0%  Outside study issue 0.5%  Wrong patient 0.2%  Wrong site 0.05% | N.S. | N.S. | N.S./  2,009 CIs among 1,071,809 imaging studies (0.19%) | N.S. |
| Wright et al. 2018, USA | Workflow events 96.2% e.g.  Informed consent events 16.5%  Simulation delays or process inefficiencies due to documentation or communication 18.2%  Deviations from specified treatment planning timelines 11.2%  Treatment machine timeout documentation 10%  Machine imaging errors 5% | N.S. | N.S. | Radiation therapist 64.5%  Physicist 22.1%  Dosimetrist 8.4%  Management staff 13.1%  Nurse 0.8%/  N.S. | N.S. |
| Aaronson et al. 2019, USA | Delay, e.g., Delay in treatment 18.4%  Medication 18.1%  Communication 14.7%  Laboratory, e.g., mislabeled specimen 6.7%  Falls 5.7%  Patient supervision/sitter 5.5%  Patient identification 3.6%  Precautions 3.5%  Misdiagnoses 2.7%  Equipment 2.3%  Blood products 2.3%  Disruptive patient behavior 2% Technical error 2%  Radiology related 1.6%  ED bed/monitor availability 1.6%  Staff safety 1.3%  Pain management 1.2% Environment 1.1%  Discharge process 1.1%  Interpreter services <1%  Skin Registration <1%  Safety culture/punitive response to error<1%  Lost records <1%  Dignity, treating with kindness <1%  Responsiveness (MD to other staff) <1%  Privacy <1%  Perceived lack of an MD/ role clarity <1% | N.S. | N.S. | Nurse 48.4%  Pharmacist 11.1%  Physicians 9.1%  Technologist 8.3%  Resident physician 6.7%  Manager 4.7%  Nurse practitioner 2.1%/  750 incidents among 108,436 ED visits (0.69%) | N.S. |
| Sendl-  hofer et al. 2019, Austria | N.S. | N.S. | Individual related reason 48% e.g.  disregarding guidelines and standards 19.1%,  lack of knowledge 18.8%,  lack of attention 11.9%  Organization/ team factor/ communication/ documentation 34% e.g., poor communication 26.1%,  deficient documentation 9.7%,  poor coordination 9.5%  Medical device associated reasons 10%, e.g., handling of medical devices 54.8%,  Insufficient introductory training 10.6%  Patient related reason 8% e.g.  very ill patients 35.8%,  acute change of illness 25.2%,  communication problems 11.3% | Nurse 57%  Physician 23%  Medical technical assistant  12%  Other 8%/  N.S. | N.S. |

\* = random samples size; *()* = calculated based on the raw numbers from the studies; N.S. = not stated