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# PATIENT SAFETY; INTERVENTIONS TO REDUCE HOSPITAL ERRORS

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## ABSTRACT

***Objective***: To evaluate practices regarding prevention of factors compromising patient safety such as drug errors, never events and critical incidence reporting.

***Study Design***: Cross-sectional study.

***Place and Duration of Study***: Armed Forces Institute of Ophthalmology, Rawalpindi, from Dec 2019 to Apr 2020.

***Methodology***: Methodology constituted of a paper-based and web-based questionnaire. A pilot study carried out at 15-20 participants for questionnaire validation and reviewed by independent experts for face validity, a final questionnaire comprised of 26 multiple-choice questions. The minimum sample size required for the study was 383, where the prevalence of medical errors related to surgery and anaesthesia was considered to be 48%.

***Results***: Total 1470 participants participated in the study and data was extracted from their responses. Out of 1470, 814 (55.4%) were anaesthesiologists while 656 (44.6%) were surgeons. Majority of the participants 1308 (89.0%), declared that critical incident reporting will improve patient safety standards, and 650 (44.2%) participants said that the most common reason for committing drug errors is a heavy workload and long working hours. The most common reason for not reporting the critical incidents was identified by 650 (44.2%) participants to be related to fear of medico-legal issue, followed by an unwillingness to reveal the details 328 (22.3%), fear of judgment by colleagues 246 (16.7%) and lastly lack of clarity regarding reporting channel 246 (16.7%). 100% identified close loop communication will mitigate preventable errors.

***Conclusion***: Effective communication among team members will prevent drug errors and never events, therefore ultimately improving patient safety. Critical incidence reporting will effectively mitigate their harmful effects on patients and healthcare workers.

**Keywords**: Critical incidence reporting, Drug errors, Surgical never events.



## INTRODUCTION

Patient Safety culture involves a constellation of measures such as preventionof adverse drug reactions, elimination surgical never events and critical incident reporting system. It is the backbone of constant endeavoursin quality assurance of healthcare facilities. Clinician's practices are accountable for patient safety therefore alleviate morbidity and mortality[1].

National Patient Safety Foundation(NPSP), Safe Practice and Agency for Healthcare Research and Quality (AHRQ) Patient Safety Net established to ensure safe clinical practices indexing more than 5665 articles, facts and figures struggle to ameliorate patient safety[2].

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Patient safety culture is defined as the organization's standing operating procedures related in particular to members of organization and teamwork in terms of their attitude, belief and perceptions towards subject[3]. A multi-faceted approach is required to harmonize reduction in drug errors, minimizing surgical never events, the establishment of critical incident reporting system and implementation of the World Health Organization (WHO) surgical safety checklist[4].

Ancient Mesopotamian Code first mentioned surgical errors adverse resultsin 1795–1750 BC. Hippocratic oath 'First not harm' is the leading principle of medical practice[5]. Institute of Medicine (IOM) of United States of America (USA) published a report with the title. To Err Is Human: Building a Safer Health System' in the year 2000 stating that each year due to medical errors 44,000-98,000 and over 1 million injuries

occur in American hospitals, therefore, making it among top 10 rated causes of deaths[6]. In the year 2001 National Quality Forum (NQF), US health organization defined 'never events' as medical care errors that can be easily identified, prevented andcan result in hazardous consequences on patients. In year, 2011 divided them into sevencategories, which constitutes of twenty-nine events. Few to quote are medication errors, surgery performed on the wrong body part, retained foreign objects, intraoperative or in immediate postoperative period death of an American Society of Anaesthesiologist's (ASA) I patient etc[7].

World Health Organization (WHO) in the year 2009 issued uniform guidelines to ensure patient safety as a global challenge with the slogan 'Safe Surgery Saves Lives', Surgical Safety Checklist illustrated in figure[8].

Drug errors proved it to be a leading cause of mortality and morbidity, each year 180,000 patients in the USA die due to medication and medical errors making it even more than vehicle accidents accounting for 450009.

Errors are broadly attributable to human malpractice, poor team communication, system or administrative fault, or equipment malfunction. Irrespective of the reason, consequences could be hard even claiming the precious life of the patient. In 2013, Surgical never events report published which enumerated, 4082 cases each year claim for a financial settlement in the United States of America (USA), therefore, galvanize exhaustion of billions of dollars[10].

Our research was based on the fact that hospitals have a paucity of critical incident reporting system. Moreover, we wanted to gauge practices followed in our hospitals to attenuate preventable errors in operation theatres and surgical setups.

## METHODOLOGY

This cross-sectional study was carried out at Armed Forces Institute of Ophthalmology (AFIO) from December 2019 to April 2020, approval was takenfrom the ethics research committee of the Institute (ERC Number–230/ERC/AFIO).

Methodology constituted of a paper-based and web-based questionnaire devised by relevant studies on the subject. A pilot study carried out at 15-20 participants for questionnaire validation and reviewed by independent experts for face validity. After modification according to feedback, the final questionnaire comprised of 26 multiple-choice questions (MCQs). The minimum sample size required for this cross-sectional study was 383, calculated by using formula (n=z2 (p) (1-p)/α2), where the prevalence of medical errors related to surgery and anaesthesia was considered to be 48% as reported by Saravi *et al*[11]. A non-probability convenience sampling methodology was employed and the questionnaire was distributed among (n=1470) participants. We included practitioners in the field of anaesthesia and surgery (general surgery, ophthalmology, gynaecology & obstetrics). We excluded clinicians in

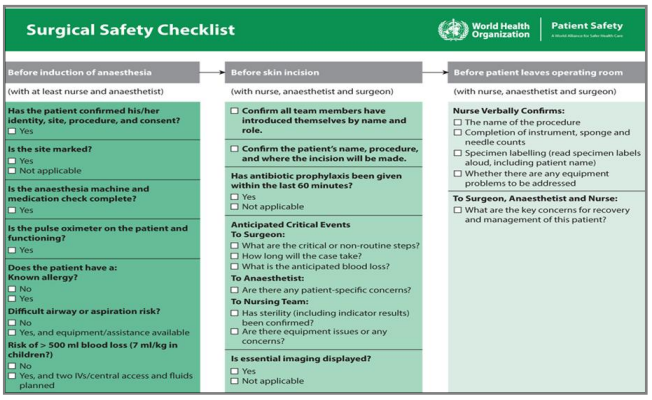


**Figure: WHO Surgical safety checklist[8].**

medicine and allied specialities, medical students and house officers. Questions were included to analyze demographic profile such asage, gender, profession, work experience. We determined about loading of drugs, drawing & labelling of drugs (label first and loadrelevant drug or load drug and then label), whether the hospital has the practice of labelled syringes with colour coding as per guidelines, the possibility of reducing drug errors by colour-coded syringe labels and double-checking of drugs before giving to patients and whether drug administration carried out by relevant anaesthetist would reduce drug errors. Experience of drug error or major morbidities (focal neurological deficit, cardiac failure etc) and

causative factors for drug errors. All cases of wrong-site/side surgery, wrong procedure, wrong implant, and unintended retained foreign object after surgery or other invasive procedure such as central line considered as never events. Therefore, we inquired participants about the experience of never events in clinical practice and particularly which part of the day, skill and patient-based factorsplaying a major role in the advent of never events, the influence of inadequate standard operating organizational procedureson frequency of never events. Third section addressed mode of critical incidents reporting system, frequency of departmental audit and discussion sessions for the critical incidents, the requirement of national critical incident reporting registry for never events and the most common reason behind not reporting drug errors and never events by professionals. Preventive measures suggested were mandatory critical incident reporting system, reduction of working hours and number of night shifts, World Health Organization (WHO) Safety checklist execution feasibility and close loop communication between team members particularly anaesthetic and surgical team with expectation to upgrade patient safety standards.

Data was entered and analysed by using software SPSS-23. The descriptive statistics of continuous variables were presented as mean and standard deviation, while for categorical data frequencies and percentages were used. Categorical grouped data was analyzed by either chi-square test. A *p*-value ≤0.05 was considered to be statistically significant.

## RESULTS

Total 1470 participants participated in the study and data was extracted from their responses. There were 896 (61.0%) males and 574 (39%) females in the study group, out of which 1227 (83.5%) belonged to the age group of 25-50 years while 243 (16.5%) had more than 50 years of age. Out of 1470, 814 (55.4%) were anesthesiologists while 656 (44.6%) were surgeons, majority of whom 978 (66.5%) had a working of less than five

**Table-I: Summary of responses related to drug errors (n=1470).**

| Study Questions | Responses n (%) |
|---|---|
| **Who usually load anaesthetic drugs into the syringe in your hospital?** | |
| Nursing Assistant | 1227 (83.5) |
| Junior resident | 81 (5.5) |
| Consultant | 162 (11) |
| **How do you draw the drug into the syringe?** | |
| Label syringes first and then withdraw drug | 896 (61) |
| Withdraw drug first and then label syringes | 574 (39) |
| **Does your hospital follows the practice of using colour-coded labels for syringes?** | |
| Yes | 1146 (78) |
| No | 324 (22) |
| **Do you think colour coding of syringe labels reduces drug errors?** | |
| Yes | 1308 (89) |
| May be | 162 (11) |
| No | - |
| **Do you think double-checking of medications before administration would decrease drug errors?** | |
| Yes | 1470 (100) |
| May be | - |
| No | - |
| **Do you think loading and administration of the drugs by the concerned anaesthetist would reduce drug errors?** | |
| Yes | 1306 (88.8) |
| No | 82 (5.6) |
| May be | 82 (5.6) |
| **Have you ever encountered drug administration error in your practice, if yes when you experienced?** | |
| Daytime working hours | 650 (44.2) |
| Night duties | 328 (22.3) |
| Not related to time off work | 328 (22.3) |
| Not Experienced Drug Error | 164 (11.2) |
| **Have you experienced any major morbidities in your patient (cardiac arrest, permanent neurological damage, etc.) due to drug errors?** | |
| Yes | 1224 (83.3) |
| No | 246 (16.7) |
| **In your opinion, select the factor which you think play a major role in causing drug errors** | |
| Inadequate practical experience | - |
| Inadequate familiarity with drug/dosing | 410 (27.9) |
| Poor labelling | 410 (27.9) |
| Heavy workload/long hours | 650 (44.2) |

years, while 328 (22.3%), 82 (5.6%) and 82 (5.6%) had working experience of 5-10, 10-20 and more than 20 years.

Related to drug errors, most of the participants 1227 (83.5%) reported that nursing assistant is responsible for loading the anaesthetic drug into the syringes at their hospitals. Almost 896 (61.0%) participants said that the syringes should be labelled first and then filled with the drug. It was reported by 1146 (78%) responders that no colour-coded labels are being used at their respective hospitals, and around 1308 (89%) thought that using colour-coded syringe labels reduces the chances of drug errors. Majority of the responders, 1306 (88.8%) said that if the drug is loaded and administered by the anaesthetist would sufficiently reduce the occurrence of drug errors. Almost 1224 (83.3%) participants declared that they have experienced major morbidities including cardiac arrest and permanent neurological damage etc in their patients associated to drug errors, and 650 (44.2%) participants said that the most common reason for committing drug errors is a heavy workload and long working hours as shown in table-I.

Regarding never events, 896 (61%) stated that they have not experienced surgical never events, while 328 (22.3%) of those who had experienced never events said that they have experienced such events during the night duties and 246 (16.7%) said that occurrence of never event is not related to the time of the work. The most common factor causing never event was said to be workload [409 (27.8%)], followed by inappropriately planned operations [405 (27.6%)], poor communication among team members [328 (22.3%)], inadequate supervision [164 (11.2%)], emergency situation [82 (5.6%)] and chaotic workplace [82 (5.6%)]. Safety checklist error is the most commonly reported by 814 (55.4%) skill-based error responsible for the occurrence of never events. The most common patient factor associated with never event was reported to be inadequate patient preparation 486 (33.1%), followed by less common factors including failure to assess/monitor patient 410 (27.9%) and inadequate documentation 328 (22.3%), while least commonly reported patient factor was failure to follow standard of care 246 (16.7%) as shown in table-II.

**Table-II: Summary of study results for never events (n=1470).**

| Study Questions | Responses n (%) |
|---|---|
| **Have you ever encountered surgical never event in your practice, if yes when you experienced?** | |
| Daytime working hours | - |
| Night duties | 328 (22.3) |
| Not related time off work | 246 (16.7) |
| Not Experienced 'Never Event' | 896 (61) |
| **In your opinion, which factor do you think play a major role in causing never events** | |
| Inadequate supervision | 164 (11.2) |
| Inappropriate planned operations | 405 (27.6) |
| Failure to address known problem | - |
| Poor team communication | 328 (22.3) |
| Chaotic workplace | 82 (5.6) |
| Heavy workload/long hours | 409 (27.8) |
| Emergency Situation | 82 (5.6) |
| **What are Skill based errors responsible for never events?** | |
| Safety Checklist error | 814 (55.4) |
| Inappropriate Technique | 82 (5.6) |
| Lack of equipment compliance | - |
| Failure to prioritize tasks | 574 (39) |
| **Patient-Related Factors responsible for never events?** | |
| Inadequate documentation | 328 (22.3) |
| Failure to follow standard of care | 246 (16.7) |
| Inadequate Patient Preparation | 486 (33.1) |
| Failure to assess and monitor patient | 410 (27.9) |
| **Do you think the absence of standard operating procedures of an organization influence the frequency of never events?** | |
| Yes | 1389 (94.5) |
| May be | 81 (5.5) |
| No | - |

The most efficient way of communicating the critical incident was reported by 1224 (83.3%) participants to be conveyed to a senior consultant rather than using the hospital critical incident reporting system. Majority of the participants 487 (33.1%) said that a monthly audit is conducted by their departments related to critical incidents, while 246 (16.7%) declared that no such audits are conducted at their hospitals. The most common

reason for not reporting the critical incidents was identified by 650 (44.2%) participants to be related to fear of medico-legal issue, followed by an unwillingness to reveal the details 328 (22.3%), fear of judgment by colleagues 246 (16.7%) and lastly lack of clarity regarding reporting channel 246 (16.7%). It was agreed by 1308 (89%) of the participants that reporting of critical incidents will help in improving patient safety as shown in table-IV.

**Table-III: Summary of study results for critical incidence reporting (n=1470).**

| Study Questions | Responses n (%) |
|---|---|
| **Mode of reporting a drug error and surgical never event** | |
| Hospital Critical Incident Reporting System | 246 (16.7) |
| Report to a senior consultant in the hospital | 1224 (83.3) |
| Anonymous entry of critical incidents into a computer or register | - |
| **How often does you/your department audit and have discussion sessions for the critical incident?** | |
| Monthly | 487 (33.1) |
| Once in 3 months | 328 (22.3) |
| Once in 6 months | 409 (27.8) |
| Never | 246 (16.7) |
| **Is it important to have a national critical incident reporting registry for never events?** | |
| Yes | 1146 (78) |
| May be | 324 (22) |
| No | - |
| **In your opinion, what do you think is the most common reason behind not reporting drug errors and never events by professionals?** | |
| Lack of clarity regarding Reporting Channel | 246 (16.7) |
| Fear of medico-legal issues | 650 (44.2) |
| Unwillingness to reveal details | 328 (22.3) |
| Fear for judgment by colleagues | 246 (16.7) |
| **Do you think critical incidents reporting will help us improve patient safety?** | |
| Yes | 1308 (89) |
| May be | 162 (11) |
| No | - |

The most effective preventive measure that can be taken to reduce the occurrence of medical errors was reported to be ensuring close loop communication/cordial working environment among team members [1470 (100%)], followed by reducing working hours/night shifts [1389 (94.5%)], and practising WHO safety checklist [814 (55.4%)] as given in table-IV.

**Table-IV: Summary of study results for preventive measures (n=1470).**

| Study Questions | Responses n (%) |
|---|---|
| **Reducing daytime working hours and number of night shifts would reduce never events** | |
| Yes | 1389 (94.5) |
| May be | 81 (5.5) |
| No | - |
| **Whether WHO Safety checklist can be Practiced on every case, keeping in view your hospital workload** | |
| Yes | 814 (55.4) |
| May be | 246 (16.7) |
| No | 410 (27.9) |
| **Do you think close loop communication and cordial working environment among team members will improve patient safety standards?** | |
| Yes | 1470 (100) |

Participants who are experiencing colour-coded syringe practices in their hospitals, more strongly believe that such practices can prevent drug errors as compared to those who are not experiencing such practices at their institutes ($p$<0.001) as shown in table-V.

Participants who have never experienced any drug error thought that the workload [650 (100%)] can be the only factor responsible for the occurrence of such errors, but in real terms, participants who have experienced especially during daytime and night time declares inadequate familiarity with drugs/doses [(328(100%)] and poor labelling [(164 (100%)] to be the cause of such events respectively as shown in table-V. Whereas participants who have experienced drug errors irrespective of time, reported inadequate familiarity with drug/doses [82 (25.0%)] and poor labelling [246 (75.0%)] to be the most significant cause ($p$<0.001).

Majority of the participants [1063 (86.6%)] who reported that nursing assistant was responsible for loading/administering the drug at their hospital believe that drug errors can be reduced if the anesthesiologist himself administer the drug

to a patient, while 82 (6.7%) of them believes that this practice would not reduce drug errors and 82 (6.7%) were sceptical about it. Whereas all of the participants who reported that junior resident and consultant [81 (100%) and 162 (100%) respectively] at their hospital were responsible for drug loading/administration, believed that same job if done by anaesthetist himself will reduce the occurrence of drug errors ($p$<0.001) as shown in table-V.

tion in working hours and night shifts will improve patient safety (94.5%).

This survey provided a window of opportunity to endorseour imperfections, besides this communication helped us with attitude, perceptions and rectifications. Patient safety in operation theatreis an emblem of anaesthetic and surgical teams. Comprehensive set of universal guidelines can minimize preventable errors[12,13,14].

Third world countries are unable to over-

**Table-V: Correlation between colour-code practices and believe that it can prevent drug errors.**

| | | Do you think colour coding of syringe labels reduces drug errors? | | *p*-value |
|---|---|---|---|---|
| | | Yes | May be | |
| **Does your hospital follows the practice of using colour-coded labels for syringes?** | Yes | 11146 (87.6%) | - | <0.001 |
| | No | 162 (12.4%) | 162 (100%) | |

**Table-VI: Correlation between drug-error encounter with factors causing drug errors.**

| | | Factor which you think play a major role in causing drug errors | | | *p*-value |
|---|---|---|---|---|---|
| | | Workload | Inadequate familiarity with drugs | Poor labelling | |
| **Ever encountered drug error in your practice, if yes when you experienced?** | Never | 650 (100%) | - | - | <0.001 |
| | At daytime | - | 328 (100%) | - | |
| | At night time | - | - | 164 (100%) | |
| | Not related to work time | - | 82 (25.0%) | 246 (75.0%) | |

**Table-VII: Correlation between current drug loading practice and perception that drug errors will be reduced if anaesthetist load/administer drug himself.**

| | | Loading and administration of the drugs by the concerned anaesthetist would reduce drug errors | | | *p*-value |
|---|---|---|---|---|---|
| | | Yes | May Be | No | |
| **Who load anaesthetic drugs into the syringe at your hospital?** | Nursing Assistant | 1063 (86.6%) | 82 (6.7%) | 82 (6.7%) | <0.001 |
| | Junior Resident | 81 (100%) | - | - | |
| | Consultant | 162 (100%) | - | - | |

## DISCUSSION

Data analysis of our studydemonstrated that critical incident reporting system will reduce preventable drug errors and surgical never events (89%) furthermore close loop communication and peer support (100%) will enhance patient safety. World Health Organization (WHO) Surgical Safety checklist is partially implemented (55.4%) in our hospitals due to overburden therefore compromising patient safety, accordingly reduc-

come the dilemma of safe basic health necessities resultantly the critical subject of patient safety is tumbledown. Therefore the first step is acclimatization and awareness. National Patient Safety Foundation updated its recommendations regarding prevention of harm by learning from our mistakes and never events[15,16].

Bandari *et al*, in their study recommended briefing and debriefing culture in the operating room which involves the introduction, discussion of surgical plan and sharing of patient detail. The

teams recognized a total of 6,202 defects (average of 141 defects per month) during the entire study period. 1,265 (46%) surfaced during briefings, and the remaining 1,495 (54%) during debriefings. Communication issues (31%) were the most prominent. (87%) respondentsagreed that briefings were effective for surfacing defects, (76%) participants agreed upon debriefings. As per results, 100% of participants believed that a closed-loop communication and cordial chemistry between team members can assemble desirable results[16].

Yee *et al* analyzed medication errors in anaesthetic practice. As per study results, 85% of the participants had experienced drug errors though the majority were of minor consequence (98%) whereas major morbidity and mortality was experienced by 2%. "Syringe swaps" (70.4%) and label mis-identification (46.8%) were commonest therefore 84% believed that drug labels would decrease incidence, when compared with our results (89%) respondents agreed that drug labels will reduce errors and (27.9%) attributed poor labelling for drug errors[17].

Evans *et al,* in a collaborative hospital study evaluated attitudes and barriers to incident reporting. (37.9%) did not have clarity of reporting channel, (20.7%) and (8.3%) were scared of litigation and penalization respectively. (13.8%) were afraid of being judged by co-workers, this fear was recorded more among junior staff (31.0%) furthermore (22.6%) had apprehension data will not be kept anonymous as they were not willing to reveal details. Similar barriers were assessed in our participants, (16.7%) had access to Hospital Critical Incident Reporting System. Reasons which refrain from reporting were lack of clarity regarding Reporting Channel (16.7%), (44.2%) said fear of medico-legal issues, (22.3%) were unwilling to reveal details, and (16.7%) hadfear for judgment by colleagues[18].

A working group from the Austrian Society for Quality and Safety in Healthcare (ASQS) surveyed Critical Incident reporting system (CIRS). Three hundred seventy-one health care professionals from 274 health care facilities were enrolled. (64.1%) of the respondents indicated that CIRS was used health care facility, however in our study only (16.7%) used CIRS depicting lack of progression[19].

Cooper *et al*, determined a drug error rate during anaesthesia of 0.49% (1 per 203 anaesthetics) and further elaborated a two-fold rise in the rates by residents compared to experienced provider, most commonly due to incorrect dose and drug substitution. In our set up (88.8%) were of opinion that drug administration by concerned anaesthetist will reduce errors, however (83.5%) affirmed that nursing assistants load and administer drugs, therefore, increasing propensity of drug errors several folds[20].

Stergiopoulos *et al*, scrutinized adverse event reporting practices among US health care professionals. Reasons declared were poor integration of adverse event systems (53%) and uncertainty about reporting procedures (52%). In our review (16.7%) highlighted similar issue[21].

Patient Safety is to work in collaboration, as deemed by (100%) participants in our study. Patient does not belong to one department or speciality, obviously, at the end of the day, we all burn out to save 'Our Patients'. An immediate step which will not involve the consumption of significant resources is the establishment of mandatory 'critical incident reporting system (CIRS)'. A surveillance organization on the pattern of developed countries such as the Agency for Healthcare Research and Quality (AHRQ) of the USA should be established on patient safety indicators based on hospital data.

Surgeon and Anaesthetists must accept the inherent issues in their roles that contribute to the error-prone environment and take lead to bring attention to the avoidable reason of patients agony.

## CONCLUSION

Effective communication related to medical errors may encourage self-reliance and ultimately improve patient safety. Reporting of errors

effectively mitigates their harmful effects on patients and healthcare workers. Finest practitioner is liable to commit errors, therefore, every professional should be motivated to provide peer support. A culture to promote self-accountability should be cultivated to achieve-durable outcome.

## CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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