A multi-method exploration of surgical incidents in UK context: causes, impact, support, and learning.

NARESH SEROU

Mr. Naresh Serou

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Abstract

Introduction: Surgical incidents are events that occur during a surgical or invasive procedure in an operating theatre. When an incident happens, priority is rightly given to supporting the patient and their family. These incidents can also have a profound negative impact on the healthcare professionals involved.

Aim: The overall aim of this PhD programme of work was to explore the impact of surgical incidents on operating theatre staff, what factors might have contributed to their occurrence, and how staff could be better supported following such events.

Methods: The thesis is comprised of four stages. The researcher conducted a systematic review of the of the psychological, emotional, and behavioural impacts of surgical incidents on operating theatre staff *(stage one)*. A second systematic review was carried out to explore what practical tools might help teams deconstruct and learn from safety incidents in various high reliability organisations and whether those tools could be adapted for use in the healthcare system *(stage two)*. The researcher also conducted a retrospective review of surgical incidents to identify what factors might have contributed to the occurrence of serious surgical incidents at a large London NHS Trust *(stage three)*. The researcher then conducted the first qualitative study in the UK to explore the personal, professional, and behavioural impact of surgical incidents on operating theatre staff (both medical and non-medical) and how they could be better supported following a surgical event *(stage four).*

Results: The researcher found a significant knowledge gap around what structured support systems were currently in place to support theatre staff involved in surgical incidents *(stage one)*. The second systematic review *(stage two)* revealed how high reliability organisations such as aviation and military use various learning tools such as debriefing, simulation, crew resource management and reporting systems to disseminate safety messages to their staff. The researcher found the following factors, including the task, equipment and resources, teamwork, work environmental, and organisational and management, contributed to the occurrence of surgical incidents *(stage three)*. Theatre protocols were also found to be either unavailable, outdated, or not followed correctly. The lack of effective communication within multidisciplinary teams, and inadequate medical staffing levels were perceived to have also contributed. The researcher conducted 45 interviews with medical and non-medical operating staff *(stage four)*, who emphasised the importance of receiving personalised support soon

after the incident. Theatre staff described how the first “go to” person was their peers and reported feeling comforted when their peers empathised with their own experience(s). Other participants found it very difficult to receive support, perceiving it as a sign of weakness. Although family members played an important role in supporting second victims, some participants felt unable to discuss the incident with them, fearing that they might not understand. This study further highlighted unfairness during the investigation process in the treatment of non-medical theatre staff.

Discussion and Conclusion: This study revealed the need for clear support structures to be put in place for theatre staff who have been involved in surgical incidents. Healthcare organisations need to offer timely support to front-line staff following these incidents. They need to encourage multidisciplinary team investigation process to promote fairness and transparency. Senior clinicians should be proactive in offering support to junior colleagues and empathise with their own experiences, thus shifting the competitive culture to one of openness and support. Healthcare organisations should find ways to adapt the learning tools or initiatives used in high reliability organisations following safety incidents. However, the way these tools or initiatives are implemented is critical and so further work is needed to explore how to successfully embed them into healthcare organisations.

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By

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Submitted for the degree of Doctor of Philosophy to

Durham University, School of Medicine, Pharmacy and Health

2022

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List of Illustrations

List of Abbreviations

AAR	After Action Review
ASA	American Society of Anaesthesiologists
ASTM	Association for Computing Machinery database or the American Society for Testing and Materials
CASP	Critical Appraisal Skills Programme
CCGs	Clinical Commission Groups
CRM	Crew Resource Management
CQC	Care Quality Commission
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CISD	Critical Incident Stress Debriefing
ENT	Ear, Nose, and Throat
HDU	High Dependency Unit
HROs	High Reliability Organisations
HSIB	Healthcare Safety Investigation Branch
ICBs	Integrated Care Boards
IHI	Institute for Healthcare Improvement
ITU	Intensive Care Unit
MeSH	Medical Subject Headings
MITSS	Medically Induced Trauma Support Services

M&M	Mortality and Morbidity
NHS	National Health Service
NOTTS	Non-Technical Skills for Surgeons
NPSA	National Patient Safety Agency
NRLS	National Reporting and Learning Systems
ODP	Operating Department Practitioner
PRISMA-P	Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols
PSIRF	Patient Safety Incident Response Framework
PSTRC	Patient Safety Translation Research Centre
REX	Retour d'Experiences
RISE	Resilience in Stressful Events
SAFRON	Safety Reporting and Learning System for Radiotherapy
SVEST	Second Victim Experience and Support Tool
SSC	Surgical Safety Checklist
StEIS	Strategic Executive Information System
UK	United Kingdom
USA	United States of America
WHO	World Health Organisation

Declaration

This PhD work has not been previously submitted for a degree and is not based on joint research.

Statement of Copyright

Acknowledgements

The researcher would like to recognise and express my appreciation to the many people who have given me their support, guidance, and time both at an academic and personal level, over the course of my PhD.

Firstly, the researcher extremely and forever grateful to my supervisors, Prof. Sarah P. Slight, Prof. Andrew K. Husband, Prof. Simon P. Forrest, and Dr. Robert D. Slight. Since starting this journey in January 2016, you have provided me with focus, support, guidance and prospects to learn new skills, all of which helped me to grow as a researcher. It was truly an amazing experience working with you all and the researcher have learnt so much from your constant constructive feedback and advice. The researcher is thankful for every moment you have spent helping me from the monthly meetings, 1:1 telephone conversation and answering my queries out-of-hours. Without your support my determination to accomplish a PhD would not have been possible.

The researcher is also hugely thankful to my internal supervisor Dr. Krishna Moorthy, Consultant Bariatric Surgeon, Ms Kim Brown, Lead Theatre Nurse, Imperial College Healthcare NHS trust, Roger King, Michelle Groves and Edwina Morris, Senior lecturers, and Professional leads in University of West London for their mentorship, encouragement and assistance offered to me during my PhD.

Researcher would also like to thank Dr. Adam Todd, Dr. Helen Close and Dr. Hamde Nazar for acting as my internal examiners and giving a critical and constructive review of researcher's work at various stages of my PhD. Furthermore, researcher cannot thank enough Dr. Clare Tolley, ex PhD Durham student for her continuous guidance, advise and friendship during this journey.

And, of course, researcher wish to express his gratitude to all surgeons, anaesthetists, theatre nurses, operating department practitioners, theatre support workers who participated in interviews, allowing him to gather a deeper understanding of their experiences following

surgical incidents. Researcher have also been fortunate enough to have worked alongside Lauren M Sahota, pharmacy undergraduate student at Newcastle University in 2016 and 2018 who assisted me in reviewing papers and contributed to the two published systematic reviews.

Researcher is blessed to be surrounded by amazing family members including my parents, grandparents, brother and sister-in-law, and I will be forever grateful for your love. Above all, researchedr would like to thank my wonderful wife Pujitha for her everlasting love and support and his boys Saranveer and Taranveer, who were very understanding while he is doing his PhD work. Researcher would like to apologise for the occasions when he was not able to spend time with them, but he will certainly make it up.

And finally, he would like to thank Lord Sai Baba for his endless blessings, which helped him to cross numerous hurdles along this incredible journey.

Dedication

The researcher dedicates this thesis to his parents Zayasankar and Mangamani, and his wife Pujitha and kids Saranveer and Taranveer. Without their staunch support over the years this PhD would not have been possible. Researcher would also like to spare a thought for his fellow healthcare professionals and friends who sacrificed their lives and families during the COVID pandemic.

About the Author

Naresh Serou, the researcher, graduated from Queen Mary University of London with an undergraduate degree in Biomedical Sciences. He then completed his Diploma in Higher education in Operating Department Practice in London Southbank University. Following that, he worked in operating theatres in major trauma centres in London from 2007, including Barts Health NHS trust, Kings College Hospital NHS Foundation Trust and Imperial College Healthcare NHS trust. At these NHS Trusts, Naresh worked in a number of different roles, including a registered Operating Department Practitioner (ODP), team leader, Anaesthetic and Recovery Co-ordinator, Senior Clinical Practice Educator and Clinical Lead in operating theatres. Alongside these roles, he also worked as an educator, including Clinical skills and Simulation tutor in Kings Medical School (2014-2016) and Lecturer in Perioperative Practice and ODP in University of West London (2016-2019). Naresh completed a Masters in Surgical Technology in 2012, at Imperial College London with a Merit, Postgraduate certificate in Clinical Education (PGCE), and successfully achieved his Fellowship in Higher Education Academy (FHEA) in 2018. Naresh also worked at the Patient Safety Translation Research centre at Imperial College London from January 2018-September 2019 as a Health Services Researcher and was involved in various medication safety and Digital Health projects under the guidance of Professor Bryony Dean Franklin. Naresh began his part-time PhD in January 2016 and published five articles in international peer-reviewed journals, presented his work at both national and international conferences, including the International Quality and Safety Conference in London 2017 and Amsterdam 2018.

Publications

Sections of below published articles are used in Chapter 1 , Chapter 2 , Chapter 3 , Chapter 4, Chapter 6, and Chapter 7, to which the researcher (PhD student) is the first author and contributed to all sections of the published articles with the contribution from fellow authors (PhD supervisory team)

1) Serou N, Husband AK, Forrest SP, Slight RD, Slight SP. Support for healthcare professionals after surgical patient safety incidents: A qualitative descriptive study in 5 teaching hospitals. *Journal of Patient Safety*. 2021; *17*(5): 335–340. https://doi.org/10.1097/pts.0000000000000844.
2) Serou N, Sahota LM, Husband AK, Forrest SP, Slight RD ,Slight SP. Learning from safety incidents in high-reliability organizations: A systematic review of learning tools that could be adapted and used in healthcare. *International Journal for Quality in Health Care*. 2021; *33*(1). https://doi.org/10.1093/intqhc/mzab046.
3) Serou N, Slight RD, Husband AK, Forrest SP, Slight SP. A retrospective review of serious surgical incidents in 5 large UK teaching hospitals: A system-based approach. *Journal of Patient Safety*.2021; *18*(4): 358–364. https://doi.org/10.1097/pts.0000000000000931.
4) Serou N, Slight SP, Husband AK, Forrest SP, Slight RD. Surgical incidents and their impact on Operating Theatre Staff: Qualitative study. *British Journal of Surgery Open*. 2020; *5*(2). https://doi.org/10.1093/bjsopen/zraa007.
5) Serou N, Sahota LM, Husband AK, Forrest SP, Moorthy K, Vincent C , Slight RD, Slight SP. Systematic review of psychological, emotional, and behavioural impacts of surgical incidents on Operating Theatre Staff. *British Journal of Surgery Open*. 2017;1(4): 106–113. https://doi.org/10.1002/bjs5.21.

Conference Abstracts (accepted)

1) Serou N, Sahota LM, Husband AK, Forrest SP, Moorthy K, Slight RD, Slight SP. A Systematic Review of the Effect of Surgical Errors on Operating Theatre Staff. *The 23rd HSRPP Annual Conference.* 7–8 April 2017. Nottingham, England.

2) Serou N , Husband AK, Forrest SP ,Slight S P. What effect has surgical incidents on operating theatre staff? A systematic review". *International forum for Quality and Safety in Healthcare*. 26-28 April 2017. Excel, London.

3) Serou N, Sahota LM, Husband AK, Forrest SP, Moorthy K, Slight RD, Slight SP . A systematic review on the organisation support and coping strategies used by operating staff following surgical incidents. *The 40th SGIM Annual Conference.* 19th-22nd April 2017. Washington D.C, United States.

4) Serou N, Sahota LM, Husband AK, Forrest SP, Moorthy K, Slight RD, Slight SP . A systematic review on the effect of surgical incidents on operating staff and related safety concerns. *The 34th International Society for Quality in Health Care (ISQua) Conference.* 1st- 4th October 2017. London, England.

5) Serou N , Husband AK, Forrest SP ,Slight SP. Systematic review of literature on practical tools to help multi-disciplinary teams deconstruct and learn from safety incidents that occurred in any sector. *International forum for Quality and Safety in Healthcare*. April 2018. Amsterdam.

6) Serou N, Sahota LM, Husband AK, Forrest SP, Moorthy K, Slight RD, Slight SP. A systematic review of practical tools or frameworks to help deconstruct safety incidents and learn from them. *The 24th Health Services Research and Pharmacy Practice (HSRPP) Conference.* 12th & 13th April 2018. Newcastle, England. [Oral presentation].

Chapter 1: Surgical Safety: Incidents, Safeguards, and Impact

1.1 Introduction

This chapter presents an overview on the concept of surgical safety before describing the aim and objectives of this PhD programme of work. The researcher also presented an overview of the structure of my thesis to aid navigation and integrate the insights from each of the different studies in the final chapter *(chapter 7)*. Few sections in this chapter are used in the five published research articles mentioned above (Page 16), to which the researcher is the first author and contributed to all sections of the published articles with the contribution from fellow authors (PhD supervisory team)

1.2 Surgical incidents: Causes, Statistics and Reports

In the United Kingdom (UK) National Health Service (NHS), more than one million patients are successfully treated for various health conditions every day.[1] It is also estimated that around 850,000 patient safety incidents occur every year in UK resulting in 40,000 deaths.[1] These patient safety incidents cost the NHS at least one billion pounds every year.[2] Some patient safety incidents in healthcare can be referred to as *serious* incidents, i.e., errors or lapses in care that result in unexpected or avoidable death, unexpected or avoidable injury resulting in serious harm. [3, 4] Never events are serious incidents, which are largely preventable in healthcare organisations. [4]

Surgical incidents are the most common and highly reported *serious* patient safety incidents in the NHS in England [5, 6] and worldwide.[7, 8] Operating theatres are one of the highest risk environments in health care for serious incidents,[9, 10] with the second highest number of serious incidents in the NHS reported to occur there (falls being the most reported).[11] These incidents relate to identifying the patient and the surgical site correctly, providing sterilised equipment, safely administrating anaesthesia, and performing the surgery.[12-14]

The treatment post-surgery is often multifaceted and provide by a multidisciplinary team.[13, 14]

Previous retrospective reviews of surgical incidents carried out in USA, Australia, UK and Spain suggest the patient injury rate following surgery is between 3-16%. [15-19] Here in the UK, the National Reporting and Learning Systems (NRLS) reported that largest number of serious surgical incidents occurred in trauma and orthopaedics (34%) and general surgery (29.7%), followed by urology (5%), ophthalmology (3.4%), ear, nose and throat (ENT) (3%), neurosurgery (2.4%) and cardiac surgery (2.2%).[20] A recent publication by NHS Improvement described how 314 surgical incidents were reported in the period between April 2019 and December 2019, with 165 due to wrong site surgery, 91 due to retained foreign object and 58 wrong implant /prosthesis.[11] Studies have found that about 60% of surgical incidents are due to human error, such as poor communication, team work, decision making, and awareness, followed by surgical equipment-related incidents, surgical techniques and system errors.[6, 18, 21]

Every NHS trust in UK is responsible for reporting serious incidents on the Strategic Executive Information System (StEIS) and the National Reporting and Learning System (NRLS).[22] Serious incidents are investigated and managed by individual NHS Trusts, according to the serious incident framework set out in March 2015.[3] The framework and NRLS was set up for the purpose of learning from these incidents and preventing reoccurrence. NHS England, NHS Improvement, and National Patient Safety Agency (NPSA) encourage healthcare organisations, department managers and risk assessment managers to have robust incident management system in place to investigate, manage, and learn from incidents.[3, 23, 24]

1.3 Safeguards, initiatives, policies, and improvements

The WHO safe surgery guidelines advocate 10 essential criteria or checks for minimising the occurrence of preventable surgical incidents.[25] These include: (1) operating on the right patient at the right site, (2) using various techniques and methods to prevent harm during the

time of anaesthesia, (3) preparing for fatal loss of airway or respiratory function, (4) preparing for risk of high blood loss, (5) avoiding an adverse or allergic drug reaction in the patient who is known to be of risk, (6) reducing the risk for surgical site infection by following appropriate procedures, (7) preventing unintended retention of instruments and swabs during surgery, (8) identifying and securing all surgical specimens, (9) sharing and communicating essential information, effectively, amongst the theatre team, and (10) establishing routine audit and surveillance of surgical services in health care organisations.[25]

Over the past decade, numerous nationwide and global patient safety initiatives have been established to help operating theatre teams achieve the above objectives. [13] The '100,000 Lives Campaign' in 2005/2006 and subsequent '5 Million Lives Campaign' in 2007/2008 by the Institute for Healthcare Improvement (IHI) aimed to reduce the mortality and morbidity in healthcare.[26] These campaigns recognised any best practices within organisations that could improve care and save lives.[25, 26] There was a particular emphasis on reducing surgical site infections by providing accurate perioperative antibiotics at the appropriate time.[25]

Even with the establishment of these initiatives, improving the safety of the surgical environment and care provided has been challenging.[13, 14, 25] Various studies of surgical safety have highlighted the importance of communication and teamwork in the surgical environment,[27, 28] and in 2009 the WHO launched the 'Safe Surgery Saves Lives' campaign accompanied by the WHO surgical safety checklist (SSC). [25] This safety tool aimed to improve communication and teamwork in operating theatres by getting the members of the operating theatre team, which included surgeons, anaesthetists, Operating Department Practitioners (ODPs), theatre nurses, and theatre support workers, to confirm critical safety measures before, during and after surgery.[27-29] The checklist reflected the natural breaks in the surgical periods (i.e., sign-in (before the patient was anaesthetised); timeout (before the start of surgical intervention); and sign-out (before any member of team leaves the operating theatre), which prompted a discussion about any potential problems that could arise or arose

during the procedure [27-29] , with the specific aspects in each step illustrated in Appendix 1. The SSC checklist was mandated by the NPSA in January 2009 for all patients undergoing surgical procedures in the NHS.[25] A wide range of studies have evaluated the implementation of the SSC checklist and shown how it reduced the rate of deaths and surgical complications by as much as one-third.[27, 30-33] It has also been associated with improved recognition of potential safety hazards, decreased surgical incidents, improved communication among operating theatre staff and significant progress in staff safety culture in operating theatres.[27, 28, 32-42] The NPSA have since adapted the SSC checklist for certain clinical disciplines such as for maternity, ophthalmology, neurosurgery and interventional radiology. The NPSA and Patient Safety First campaign further updated these SSC checklists to Five Steps to Safer Surgery in December 2010,[25] to include briefing and debriefing before and after surgery. Briefing include multidisciplinary teams within theatres huddle to one place before the start of the list to discuss about the patients to be operated, level of care needed to each patient including surgical and anaesthetic equipment needed during the time of surgery.[43-45] Debriefing include operating theatre teams both medical and non-medical, discussing about the entire day surgical list , what went well ,what did not and what can be done in future to improve practices.[43-45] With the help of multiple strategies such as quality improvement works, local champions, education and training, the checklist is now part of a standard clinical procedure before, during and after surgical procedures across the globe.[13, 25] However, there have been numerous barriers reported during the initial implementation of the checklist, including delays to starting the operating theatre list; increased workload; reduced applicability during emergency situations; concerns that patient might become restless or anxious if they were to overhear the process, and the perceived lack of importance given to the checklist by healthcare professionals.[27-29]

Previous reports have also highlighted how the mandatory debriefing following surgery is not always conducted to the optimal standard and there have been several disparities reported between actual and ideal debriefing.[43, 44, 46, 47] This may be due to local working

provisions,[48] checklist fatigue,[32] or those using them do not fully understand their purpose and importance.[42, 48] Staff workload, staff shortages and lack of time and resources were other major barriers reported in research in facilitating and using the mandatory checklist. [43, 49, 50] This PhD study further explores why mandatory safety checklists were not used as intended *(qualitative study, chapter 6).*

1.4 Second victim phenomenon and its significance

Healthcare professionals have been recognised as secondary victims of medical errors.[51, 52] Professor Albert Wu first coined the phrase *'second victim'* in the 1980s,[53] with Scott *et al* defining it as '*a health care provider involved in an unanticipated adverse patient event, medical error and/or a patient related-injury, who becomes victimised in the sense that the provider is traumatised by the event'*.[52, 53] Along with the impact on the surgeon, studies have highlighted how nurses and other allied health professionals can experience emotional distress and depression, with symptoms similar to those of post-traumatic stress syndrome.[54] A survey of 7,900 surgeons in USA highlighted how they experienced low quality of life, anxiety, burn-out and depression in the three months following the incident [55]. Other studies have highlighted how the impact of surgical incidents on surgeons can be enduring and, in some instances, the individual may never fully recover and might consider changing profession to non-clinical duties such as to management or academia;[54, 56-58] others have attributed it to their increase usage of illicit drugs[56] and addiction to alcohol. [59, 60] Such experiences not only have a profound effect on the individual and their families but can also negatively impact upon the provision of patient care. [51, 52]

However, it has recently been suggested that the term "second victim" be abandoned as some patient groups felt it was inappropriate to refer to both patients and healthcare professionals as victims following incidents.[61] The term promotes the belief that patient harm is random and not preventable, leading to some healthcare professionals not being held accountable for their actions.[61] The term continues to be used internationally by healthcare professionals, managers and policy makers with the emphasis being on raising awareness of the topic. [62]

The UK Care Quality Commission (CQC), an independent regulator of health and adult social care, recommended that healthcare organisations offer support to second victims, such as counselling, professional support interventions and well-being initiatives.[63] Systematic reviews in this field also highlighted the need for healthcare organisations to implement support strategies for their staff following an incident.[52, 64-67] NHS England introduced a novel Patient Safety Incident Response Framework (PSIRF),[68] which set out the NHS's approach to developing and maintaining effective systems and processes for responding to patient safety incidents for the purpose of learning and improving patient safety. The PSIRF highlights how the organisation needs to engage with those affected, what governance processes for oversight are in place, and how learning responses are translated into improvement and integrated into wider improvement work across the organisation.[68] Research to date on second victims has concentrated on medical errors, with little published on the impact of surgical incidents on health professionals, including the wider operating team.[67, 69-72] This PhD programme addresses this important research gap by exploring the significant impact surgical incidents can have on healthcare professionals in operating theatres and what support they need from their colleagues, managers, and healthcare organisations. It is also useful to reflect and review the processes following safety incidents in other high reliability organisations (HROs), like aviation, naval aircraft carriers, nuclear power operations, military organisations, chemical industries, construction, and railways.[73, 74] HROs are known to function nearly error-free by applying principles such as pre-occupation with failure, reluctance to simplify, sensitivity to operations, a commitment to resilience, and deference to expertise in their daily operations.[73, 75] A number of learning tools and initiatives have also been used within HROs to learn from safety incidents; they intended to fall into two broad categories of approach involving either simulation and/or debriefing.[46, 49, 76-80] Simulation and debriefing have been used in healthcare mostly in education setting but not widely used to learn from patient safety incidents.[46, 81, 82] This PhD programme of work further explored what tools or initiatives have been used in HRO and whether they can be adapted for use in health care sector to learn from patient safety incidents.

1.5 Aim and Objectives of the PhD programme of work

1.5.1 Aim

The overall aim of the thesis is to explore the impact and support received by the operating theatre staff (both medical and non-medical) following surgical incidents.

1.5.2 Key Objectives

1) To review the literature to explore the psychological, emotional, and behavioural impact of surgical incidents on operating theatre staff.
2) To review the literature to identify what practical tools are currently available to help multidisciplinary healthcare professionals learn from safety incidents.
3) To identify the underlying causes of surgical incidents in operating theatres.
4) To interview operating theatre staff to understand the personal, professional, and behavioural impact of surgical incidents and the challenges they face while working in operating theatres.
5) To examine what follow-up support is offered to “so called” second victims.
6) To make recommendations for improving healthcare systems to support staff involved in surgical incidents.

1.6 Structure of the thesis

To achieve the above aims and objectives, the content of this thesis is organised into following six chapters. A systematic review of the literature was conducted to understand and explore what effects surgical incidents can have on operating theatre staff, and how their attitudes and behaviours might change following the event *(Chapter 2)*. One of the key recommendations from this review was to explore the practical tools available to learn from safety incidents in healthcare. A second systematic review was conducted to explore the various practical tools or initiatives currently available to help teams deconstruct and learn from safety incidents in

various HRO and examine how those tools could be used in healthcare to learn from patient safety incidents *(Chapter 3)*. A retrospective review of administrative data was conducted to identify the underlying causes of serious surgical incidents at one large London NHS Trust *(Chapter 4)*. A qualitative study was undertaken to explore the personal, professional, and behavioural impact of surgical incidents on operating theatre staff (both medical and non-medical) and how they could be better supported following a surgical event, with the methodology described in *Chapter 5*. The results of this study were presented in *Chapter 6.* The final chapter, *Chapter 7,* discusses these findings in relation to wider literature and provides recommendations for improving healthcare systems to support staff involved in surgical incidents.

1.7 Summary

This chapter gave a brief overview on the concepts of surgical safety with particular emphasis on the causes of surgical incidents, current safeguarding systems used in operating theatres and safety initiatives introduced into the NHS. It introduced the second victim phenomenon and its significance to patient safety. The aim and objectives of this PhD programme of work were described. The next chapter explores the psychological, emotional, and behavioural impact of surgical incidents on operating theatre staff, which shapes the qualitative work described in the later chapters.

Chapter 2: The psychological, emotional, and behavioural impacts of surgical incidents on operating theatre staff

2.1 Introduction

Surgical incidents can have a devastating effect on both patients and healthcare professionals. As mentioned in the previous chapter, healthcare professionals have been recognised as second victims of medical errors. Most qualitative studies in the literature have focused on the impact of errors on healthcare staff that occurred outside the operating theatre.[51, 70, 83-90] However, the operating theatre is an environment uniquely characterised by acute stress and quick decision-making.

There is a dearth of literature on the effect of surgical incidents in particular on operating theatre staff. A scoping review or systematic review are two different approaches that could be used to synthesise the evidence. The researcher wanted to use the results of this review to provide evidence to inform practice. According to Munn et al., a systematic review is the most valid approach to use if the research question focuses on the appropriateness of a certain practice.[91] The researcher conducted a systematic review to ascertain the psychological, emotional and behavioural impacts of surgical incidents on operating theatre staff, and how their attitudes might change as a consequence of experiencing these incidents. This review also considered the safety concerns raised by staff who were affected, and the support offered to them following such a surgical incident. This systematic review has been published (The researcher is the main author and contributed to all the sections of this published work with the support of fellow authors). ***Serou, N., Sahota, L.M., Husband, A. K., Forrest, S. P., Moorthy, K., Vincent, C., Slight, R. D., & Slight, S. P. (2017). Systematic review of psychological, emotional, and behavioural impacts of surgical incidents on operating theatre staff. BJS open, 1(4), 106–113.*** **https://doi.org/10.1002/bjs5.21.[10]** (See Appendix 2)

2.2 Aim:

The aim of this systemic review was to explore the psychological, emotional, and behavioural impacts of surgical incidents on operating theatre staff.

2.3 Methods

This review followed the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) reporting guidelines.[92] The review was registered with the PROSPERO database (number 420112042415).

2.3.1 Inclusion and exclusion criteria

The PICOS tool was used to formulate eligibility criteria in this systematic review: Population (operating theatre staff, both medical and non-medical), Intervention (surgical incidents), Comparison (irrelevant), Outcomes (the impact and support received following surgical incidents), and Study (Qualitative, quantitative, or mixed, reviews).

Studies were eligible for inclusion if they were primary research or reviews focused on the effect of surgical incidents on operating theatre staff (medical and non-medical) in primary, secondary and tertiary care settings. A surgical incident was defined as an incident that occurred while performing a surgical or invasive procedure in an operating theatre (including operating room and anaesthetic room) or suite (for example primary care medical centre) that may or may not have resulted in patient harm (near misses, serious incidents and never events). Operating theatre staff were defined as healthcare professionals working in an operating theatre or suite (both medical and non-medical) covering any specialty and level of expertise.

Articles of interest included data concerning one or more of the following: professional and personal impact of a surgical incident on operating theatre staff, including psychological or

emotional consequences that affected staff performance, practices and responses; safety concerns raised by staff affected by a surgical incident; and support offered to staff by their colleagues, seniors, department or organisation following a surgical incident. Studies that investigated the impact on patients, malpractice litigation, publications in languages other than English, those related to dentistry, and studies of the impact of other kinds of error not involving invasive procedures were excluded.

2.3.2 Search strategy and study selection

A comprehensive set of search terms were developed based on the definitions of surgical incidents and operating theatre staff. A list of MeSH (medical subject headings) terms and text words were generated; these are provided in Appendix 3. The following electronic databases were searched in June 2016 from the date of their commencement: MEDLINE in Process (Ovid), Embase (Ovid), the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and PsycINFO. Grey literature was also searched for sources including reports from UK government agencies such as National Patient Safety Agency, and local and regional clinical commission groups. Doctoral dissertations, conference proceedings, posters and publications from patient safety conferences, Association for Perioperative Practice (https://www.afpp.org.uk/) and Open Grey (http://www.opengrey.eu) databases were also searched. Studies identified as potentially relevant for inclusion were assessed by two independent reviewers (NS and LS), with arbitration by a third reviewer (SPS), if necessary. This involved reviewing all titles, abstracts and full texts, and documenting the reason why each full-text article was excluded, as outlined in Figure 1.

2.3.3 Data extraction and synthesis

A customised data extraction form was developed and used to capture pertinent information from included studies. Authors' names, year of study, country where the research was conducted, research methods, types of error discussed, aims and objectives of the research, any recommendations or key findings, and quality assessment of each article were recorded

as detailed in Appendix 4. Study authors were contacted by e-mail if further information or clarification was required. A narrative synthesis of the data was undertaken.[93] Emerging and recurrent subthemes relating to the research aims were identified from the included qualitative studies.[94] Quantitative data from the reviewed articles were summarised and analysed. Details of the initial subthemes and overarching themes are shown in Appendix 5.

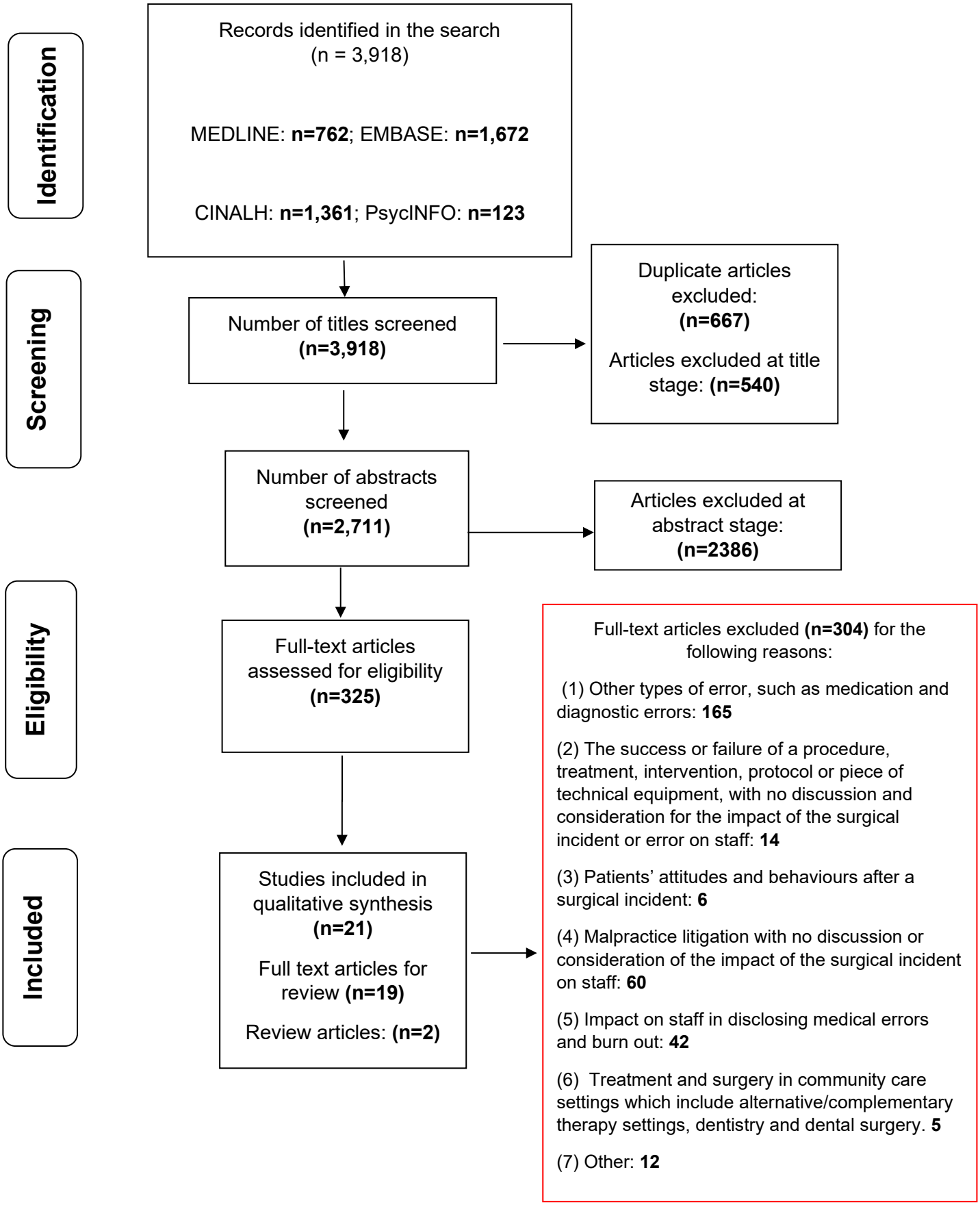
2.3.4 Risk of bias (quality) assessment

The quality of included qualitative studies was appraised using the Critical Appraisal Skills Programme (CASP) tool.[95] This tool consists of a list of questions, with 1 point awarded for each question up to a maximum score of 10. Quality appraisal of each article was carried out independently by two reviewers (NS and LS). Any disagreements were resolved by discussion with a third additional reviewer (SPS). The scores and quality of the selected articles were recorded in the final column of data extraction sheet illustrated in Appendix 4.

2.4 Results

A total of 3,918 articles were identified. After removal of 667 duplicates, a further 3,230 articles were excluded at title (540), abstract (2386) and full-text (304) stages, leaving a total of 21 articles (19 full-text and two review articles) (*Fig. 1*). Most of the individual studies selected were conducted in North America (n=12) followed by western mainland Europe (n=3), the UK (n=3) and Australia (n=1). Of these, 11 studies used quantitative methods, seven qualitative methods, one mixed method and two review articles.[52, 88] The number of individuals who participated in the qualitative studies ranged from 11 to 31. [51, 56, 59, 60, 84, 89, 96, 97]

Figure 1: PRISMA diagram showing selection of articles for systematic review



These studies were assessed for the use of methodological triangulation (use of 2 or more methods), which has been advocated as a way of safeguarding the 'validity' of qualitative studies.[98] As part of the quality assessment of articles, more than half of the selected articles used only one method to obtain the data. A score of 8 out of 10 was deemed to represent a 'good quality' paper. Five overarching themes emerged and included: emotional impact on health professionals, organisation culture and support, individual coping strategies, learning from surgical complications, and recommended changes to practice. Appendix 5 shows the subthemes and overarching themes extracted from each individual article in the review.

2.4.1 Emotional impact on health professionals

Health professionals experienced a range of emotions, either immediately or soon after a surgical incident. One of the neurosurgery residents in a Canadian study described this range of emotions as follows: *"…The first thing is probably a bit of shock, and horror. That's quickly replaced by some sort of sadness and depression to some extent … this patient trusted me and my team to do something and we betrayed that trust. So I think for me that's the path of emotions that I follow: initial shock and horror followed by sadness and depression followed by a component of guilt and then self-doubt."* [59] Other surgeons felt distraught and described how it impacted their ability to perform more mundane tasks: *'I honestly think I almost crashed into four parked cars before I got out of the parking garage that day. I was so distraught…'.*[97] Another surgeon reported having difficulty sleeping, repeatedly recalling the event in their mind : *'I couldn't sleep without thinking about it… I grieve for how badly it makes me feel. I'm always saying I've got to get out of this business because it's hard. It's depressing…'.*[97] Some also considered a change in speciality or even early retirement as they felt unable to cope with another similar incident in the future.[97] A number of different factors appeared to influence

individual reactions to an incident, including the individual's resilience and character, their standing within the team hierarchy, and the patient outcome. Taking each of these factors in turn, one consultant general surgeon explained how some people appear to be unaffected by the event *"...[like] water off a duck's back,*[56] *"absolute rocks..[97]* , while others *"completely fall to pieces".*[56] Some consultant surgeons agonised over the incident, blaming themselves for their *"particular lapse"* or how they *"personally missed something".[56]* These events appeared to 'live' with them: *"… [I remember] all their names, I remember their faces, I remember their families".*[97] Another vascular registrar anticipated the impact will be enduring: *"I'm sure in 20 years' time I'll still be able to remember this case and what it taught me . . .'.*[56] Junior surgeons appeared to experience more extreme emotions than their senior colleagues,[52, 56, 59, 84, 88, 96, 97] feeling insecure, isolated, and concerned about their reputation and what others might think: *"…is this an error that I've made that's unforgivable and is it going to affect people's professional opinion of me ...'*. [56] Some felt that senior colleagues had tried to place the blame on them: *"he basically pinned the whole thing on us. ... I don't like it when people finger point and that happens a lot…".*[84] The cumulative impact of these events on their practice and emotional experience over time was also highlighted. Surgical incidents that resulted in a patient's death or permanent disability appeared to have more of an emotional impact on surgeons. One vascular surgeon explained how *"... repairing someone's aneurysm, giving them a stroke and then rendering them paraplegic, it would be a terrible outcome ... Death, limb loss, paralysis, they're huge and probably affect the impact of complication on your emotions...'.*[56] Surgical incidents that occurred during elective procedures also appeared to have more of an impact on operating staff than those that occurred during emergency surgery, perhaps because they considered these events less likely.[56, 59, 84, 89]

2.4.2 Individual coping strategies

Health professionals used different coping strategies in the aftermath of a surgical incident, such as seeking peer support or counselling, openly discussing the incident with patients and families, reflecting on the incident privately, and implementing changes to their practice. Health professionals often sought the support of their peers or, in some cases, independent counsellors following a surgical incident.[59, 85, 86, 88, 97, 99] Most surgeons and anaesthetists discussed the event with senior colleagues within their own speciality: *"the best 'counselling' is by talking to a skilled trusted senior anaesthesiologist to put the case into perspective as they can much more understand the context and situation than a counsellor*".[99] In situations where the peer support was unavailable, operating theatre staff tended to seek counselling from professional counsellors with mixed results.[99] Some surgical residents felt that sharing experiences with their peers helped eliminate self-doubt and minimise guilt.[59, 84, 88, 100] Simply asking the question *"Has this ever happened to you …?"* gave one resident reassurance that others had or were *"going through the same thing".* [84]

Some health professionals chose to discuss the incident with both the patient and their families, which they found helpful.[84] Others chose to privately reflect on the incident, with one vascular registrar explaining how they mentally "*deconstruct[ed] it and replay[ed] it"* to assess their degree of responsibility.[56] One surgeon in a Canadian study found it helpful to write a standard operating procedure (SOP) to help prevent such an incident occurring in the future: *'I will put in [a SOP] if I think maybe this piece wasn't right. (…) how will I deal with that one next time, maybe that's my coping mechanism.'*[97]

2.4.3 Organisation culture and support

The majority of operating theatre staff felt that they received inadequate support from their managers and peers within the organisation following a surgical incident. One UK consultant general surgeon felt very strongly about the lack of support offered in his hospital: *'... I don't*

think the institutions have any knowledge of the difficulties that their consultants face and to my knowledge there are no mechanisms for support, at all. If Surgeon mucks up the Trust's response is to suspend them'.[56] Consequently, operating staff felt reluctant to disclose or discuss any incidents for fear of retribution. One general surgery registrar explained, *'... If you feel that you're working in a blame environment ... you wouldn't be performing to your optimal anyway because you're watching your back the whole time ... You might feel that you want to keep things to yourself ...'.*[56] Junior surgeons often felt reluctant to seek emotional support when they were involved in a surgical incident, as it was seen as a personal weakness.[59, 84, 97, 101] Different suggestions were proposed to encourage informal and constructive discussions about surgical incidents, including the arrangement of 'morbidity and mortality (M&M)' meetings in the UK or 'deaths and complications (D&C)' meetings in the US. [54, 56, 60, 84, 97] At these meetings, deaths, serious incidents and never events were discussed to encourage professional learning and create a positive patient safety culture. One of the surgical interns in a US hospital found these meetings very supportive and conducive to learning: "…*I've asked, "God, this patient is not doing so well do you think it's because of ...?" ... And you know I just try to get education from other people."*[84] In contrast, one general surgery registrar recounted a very different experience, with surgeons becoming very defensive at their M&M meetings in the UK: *"…everybody in that room is very defensive and aggressively pursues an angle that puts them in the best possible light and professional rivalries exist ...".*[56]

2.4.4 Learning from surgical complications

Though most of the studies concentrated on the emotional impact of being involved in a surgical incident, others discussed the importance of personal and organisational learning from incidents. Sharing the lessons learnt was seen as vital for improving patient care.[56, 59, 83, 84, 89, 96, 97, 101, 102] As we have outlined earlier, reflection played an important role in surgical trainees' learning. One surgical resident in the US highlighted how important it was to acknowledge mistakes and find ways of preventing them from happening again.[84] One

UK general surgeon reflected on how he and his colleagues were less likely to perform the same type of surgery in the future and admitted that this also might not be in best interest of patients: *'…Well it might make me much less prone to taking any form of risk… and sometimes that's not necessarily in the best interest of the patient...'*.[56] Some senior surgeons also deconstructed the events that led to an incident and evaluated whether there were any gaps in their knowledge and skills: *"Is there any knowledge that we don't have and that could have been useful in this case?"*.[89] Some studies recommended for M&M and D&C meetings to be more structured and blame free to encourage open discussions about an incident and promote a culture of shared learning within the organisations. One surgical US intern felt that the D&C meetings helped facilitate this learning: *'This (D&C) has been a tradition among surgical education for a long time that you present things when they go wrong. (…) ... I think it is very educational. It makes you feel like you can talk about what happened and what you can do differently next time'.* [84]

2.4.5 Recommended changes to practice

All articles discussed how health professionals could be better supported following a surgical incident. A list of potential recommendations is shown in Table 1.

Table 1 Potential recommendations from selected articles.

Recommendations	Brief description from articles
One-to-one support sessions	An informal one-to-one discussion with a senior colleague soon after the incident, with a second follow-up meeting if necessary [51, 54, 56, 59, 84, 85, 87-89, 97, 100-103]
Debriefing sessions	Debriefing sessions to help deconstruct the incident and encourage learning [56, 96, 99, 103]
	Trained psychologists to carry out formal debriefing sessions with the individual [51, 56]
Mentoring	Putting structured peer support or mentoring programmes in place where the affected health professionals would be

	followed up by a senior colleague or manager soon after an event [56, 89]
Morbidity and mortality meetings (UK) Deaths and complications meetings (USA)	Morbidity and mortality, and deaths and complications meetings to be more structured and blame-free, to encourage open discussions about an incident and promote a culture of shared learning within the organisations [56, 59, 60, 84]
	Opportunities to discuss freely an incident that they were involved in and draw on the experiences of senior colleagues across various specialties to promote learning [56, 59, 60, 84]
Education and training	Health professionals should be educated as part of their undergraduate curriculum about the possibility of surgical errors occurring in practice and what different coping strategies could be employed following these incidents. [56, 59, 84, 86, 100]
Supportive environment	Organisations should promote an environment where mistakes from juniors are not perceived as their individual problems, but rather common glitches expected from trainees .[59]
	The option to have some time off work in the aftermath of a surgical incident, if required. [56, 96, 99, 103]
	Managers and peers to listen and support affected individuals. This support should be offered at an early stage following the event .[56, 66, 70]
	Support systems should be structured and meet individual needs. [66]
Investigation or inquiry process	To have an open and transparent process in analysing these events. [89]
	A need for the formal investigation process to be explained more clearly following a surgical complication .[59, 89]

Offering one-to-one support sessions to those affected by a surgical incident was viewed as particularly important.[51, 54, 56, 59, 84, 85, 87-89, 97, 100-103] This could take the form of an informal one-to-one discussion with a senior colleague soon after the incident, with a second follow-up meeting if necessary. One general UK surgeon highlighted the importance of having someone more senior to speak to following the incident: *"... it's very good to have someone a little more senior that if you have a problem you can say, "What am I going to do?" or "What happens next?" That's very, very unofficial".[56]* Some studies proposed that clinicians from various specialities be trained to support staff involved in an incident.[52, 56, 59, 84, 88, 89, 102] One Canadian surgical trainee made comparisons with other industries, like aviation, and how trained psychologists would carry out formal debriefing sessions with individuals to help them *"figure out what went wrong, what was random"* [59] One anaesthetist was frustrated with the lack of organisational support offered to him: *"NO ONE…sought to ask how I felt about it (patient death) and how it was affecting me."*.[99]

A number of papers discussed the culture of surgery and need for organisations to promote an environment where mistakes '*are not viewed as problems with someone's character. Mistakes happen because you're a doctor in training and everyone has made a mistake at some point'*.[59] Allowing staff to take some time off after an incident is also important for the individual.[99] This might just be for a short period of time to enable the individual to reflect on the incident, although this could depend on the individual concerned. [56, 59, 84]

2.5 Discussion

Healthcare professionals can suffer severe emotional distress following a surgical incident. These incidents may arise from an operation that had a poor outcome, or an error assumed to be due to a member of the surgical team. This distress is influenced further by several other factors including the severity of the error, the individual's personality and character, and what, if any, support was offered to the individual following the incident. This review has highlighted how health professionals viewed and reacted to these events, and the variety of coping

strategies to regain their self-confidence and positive thinking. It also identified the need for the development of an open culture of shared learning within an organisation.

Most studies focused on the impact of surgical incidents on surgeons and anaesthetists and neglected other members of the operating theatre team. Theatre nurses, other healthcare professionals and support workers can all experience emotional and psychological distress when involved in surgical incidents, with significant impact on their professional work.[52, 88, 104, 105] This review also highlighted how a surgeon may become more risk-averse following a surgical incident.[56] It is possible that some health professionals may subsequently be reluctant to perform a surgical procedure similar to that related to the incident. Similarly, other professionals who were part of the team that witnessed the incident may feel reluctant to work with others or participate in a similar procedure. Conversely, some staff appeared more resilient following an event, reflecting and learning from the incident, and wishing to perform the same invasive procedure or get involved within the same environment to improve their self-belief and confidence. Further work is needed to explore what knock-on effects such decisions may have for patient care.

The majority of operating theatre staff felt that they received inadequate support from their managers and were reluctant to discuss incidents for fear of retribution. This was an important finding and highlighted the need for attitudinal change with respect to patient safety. Organisations need to cultivate a supportive environment to learn from incidents. Similar to the way in which the operating team comes together to complete the WHO Surgical Safety Checklist for every patient undergoing a surgical procedure, they should also collectively reflect on surgical incidents that occurred and identify learning points. One suggestion might be to draw on the insights from the aviation industry, where trained psychologists carry out formal debriefing sessions with individuals and teams to help them ‘figure out what went wrong’.[46] The aviation industry places more emphasis on structured systems that link the adverse event to learning from it. Tools should be developed to help the team deconstruct surgical incidents that occur.[106]

This review also highlighted other ways that health professionals could be better supported following a surgical incident. Individuals need to be able informally discuss the incident with a senior colleague or mentor soon after it has occurred.[56, 89] This would give them the opportunity to reflect with another experienced healthcare professional on what happened, possibly drawing on their knowledge or experience to promote learning and rebuild the individual's self-confidence. M&M meetings need to be structured and blame-free to encourage open discussions about an incident and promote a culture of shared learning within organisations.[56, 59, 60, 84] Organisations themselves need to cultivate a culture of 'psychological safety', whereby any member of staff can ask questions and receive feedback without appearing incompetent, so that new ways of working can be considered. This culture of psychological safety could potentially reduce the impact of incidents on individuals and promote learning. Those responsible for the provision and organisation of surgical services must also recognise the need to not only work with frontline staff to learn from these incidents, but also to disseminate lessons learned across their organisations effectively.

This review has limitations. Most of the included studies were conducted in North America. The review did not include studies that focused solely on the effect of malpractice claims on health professionals following an adverse incident. Although outside the scope of this review, these studies may have provided further insight into the emotional effects of incidents on theatre staff and their long-term consequences. Furthermore, as part of the quality assessment of articles, more than half of the included articles used only one method to obtain data, which could be viewed as a weakness in these particular studies.

2.6 Conclusions and Summary

The operating theatre is one of the highest-risk areas for surgical incidents. Mistakes happen and learning from such incidents should be a team exercise without individual blame apportioned. An open culture of shared learning needs to be developed within organisations. Operating theatre staff should also be provided with the tools to help facilitate shared learning from incidents. As mentioned previously (Chapter 1, section 1.4) HROs are known to function nearly error-free in extremely challenging and uncertain environments and use number of key learning tools and initiatives to learn from safety incidents. The following chapter will examine what learning tools are used in HROs and explore whether they can be adapted for use in health care sector to learn from patient safety incidents.

Chapter 3: Learning tools that could be adapted and used in healthcare.

3.1 Introduction

The previous chapter described the psychological, emotional and behavioural impacts of surgical incidents on operating theatre staff. Three key findings emerged from this review. Firstly, very little had been published on the impact of surgical incidents on the wider operating team beyond surgeons and anaesthetists. Secondly, it was unclear in what ways the surgeons or any health professionals might change their attitude or behaviours following a surgical incident. Thirdly, our review emphasised the need to deconstruct serious incidents in surgical environments so as to understand the reason(s) why they occurred and apply the lessons learnt. One of the key recommendations from this review was to explore what practical tools might be available to learn from safety incidents in healthcare.

There are a variety of practical tools currently available to help teams deconstruct and learn from safety incidents in various HROs such as aviation, military and oil industries. This chapter takes a closer look at these tools and whether they could be adapted and/or used in healthcare to learn from patient safety incidents. This chapter was published (The researcher is the main author and contributed to all the sections of this published work with the support of fellow authors); ***Serou, N., Sahota, L.M., Husband, A.K., Forrest, S.P., Slight, R.D., & Slight, S.P. (2021). Learning from safety incidents in high-reliability organisations: a systematic review of learning tools that could be adapted and used in healthcare. International Journal for Quality in Health Care, 33(1).*** **Doi: 10.1093/intqhc/mzab046** (Appendix 6)

3.2 Aim:

The aim of this review was to identify learning tools deemed to be effective that could be adapted and used by multidisciplinary teams in healthcare following a patient safety incident.

3.3 Methods

The PICOS tool was used to formulate eligibility criteria in this systematic review: Population (HROs), Intervention (practical tool for learning following safety incident), Comparison (irrelevant), Outcomes (effectiveness of the tool for learning following safety incident), and Study (Qualitative, quantitative, mixed or reports)

This review followed the Preferred Reporting Items for Systematic Reviews and Meta Analyses for Protocols (PRISMA-P) reporting guidelines and is registered with the PROSPERO database (CRD42017071528). The researcher defined a practical tool as a learning process or method used to learn from safety incidents and included all articles that met the following inclusion criteria:

- Primary research articles or reviews that described a practical tool or initiative to help deconstruct safety incidents for learning purposes.
- Any learning tool used in any HROs, high hazard industries or safety critical industries.
- Studies using any type of research method.
- Any unpublished articles, conference proceedings, editorial comments.

Exclusion Criteria include

- Any articles that did not describe a tool or initiative in detail, and focused more on learning theories, or were not available in English were excluded.

3.3.1 Search strategy and study selection

The researcher developed a comprehensive and broad set of search terms, which included both MeSH terms and text words, with the input of the University librarian. He carried out a simple search using key concepts, such as “high reliability”, “high reliability organisations”, “high dependable organisations”, “high standard organisations”, “high dependable organisations”, “high standard organisations”, high reliability companies”, “high reliability industries”, “high reliability bodies” in different databases to find relevant articles and see how they were indexed using controlled vocabulary. The researcher repeated these for a number of different articles to see what subject headings have been used. A list of MeSH terms and Boolean operators used in the electronic databases is provided in Appendix 7. The researcher conducted a search of the following electronic databases in January 2021 from the date of their commencement: Web of Science, Science Direct, MEDLINE in Process (Ovid) Jan 1950-present, EMBASE (Ovid) Jan 1974-present, The Cumulative Index to Nursing and Allied Health Literature (CINAHL) 1982-present, PsycINFO 1967-present, Scopus and Google Scholar. The researcher also searched the grey literature including reports from HRO websites, such as www.high-reliability.org; www.hse.gov.uk; https://psnet.ahrq.gov; https://safetymatters.co.in/; https://llis.nasa.gov/ and government agencies such as NPSA, and Local and Regional Clinical Commission Groups(CCGs). Any relevant doctoral dissertations and conference proceedings identified in the grey literature (http://www.opengrey.eu), and reports from NPSA, Association for Perioperative Practice, Institute for Health Improvement, Local and Regional Clinical Commission Groups and ResearchGate (www.researchgate.net) were reviewed. The Institute for Health improvement and other particular groups have had an interest in the successful strategies used in other industries to help evaluate, calculate, and improve the overall reliability of complex systems. Further material was sought by scanning reference lists of the included articles. Searches were also carried out within specific academic journals (*e.g.* Safety Science, Organisation Science) in order to identify any relevant papers in press or recently available. Duplicate

articles were removed using Endnote reference management tool version X7.7.1. Studies identified as potentially relevant for inclusion were assessed independently by two reviewers (NS and LS), with arbitration by a third reviewer (SPS), if necessary. This involved reviewing the titles, abstracts and full texts, and documenting the reason why each article was excluded. Figure 2 represents the PRISMA diagram illustrating the steps involved in the search strategy.

3.3.2 Data extraction and synthesis

A customised data extraction form, provided as Appendix 8, was developed and included the authors' names, year of study, country where the research was conducted, research methods used, tool or initiative described, what the purpose of the tool was, what types of population the tool was used for, how the tool facilitated learning in terms of mechanism by which it worked and how well it worked, and a risk of bias (quality) assessment of each article. A narrative synthesis of the data was undertaken by the researcher.[93] A narrative synthesis of the data was undertaken by the researcher and pharmacy student. First, a preliminary synthesis was undertaken to develop an initial description of the results of included studies. Then, the reviewers moving beyond identifying and tabulating results to further explore relationships within and across the included studies, such as how and why a particular learning tool worked in different circumstances in various HROs. Finally, overarching themes and subthemes relating to the research aims were identified independently by two reviewers. Third author (researcher supervisor) was used to check for consistency and approval of the final themes emerged from the studies. The results of included studies were first summarised, before exploring how and why a particular learning tool worked in different circumstances in various HROs. Studies which used the same tools were compared and contrasted, and overarching themes and subthemes were identified and discussed with the supervisory team.[94] Appendix 9 gives further details of the subthemes and overarching themes extracted.

3.3.3 Risk of bias (quality) assessment:

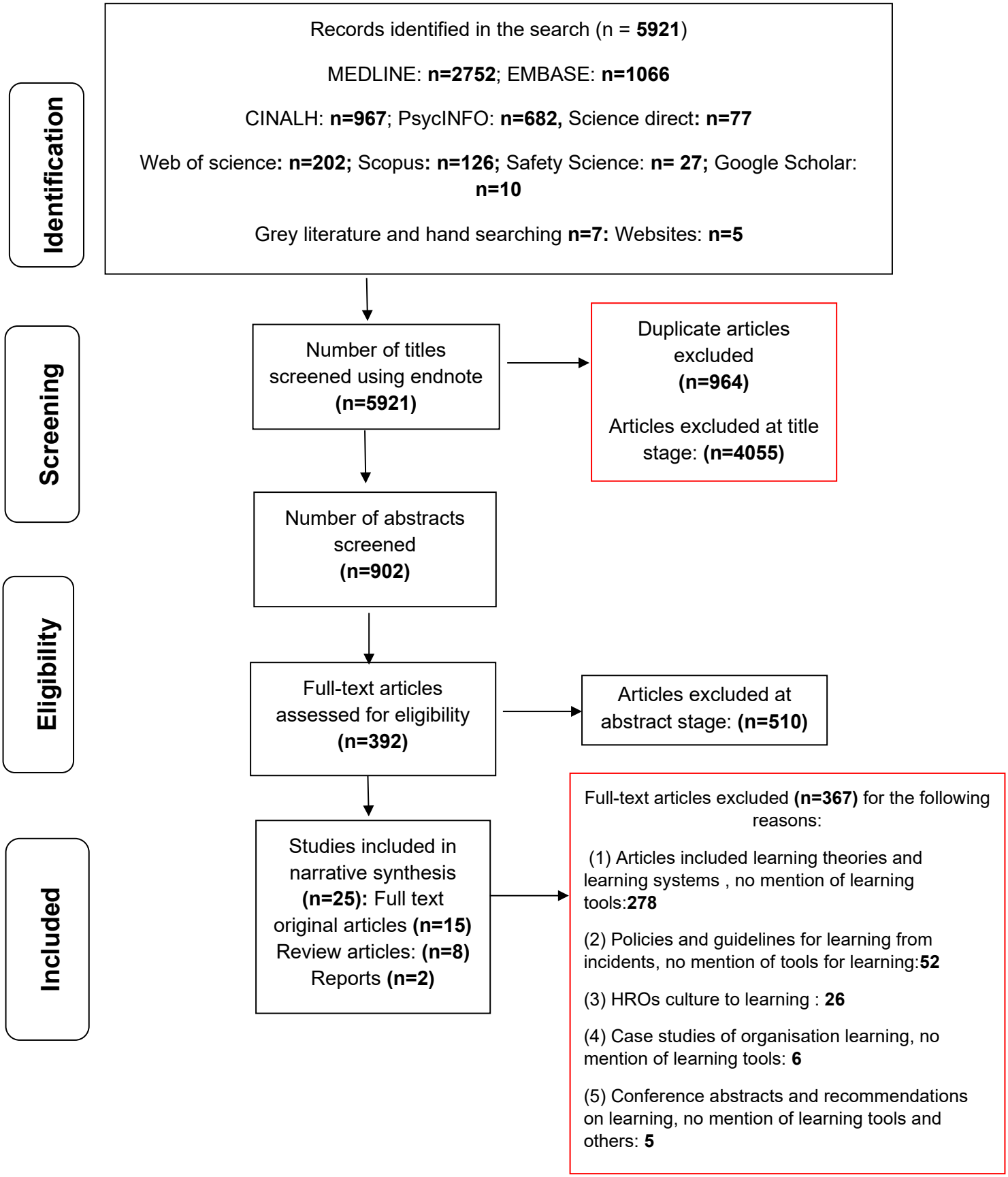
A Critical Appraisal Skills Programme (CASP) tool was used to access the quality of qualitative paper. This CASP tool consists of 10 questions that each focus on a different methodological aspect of the study. Two reviewers (NS and LS) carried out quality appraisal of each article independently. Any disagreements were resolved by discussion with a third additional reviewer (SPS), if needed. The scores and quality of the selected quantitative and qualitative papers were included in the data extraction table provided Appendix 8. CASP scores were used to distinguish studies of relative higher and lower quality. The qualitative studies were also assessed for the use of methodological triangulation (use of 2 or more methods), which has been advocated as a way of safeguarding the 'validity' of qualitative studies.[107, 108].

3.4 Results

A total of 5,921 articles were identified, with 964 duplicate articles removed and 4,932 excluded at the title (4,055), abstract (510) and full text (367) stages. Twenty-five articles were included in the final review (15 primary research articles, eight review articles and two reports). Figure 2 provides a diagrammatic representation of the search strategy used. The 15 primary research studies were conducted in six countries: United States (n = 8)[109-116], Europe (n = 2)[117, 118], Australia (n = 2)[119, 120], New Zealand (n = 1)[121], Israel (n=1)[122] and United Kingdom (n=1)[123]. Of these 15 articles, eight used quantitative method,[109-111, 115, 118, 121-123] six qualitative methods,[112-114, 117, 119, 120] and one mixed methods.[116] Two of the six qualitative articles used more than one of the following methods of data collection: observations, formal and informal interviews, recorded debriefing sessions, observed and recorded simulator sessions. The four remaining qualitative studies used only one method.

The eight quantitative studies [109-111, 115, 118, 121-123] were heterogeneous, with different outcomes, study designs (e.g., surveys and questionnaires), populations, interventions (*e.g.*, After Action Review (AAR) model or simulation), and settings (military, fire

Figure 2: PRISMA diagram: Representation of the steps involved in the search strategy



department, aviation); it was not possible to conduct a meta-analysis. Simulation, Crew Review Management (CRM) and Dissemination of Safety Messages were identified as individual tools or initiatives and discussed below. Debriefing was also used by HROs as an approach and separate tools such as After Action Review (AAR), post-flight debrief, Mitchell Model and post project review, used as part of this approach.

3.4.1 Simulation

Simulation has been used in HROs to deconstruct and learn from safety incidents.[82, 120, 123] The term ‘simulation’ refers to a model of a real activity created for training purposes. A typical simulation model consists of seven sequential steps: introduction, simulation briefing, theory input, scenario briefing, scenario, debriefing and ending.[82, 119, 123] The scenarios are usually based on real life or past events, and are typically facilitated by experienced facilitators.[123] Four studies explored the impact of simulation in learning after safety incidents in HROs. Engineers from British petroleum industry and aviation crew at all levels from different aviation sectors were included in these studies.

In the aviation sector, it is mandatory for flight crews to take part in simulation following a significant safety event. One such incident was when a passenger flight in Canada crashed after only few seconds after take-off because it was not able to reach adequate altitude beyond the end of the runway, due to ice and snow on the wings.[82] The subsequent simulation exercise was found to be effective in changing flight crews attitudes and behaviour, and helping them recognise the importance of human performance limiters (such as fatigue and stress) and adequate aircraft maintenance.[82] In the maritime sector, British Petroleum (BP) used simulation after a safety event in the Gulf of Mexico relating to an oil leak.[123] These mandatory simulation events enabled the crew to relive the event again by performing the tasks in a role-play, and sharing the subsequent learning and recommendations.[123] Some of the participants described how this approach was a *“useful way to gauge thoughts and decisions” and a “better way to discuss [an] incident”. [123]* Along with technical aspects,

simulation was found to be beneficial in training staff on non-technical skills such as teamwork, communication, prioritisation, leadership and situation awareness.[82, 123]

3.4.2 Debriefing

The term ‘debriefing’ refers to conversational sessions that involve seeking the views and understandings of individuals after a specific event.[117, 119, 123, 124] Debriefing sessions have been widely used by soldiers at all levels in the military, pilots and air crew in aviation, fire fighters in fire departments, engineers and workers in railways and chemical industries, and are normally carried out soon after the event. The review also found various HROs used debriefing either on its own or as part of simulation-based learning to help deconstruct and learn from safety incidents. Different debriefing tools were identified such as post-flight debrief, Mitchell Model post project review and AAR, the latter using four main questions: *What was supposed to happen? What actually happened? Why were there differences? What can you learn from this experience?* These sessions were facilitated by observers/controllers who used probing questions to elicit responses, such as *“talk me through it"* and *"how did that work?”,* or photographs with probes such as *'What do you see? What's going on here?"*.[113] Fire Fighters in the eastern United States, who were often offered AAR after any fire rescue operation, were surveyed on their experience, with one participant explaining how it allowed them *“to say something without retribution.”* [116]

In the aviation industry, team-based ‘debriefing’ sessions took place both before and after flight take off where an experienced senior member of staff and a trained psychologist provided feedback on the technical and non-technical performance of the flight members, respectively.[82, 117, 120, 124, 125] One participant described how: *“Normally the operative debriefing is straightforward and amounts to declaring that everything went according to normal operations. Occasionally, we need time to work through specific events that occurred during the flight, either in the cockpit or in the cabin. The debriefing will then continue to its conclusion with no regard to time”.*[117] The Mitchell model was used to enhance resistance

to stress reactions or help individuals “bounce back” from a traumatic experience.[126] It included seven elements: introduction, fact, thought, reaction, symptom, teaching and re-entry,[126] and was slightly different to AAR debriefing as the personal experiences of the affected individual, including the impact of and their reaction to the incident, were discussed in detail.

3.4.3 Crew resource management (CRM)

HROs such as aviation, military and automotive industries also developed CRM training programmes, which were complementary to the simulation-based team training with debriefing sessions, but put more emphasis on non-technical skills.[127] These included effective leadership, teamwork, dealing with diverse personalities and operating styles, workload management and situational awareness; preparation, planning, and vigilance; workload distribution, distraction avoidance; individual factors, and stress reduction.[127] A US study showed significant improvement in safety, efficiency, dependability and assertiveness amongst aviation managers following CRM training.[115] Similarly, a New Zealand study found significant improvements on flight attendants’ and cabin crews’ understanding of each other’s role and responsibilities, their roles in flight emergencies, and their perception of safety, following CRM training.[121] These improvements were evaluated and measured using the Flight Safety Attitudes Questionnaire in the study.[121] The study also found that joint training sessions, where flight attendants and pilots work together to find solutions to in-flight emergency scenarios, provided a particularly useful strategy in breaking down communication barriers.[121] A German study also found a significant improvement in teamwork-related attitudes and workers’ situational awareness after the CRM training program.[118]

3.4.4 Reporting and dissemination of safety messages

The reporting and dissemination of safety messages to staff is also viewed as an effective learning process following an event.[80, 110, 114, 122, 124, 128, 129] Incident reporting systems provide valuable information on hazards and the potential risk that these hazards may cause harm; this is useful for organisations as they can learn from previous incidents and implement interventions to reduce these risks. HROs such as nuclear and radiation power plants developed sophisticated incident-reporting systems to record and improve organisational learning from incidents.[80, 129] For example, the radiotherapy institute in USA developed the Safety Reporting and Learning System for Radiotherapy (SAFRON), which allowed users to submit their own incident reports to the system, as well as search and review similar incident reports about technologies, procedures or near misses so as to learn from them.[129] Similarly, the Belgian Nuclear Research Centre used a sophisticated incident reporting system named Retour d'Experiences (REX) to share reported incidents and safety messages with staff within their centre.[80] Staff expressed their satisfaction in using the system as key learning points, and active causes of the incidents were analysed and reported.[80]

3.5 Discussion

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement, published in 2009, was designed to help systematic reviewers transparently report why the review was done, what the authors did, and what they found. The PRISMA 2009 statement comprised a checklist of 27 items recommended for reporting in systematic reviews providing additional reporting guidance for each item, along with standards of reporting.[92] In 2015 an extension of the PRISMA statement has been developed for protocols ,PRISMA-P, to facilitate the development and reporting of systematic review protocols. It contains 17 items (with 26 sub-items)considered to be requisite and minimum

components of a systematic review or meta-analysis protocol with three main sections administrative information, introduction, and methods. When compared to PRISMA, PRISMA-P uses minimum list of items when preparing a protocol but focused more on encouraging authors to provide detailed description of some protocol sections such as on eligibility criteria, outcomes and prioritisation to enable transparency and future reproducibility. [130]

Further, The PRISMA 2020 statement, published in 2021, includes new reporting guidance that reflects advances in methods by adding inclusive wordings to accommodate other beyond randomizes trails of health interventions. [131] To facilitate this, some of the categories have been broken down into more coarse sub-items that are clearer and provide more clarity about what exactly should be reported, some new items and sub-items have been introduced or expanded upon; and some of the items have been slightly re-ordered in the checklist. [131]

The findings of this review are timely, given the recent report published by the World Health Organisation (WHO) on Patient Safety Incident Reporting and Learning systems, which highlighted the significance of using and developing learning systems following patient safety incidents.[132] Our review shows that debriefing, simulation, CRM and systems to disseminate safety messages following safety incidents were positive tools and approaches for learning. Simulation has been used in HROs to train staff on technical and non-technical skills, and debriefing used to help deconstruct and learn from safety incidents. CRM put more emphasis on non-technical staff skills, while sophisticated incident reporting systems helped record and improve organisational learning from incidents. The effectiveness of learning and staff satisfaction in using debriefing and simulation appeared to depend on the facilitator and the environment in which the sessions were organised and conducted. The contents and structure of the learning tool was also reported to be as important as the facilitation of these sessions. They also needed to be conducted in a safe environment for staff to discuss and reflect on the incident(s) and encourage efficient team engagement with the process.

Healthcare has used simulation as an educational tool for training staff on clinical interventions, such as acute management of patients in emergency and in basic and advanced

life support programmes rather than for the sole purpose of deconstructing and learning from safety incidents.[76, 133-135] Previous studies have highlighted how staff working patterns, staff shortages and time pressures made simulation training a challenging prospect in healthcare.[135-138] The review recommend that organisations should take into account these important barriers and explore how to better adapt and embed these tools into healthcare organisations. The different casual factors, which contribute a real incident, could be replayed in simulation for the staff to reflect and learn as a team without compromising patient safety.

Few studies have been conducted to explore the usage of AAR structured format for debriefing sessions in the healthcare context. The WHO implemented five steps of safer surgery, including a briefing and *debriefing* before and after the surgery, [139] the benefits of which have been well reported.[43-45] However, there have been inconsistencies between what the surgical community viewed as an *effective* debriefing and actual practice.[43, 44] Ahmed et al found that debriefing was often conducted in an unstructured way following surgery and feedback focused more on the negative than positive aspects of individuals' performance.[43] Competitive professional culture, clinical and educational commitments, and lack of time where found to be the main barriers for conducting debriefings after surgery.[43, 44, 140] More work needs to be done in removing these barriers and encouraging more effective facilitation. HRO have prioritised safety over other goals, allocating extra staff and resources where needed, and relaying a consistent message that safety is as or more important than other business objectives.[75] Health care organisations need to endorse these HRO principles by prioritising continuous learning and safety at work place. HROs also promote "mindful leadership" and identify any gaps between how managers think that procedures should be used and how they are actually applied by front line staff.[141] Similar to HROs, health care leaders need to identify these gaps and promote a culture of learning within their organisation in order for any tools, discussed in this review, to be effective.

This review identified the importance of non-technical skills and their contribution towards learning from safety incidents. These include the social, cognitive and personal management skills that enable safe and effective work performance, by enhancing the individual's communication, situation awareness, decision-making, and managing stress and fatigue while working in HROs. Several studies in the healthcare sector have identified poor non-technical skills as significant contributing factors for patient safety incidents especially in operating theatres.[134, 142] Similar to how simulation has been used in healthcare as an educational tool, some clinical specialities have also devised training programmes based on CRM components.[134, 142-145] Using CRM to help deconstruct and learn from safety incidents in healthcare could lead to greater understanding of the importance of non-technical skills and improvements in safety.[142, 144, 146] CRM was adapted for healthcare, with an increase in care improvement and a reduction in harm across a wide variety of medical specialties.[127, 147-149] When implemented in the operating rooms, CRM has been shown to, not only, improve communication and staff morale, but also reduce patient morbidity and mortality.[127, 147, 149, 150] However, unlike HROs, these programmes do not appear to be mandatory in the healthcare sector[145, 149-152] and more work is required to adapt these learning approaches for staff development training, undergraduate and postgraduate medical and surgical education curriculums. Furthermore, health care organisations could support the utilisation of learning tools in a number of ways, including ensuring that teams have the necessary time to engage in this activity and involving trained facilitators and psychologists in the debriefing process, the importance of which has been highlighted in previous studies.[46, 153]

Various studies in safety science and quality & safety stressed that one or two initiatives or learning tools alone are not sufficient to address safety incidents nor is there a 'one size fit all' solution.[73-75, 77, 78, 154-160]. It is challenging to recommend any specific interventions as all learning tools have shown considerable promise for positive learning. Healthcare organisations should be encouraged to use a combination of methods to help staff learn from

safety incidents. NHS improvement recognised the various steps involved in a patient safety incident,[3] including the reporting of the incident, further investigations conducted into why it happened, and certain changes put in place to prevent the incident occurring in the future.[3] The learning tools identified in this review could be used at different stages of this process. For example, simulation can be used to help staff understand how they need to act in real life situations and allow them to fine-tune both their technical and non-technical skills in a safe environment. Similarly, sharing safety messages following incidents in daily team meetings will increase staff awareness and help them become more vigilant. Although used effectively in HROs, learning tools, such as debriefing and simulation, have been used inconsistently in healthcare, with several disparities reported around conducting debriefing sessions following surgery.[43, 44, 46, 47]

To the researcher's knowledge, this is the first systematic review to explore the tools and approaches used in HROs to learn from safety incidents and give recommendations as to how these approaches could be used in the healthcare context. He identified learning tools used in a wide variety of HROs such as aviation, military, fire department, automobile industries, chemical, petroleum, nuclear and radiation industries. He excluded several studies that focused solely on learning theories, as they did not concentrate on learning tools or initiatives per se, but rather the wider cultural barriers that exist in bringing about change. Although outside the scope of this review, these studies may have provided further insights and recommendations for future learning. The researcher acknowledges that the inclusion of some more targeted library databases (e.g., the Association for Computing Machinery database or the American Society for Testing and Materials (ASTM) Standards and Engineering Digital Library) might have been useful. While it would have been impossible to search all relevant library databases, some important research may have been missed.

3.6 Summary and Conclusions

HROs have adopted a variety of learning approaches following safety incidents and studies stress that one or two alone are not sufficient to address safety incidents. Healthcare organisations should be encouraged to use a combination of methods to help staff learn from safety incidents. Healthcare organisations should adapt the learning tools used in HROs following safety incidents; however, the way these tools or initiatives are implemented is critical. Further work is needed to explore how to successfully embed them into healthcare organisations so that everyone at every level of the organisation embraces them. Leaders within healthcare need to promote a culture of continuous learning and psychological safety for these learning tools to be effective.

The findings and tools explored in this review were further investigated in the semi-structured interviews conducted at the research site (Chapter 6). Participants were asked for their views on learning tools, such as debriefing, and how they could be successfully implemented in healthcare. Furthermore, the review explored how the learning tools such as simulation and debriefing explored the gaps in technical and non-technical skills which could have been the contributing factor for the safety incident. The following chapter will explore the technical and non-technical (skills) causes of surgical incidents occurred in five teaching hospitals within a large NHS trust (research site) and analyse how these above learning tools would help staff learn from patient safety incidents.

Chapter 4: A retrospective review of serious surgical incidents in five large UK teaching hospitals

4.1 Introduction

The previous chapter explored the various practical tools or initiatives that are currently available to help teams deconstruct and learn from safety incidents in various HROs such as aviation, military and oil industries, and whether such tools could be used in healthcare to learn from patient safety incidents. The most common serious patient safety incidents occur in surgery, and there are different incident analysis frameworks which can be used to investigate the root cause of incidents in health care.[82, 161]

A previous retrospective review of patient safety incidents and reports published by the NPSA have highlighted specific causes of incidents such as failure in human factor principles, such as communication, teamwork, leadership, awareness, and technical deficiencies. [11, 20, 162] Multiple factors were found to have contributed to the occurrence of serious surgical incidents, many of which related to system and organisational failures alongside human failures.[23, 69, 163]

The researcher conducted a review of serious surgical incidents recorded by five large teaching hospitals, located in one London NHS trust to identify possible contributing factors to the surgical incidents reported using the London Protocol system analysis framework[164] and proposed recommendations for safer health care systems. This chapter is published in Journal of Patient safety (The researcher is the main author and contributed to all the sections of this published work with the support of fellow authors). ***Serou N, Slight RD, Husband AK, Forrest SP, Slight SP. A Retrospective Review of Serious Surgical Incidents in 5 Large UK Teaching Hospitals: A System-Based Approach. J Patient Saf. 2022 Jun 1;18(4):358-364. doi: 10.1097/PTS.0000000000000931*** (Appendix 10).

4.2 Methods

4.2.1 Data collection

When a healthcare professional within a UK hospital witnesses a patient safety incident, they are required to fill in an incident report form on the Datix system and grade the incident in terms of patient harm. There are six possible grades of patient harm: near miss, no harm, low harm, moderate harm, major harm, extreme (death); the full NPSA definition of each grade can be found in Appendix 11.[4] The researcher searched the Datix system for all surgical incidents recorded between October 2014 and December 2016 in five teaching hospitals in one London NHS Trust. These five hospitals have nearly 1,000 operating staff who provide elective, speciality, emergency, and trauma services for around 1,500,000 people every year. This London Trust performed 40,000 elective and emergency operations in the year 2018/19. The researcher worked at this study site in the role of "Clinical Practice Educator in operating theatres" from 2014to 2019 and was familiar with searching and generating reports in the DATIX system. Thus, this London Trust was chosen as the study site.

The search included all incidents that occurred in any operating room, excluding critical care departments such as ITU. Incidents which occur in interventional radiology and Cath labs were also included. The researcher then identified all those that were considered serious i.e., that resulted in either moderate, major or extreme harm, and reviewed the following data for each incident: (a) place, time, location and detailed description, (b) staff statements recorded at the time, (c) any correspondence the trust incident investigator had with the personnel involved, (d) patient care documentation such as a patient's medical notes, and (e) the final investigation report carried out by the designated trust incident investigator.

4.2.2 London Protocol System Analysis Framework

There are few incident analysis frameworks such as fish bone model, Swiss cheese model for causation of errors were used to investigate the root cause analysis of an incident in health care.[82] Researches in safety were critical in using these frameworks as they focus on a

single root cause or few root causes of the incidents.[82, 161] The researcher used the London Protocol system analysis framework to identify the factors that led to the specific surgical incident occuring.[164] In comparison to other analytical frameworks, the London Protocol proposes a system-based analysis of incidents to identify the gaps and inadequacies in the healthcare system. . The theory underlying the protocol and its application is based on research in settings outside healthcare and is further adapted from the Organisational Accident Causation Model used in aviation, oil and nuclear industries for incidents analysis.[8, 165] It encourages mainly to consider the circumstances or situations in which incidents occurred and the wider organisational setting, which are known as contributory factors. These circumstances include factors such as high workload and fatigue; inadequate knowledge to perform a task , ability, or experience; inadequate supervision; a demanding situation or setting; rapid change within an organisation; inadequate systems of communication; poor planning and scheduling; inadequate maintenance of equipment and buildings. The protocol proposes that these factors influence staff performance, and which may precipitate errors and affect patient outcomes. Factors taken into consideration while analysing the incidents include Organisational factors, work/environment factors, team factors, individual (staff) factors, task/technology factors and patient factors. [17, 164, 165] It is an extended version of Reason's Swiss cheese model for error causation [166, 167] and involves the broad examination of the incident, people involved in the incident, and the communication and interaction between the team leading to the incident.[165]

4.2.3 Data analysis:

Table 2 describes the different factor types and contributing factors that have been included in the Framework. He defined the active factor or root cause of an error as the prime reason for the incident occurring and its contributing factors as both proximal (*e.g.*, communication) and latent (*e.g.*, working environment) causes of error. Factors within the London Protocol that were taken into consideration while analysing the incidents include organisational factors,

work/environment factors, team factors, individual (staff) factors, task/technology factors and patient factors[17, 164, 165].

Table 2: Framework of Contributory Factors Influencing Clinical Practice[164]

Factor types	**Contributory Influencing factors**
Patient Factors	Condition (complexity & seriousness) Language and communication Personality and social factors
Task and Technology Factors	Task design and clarity of structure Availability and use of protocols Availability and accuracy of test results Decision-making aids
Individual (staff) Factors	Knowledge and skills Competence Physical and mental health
Team Factors	Verbal communication Written communication Supervision and seeking help Team structure (congruence, consistency, leadership etc.)
Work Environmental Factors	Staffing levels and skills mix Workload and shift patterns Design, availability and maintenance of equipment Administrative and managerial support Environment Physical
Organisational & Management Factors	Financial resources & constraints Organisational structure Policy, standards and goals

	Safety culture and priorities
Institutional Context Factors	Economic and regulatory context National health service executive Links with external organisations

This methodological approach has been used in previous studies,[17, 165] and involves a two-staged process.[17, 165] In *Stage one*, the researcher reviewed and prepared a brief description of each incident from the reported incident data, and identified the contributing factors which had a direct or indirect effect on the patient. These included individual factors (e.g., the specific actions of healthcare staff), patient factors (e.g., multiple comorbidities), and the wider organisational context (e.g., financial resources & constraints, organisational structure, policy, standards and goals). *Stage two* involved an expert panel reviewing and discussing each one of these brief descriptions in depth, using a series of questions (Box 2) to identify what the most likely contributing factors were and what recommended changes should be considered for practice. The expert panel consisted of the researcher's supervisory team which included a patient safety expert, social scientist, qualitative researcher and medication expert, and NHS consultant surgeon.

Box 1. Case example with a narrative and the contributing factors and root cause of the surgical incident.

A female patient was taken to operating room for an 'above knee amputation' of an unsalvageable right leg with necrosis to the mid-calf, and anaesthetised. Before the surgical incision, it was noted that the patient had not signed the consent form. This effective check for valid consent was not done at multiple points during the patient journey from the ward to operating rooms, including 1) on the ward round or when marking the patient by the surgical team, 2) as part of the nurse assessment before the patient left the ward to operating rooms, 3) at sign-in in operating rooms, as per the sign-in phase of WHO surgical safety checklist.

Box 2: Predefined questions for system analysis:

- Was the grade of staff or staff skill mix appropriate to the task?
- Was there a staff shortage at the time of surgical incident?
- Was there evidence of lack of continuity of observation and care?
- Was there evidence of equipment or instrument failure during the surgical incident?
- Was there any guidance and protocols in place, which could have prevented the surgical incident? Or did staff follow the agreed trust guidance and protocols at the time of surgical incidents?
- Was there adequate communication within the multidisciplinary team at the time of incident? *i.e*., team briefing, handovers etc.

4.3 Results:

One thousand and fifty-one surgical incidents were recorded in the time period, categorised as near misses (n=130), no harm (n=794), low harm (n=113), moderate harm (n=14), major harm (n=0) and extreme incidents (n=0). For the purposes of this review, the researcher focused on all 'serious' surgical incidents (n=14) that occurred across different clinical specialties, including General surgery (n=3), Emergency surgery (n=1), Ear, Nose and Throat (n=1), Gynaecology and Obstetrics (n=1), Orthopaedics (n=1), Cardiothoracic and Vascular surgery (n=2), Renal surgery (n=2), Ophthalmology (n=1), Anaesthetics (n=3). The review identified five main contributing factors in these incidents: 1) Task factors, 2) Equipment and resource factors, 3) Team factors, 4) Work environment factors, and 5) Organisational and management factors, each of which will be discussed in turn, with aid of examples. Table 3 provides a brief description of each of the fourteen surgical incidents discussed.

Table 3. Brief Description of the fourteen incidents.

Contributing factors of each incident following analysis: Task design (TD); Operating room protocols (TP); Patient records (PR); Faulty equipment (FE); Poor design (PD); Standardisation of resources (SR); Lack of resources (LR); Communication (C); Team structure (T); Leadership (L); Staffing levels and skills mix (S); Workload and shift patterns (W); Time pressures(TiP); Noises and distractions (DiS); Financial resources & constraints (FR); Organisational structure(OS); Policy, standards and goals (PSR); Safety culture and priorities (SCP)
A) Retained foreign object: metal object from large instrument : A key head of a rib approximator (retractor) became displaced during a gastro-oesophagectomy surgical procedure. This key head separated from a rib approximator (retractor) while the instrument was in use and was inadvertently left inside the abdominal cavity. All instrument and swab count at end of procedure were noted as correct. The patient reported to had post-operative complications such as mild fever and discomfort. The key head was identified on routine post-operative imaging and necessitated laparotomy surgery (surgical procedure involving a large incision through the abdominal wall) to remove the item four days following the initial surgery. The patient made a good recovery and was discharged from hospital. **Contributing Factors:** TD, TP, FE, LR, TS, SR, L, S, FR, OS, PSR, SCP
B) Cancellation of surgery following anaesthesia due to patient anti-coagulant therapy: A patient scheduled for a right nephrectomy was anaesthetised (for near 20 minutes) and did not undergo their operation as planned. The operation was cancelled when the surgeon became aware that the patient had received a dose of Tinzaparin (anticoagulant) on the morning of surgery. Due to the nature of the surgery and the patient's past medical history, it was considered not safe to proceed with the operation. **Contributing Factors:** (TP, S, W, TiP, DiS)
C) Cancellation of surgery due to incomplete consent form: A female patient was anaesthetised and transferred to operating room for an "above knee amputation" of an unsalvageable right leg with necrosis to the mid-calf and significant pain. In the operating room, it was noted that the patient had not signed the consent form. As the surgery was deemed not to be 'life or immediately limb saving', the decision was made by the operating team to cancel the surgery and the patient was woken up and the surgery rescheduled. **Contributing Factors:** TP, C, TiP, DiS
D) Loss of specimen: Two patients underwent a micro bladder biopsy. Both patient's specimens were placed in the same pot by mistake, and it was not possible to differentiate which specimen was belonged to which patient. Consequently, both specimens needed to be discarded. **Contributing Factors**: TP, C, W, L, DIS, SCP
E) Burns on the upper limb following surgery: A male patient sustained a partial thickness burn (a burn that affects a deeper layer of skin, excluding any damage to the underlying muscle or bone) during a Right Elbow Reconstruction operation. The burn was caused from alcoholic skin preparation being in contact with the skin under a tourniquet. This burn required further treatment, including debridement of the wound (removal of unhealthy tissue to promote healing), and skin grafting involving the transfer of skin from one area to another. **Contributing Factors**: LR, C, L, SCP
F) Child Intraoperative bleeding: A six-month-old baby underwent an urgent microlaryngoscopy and bronchoscopy (MLB). During the procedure, the surgeon reported that the scissors from the microlaryngoscopy instruments sets were blunt and asked to try another set. After trying numerous sets of equipment (all of which he reported to be blunt), the baby's condition deteriorated, and their larynx became swollen. The baby required cardiopulmonary resuscitation and was admitted to Paediatric Intensive Care Unit (PICU).

Contributing Factors: FE, LR, C, L, FR, OS, PSR, SCP
G) Retain of guide wire: The patient was undergoing elective surgery and required central venous access for this (quad lumen and dialysis lines). In order to prevent the catheter to loop or knot within the central vein, a guide wire which comes along with catheter helps the practitioner to guide him/her to insert the catheter through the central vein. Usually, the practitioner should hold the guide wire at the non-inserted tip of the catheter so that the guide wire will not be lost during the insertion. The Central venous pressure was measured throughout the procedure, and the mean transduced pressure was found to be higher than expected. The distal lumen of the central line however would not aspirate blood. The possibility of a retained central venous line guide wire was investigated, and a chest X-ray confirmed that the guide wire was visible in the vena cava. The patient was moved to the interventional radiology suite under general anaesthesia where the guide wire was removed. **Contributing Factors:** TP, PD. Dis
H) Inaccurate laboratory results led to inappropriate care processes : Two patients underwent a cardiothoracic procedure on the same day in different operating rooms. During their respective surgeries, Patient A had a bronchial pus sample and Patient B had a pleural biopsy taken. Patient A was discharged following recovery and Patient B developed fast atrial fibrillation on the ward and was started on antibiotics. The Cardiothoracic Specialist Registrar (SpR) subsequently reviewed the microbiology report, which stated that Patient B's sample had been pus like and realised that this report was likely made in error as it did not match the clinical details of Patient B. Patient A did not receive antibiotics and had been discharged. Patient A was contacted and has remained asymptomatic. The patient has not required any further treatment. Patient B developed cannula tissuing and diarrhoea following the commencement of the antibiotics, which resolved on stopping them. Patient A should have received antibiotics but didn't, and Patient B was given antibiotics, which were not needed. **Contributing Factors:** SR, TD, TiP
I) Patients need further surgery due to displaced RIG tube:A radiologically inserted gastrostomy (RIG) tube was inserted into a patient and became misplaced after insertion. The patient had received hydration and medications via the RIG tube and required a laparoscopy surgery (a surgical procedure in which a fibre-optic instrument is inserted through the abdominal wall to view the organs in the abdomen) and washout for peritonitis (infection to the inner lining of the abdomen which covers the internal organs) and was admitted to Intensive Care Unit (ITU). **Contributing Factors:** TP, TD, DiS
J) Retained specimen retrieval bag :A patient was admitted for an emergency laparoscopic appendectomy (removal of appendix). The procedure was converted from laparoscopic to open during through the surgery due to complication (the appendix was found fragmented, and it is not feasible for the surgeon to dissect the appendix in open piece), and an open hemicolectomy (removing part of colon) was completed along with removal of appendix. The SSC checklist and final counts were completed and documented as correct, and the patient was discharged. The patient was readmitted a month later due to abdominal pain and a subhepatic collection (fluid under liver, normally occurs if there is an infection or inflammation) was seen on CT which was in keeping with an abscess having formed around a possible retained object. A diagnostic laparoscopy was conducted, and a laparoscopic retrieval bag was found in the patient's abdominal cavity. This was removed by the consultant surgeon and the patient made a full recovery. **Contributing Factors:** TD, TP, FE, LR, TS, SR, L, S, FR, OS, PSR, SCP
K) Surgical infection: A patient was admitted for a coronary artery bypass graft (CABG) and mitral valve repair (MVR). Following surgery, the patient was transferred to another Trust and discharged home. However, the patient later developed a surgical site infection (SSI) which required readmission. Tissue samples confirmed Mycobacterium which was likely to have been contracted during the previous cardiac surgery. The patient required treatment for the SSI

including multiple episodes of wound debridement (removal of unhealthy tissue from a wound to promote healing), removal of the patient's sternal wires (inserted as part of the initial cardiac bypass surgery to prevent ischemia), PICC line insertion (peripherally inserted central catheter for continuous antibiotic therapy), and wound closure. The patient also required long term antibiotic therapy. The presence of Mycobacterium in Trust Cardiopulmonary bypass equipment is a known risk of this procedure. **Contributing Factors:** FE, SR
L) Wrong route drug administration: A combined spinal epidural was given to a patient for pain relief by CT2 (Core trainee, year 2) anaesthetist under the supervision of an ST6 (Specialist trainee, year 6). During the procedure, the ST6 was called away for an emergency and the CT2 incorrectly connected the epidural giving set to an intravenous cannula. 2 hours and 40 minutes later the patient pressed her patient-control button, and the solution was infused intravenously and reported to have had no analgesic effect. A further 9ml was infused 15 minutes later, on instructions of the midwife to aid pain relief. The consultant anaesthetist was called and noted that the epidural had been incorrectly connected. Corrective action was taken. The patient was monitored closely, and no harm was reported to have been sustained. **Contributing Factors:** S, W, TiP
M) Choroidal (vascular layer of the eye) haemorrhage: A patient underwent vitreoretinal surgery, during which globe pressure was maintained by air infusion through line via three-way tap. The scrub nurse mistakenly turned off the air infusion to the eye during the procedure, resulting in the globe collapsing and significant choroidal haemorrhage occurring, involving the macula. The haemorrhage subsequently cleared from the macula and the patient's vision was noted to have improved to that which would have been expected following surgery had the haemorrhage not occurred. **Contributing Factors:** S, W, D
N) Poor decision making to continue surgery on a high-risk patient with multiple comorbidities: A patient with a past medical history of spina bifida, kyphoscoliosis, a raised hemi-diaphragm, and an ileal conduit was admitted for a left laparoscopic nephrectomy under general anaesthetic (for the removal of the non-functioning kidney due to recurring infections). The patient also had a ventricular shunt present which was not known pre-operatively. The procedure had to be converted intra-operatively to an open operation in light of a scarred abdominal cavity from the previous ileal conduit surgery. At the end of the surgery, the patient was difficult to wake and could not self-ventilate. The patient required a prolonged admission to ICU and was subsequently extubated successfully. Unfortunately, the patient's wound later became infected during the admission, and the patient eventually died in ICU. **Contributing Factors:** PR, C, T, TiP

4.3.1 Task factors:

Operating room protocols were found to be either unavailable, outdated, or not followed correctly in 12 of the 14 incidents studied. The WHO surgical safety checklist was not adhered to in eight of the surgical incidents reported, with the surgical and anaesthetic teams not informed about faulty equipment or product shortages at the '*briefing and sign in' phase,* and the instrument count not performed correctly at the *'sign-out' phase.* The review found that failure to follow the protocol for instrument count was due, in part, to its ambiguity. For example, when the total count of instruments was performed before surgery, it was unclear whether each of the individual parts of a surgical instrument should be counted separately or counted as just one whole piece. There was also no clear guidance on the management of supplementary items used during surgery. In Cases A and J above (Table 3), a key head of a rib approximator (retractor) and a laparoscopic retrieval bag were retained in the patient's thoracic and abdominal cavities, respectively, although the surgical safety checklist and final counts were completed and documented as correct.

In Case B (Table 3), parts of the surgical safety checklist were either omitted (e.g., the patient's anticoagulation status was not checked*)* or not adhered to (e.g., the senior surgeon was not in attendance) at the *briefing and sign-in phase*. Further analysis of this case revealed that, at pre-assessment, there was no clear treatment plan documented or communicated with the patient (in relation to their anti-coagulation therapy) and no checks conducted on the ward pre-operatively to ensure that it had been completed. Similarly, in Case C (Table 3), only the first page of the consent form (which contained the surgeon's signature) was checked both on the ward and in the operating room before anaesthetising the patient. The patient had not signed the consent form (page 2), which only came to light once the patient had been anaesthetised.

4.3.2 Equipment and resource factors:

Some surgical instruments were reported to have been faulty or in short supply. In Case A (Table 3), it was documented in the investigation report that there were limited rib retractors in the

department, which may have influenced staff decision to send the faulty instrument (rib retractor) off for repair when it was found to be faulty (missing a screw); operating room staff continued to use this instrument as it was reportedly *"working fine"* (without the screw). Similarly, it was also documented in the investigation reports that there were not enough microlarynoplasty sets within the ENT department and the ENT surgical team continued to use the faulty (blunt) scissors, which contributed to Case F above.

Shortages of other operating room products such as 6cm tourniquet sleeves (upper limb shut off covers) were also reported, with the incorrect sized tourniquet sleeve (9cm lower limb shut off cover) used on the patient upper arm as an alternative in Case E (Table 3); this resulted in patient burns when the alcoholic skin preparation came in contact with the skin. The operating room staff acknowledged that they were aware that there were no 6cm upper limb shut off covers a month before the incident took place. In Case D (Table 3), staff retained all specimens in operating room until the end of the operating room list before manually printing the labels in a central location (as there were no label printers in day surgery operating rooms); this change in their usual practice led to two patients' specimens been mixed up in a single pot. According to operating room protocol, the specimen should have been stored in the designated specimen containers and sent to the laboratory following every surgical procedure. Finally, the way certain pieces of equipment were designed may also have contributed to some surgical incidents occuring. For example, in Case G (Table 3), the design of the central venous catheter may have contributed to the guide wire being left inside the patient central vein as it did not have a safety knob (unlike the ones used in other interventional units across the trust), which would have prevented guide wire getting lost in the blood vessel.

4.3.3 Team Factors:

The lack of effective communication and integration within multidisciplinary teams, whether verbal, non-verbal or written, was perceived to have contributed to the occurrence of some surgical incidents. For example, in Case N (Table 3), the pre-assessment team did not (a) book the patient for anaesthetist review prior to surgery, although the patient had abnormal airway

anatomy and co-morbidities, or (b) request the patient's second set of medical notes from a different Trust (where they had been receiving specialist care). It is likely that the information contained in these notes would have helped inform whether further imaging was needed prior to surgery, as well as the patient's intra- and post-operative plan. On the day of surgery, the surgical and anaesthetic team also failed to request an HDU/ITU (High dependency unit/Intensive care unit) bed from the bed manager as appropriate assessment was not done prior to surgery.

A lack of clarity over the responsibilities of particular team members was also felt to have contributed to some surgical incidents. For example, in the Case F (Table 3), the ENT team leader assumed that the operating room co-ordinator (junior manager) and operating room manager were going to chase up the procurement of new instruments, whilst the operating room co-ordinator and manager assumed that the ENT team leader was taking responsibility for this task. As also mentioned in Case C above, the operating room team did not communicate effectively with the surgical ward team to check whether the patient had signed the consent form prior to surgery.

4.3.4 Work environment factors:

Time pressure, workload, fatigue, interruptions, and distractions were contributing factors in six surgical incidents (C, D, G, J, L, M). For example, in Case M (Table 3), the scrub nurse was asked to perform a dual role, in which she inadvertently turned off the three-way tap resulting in choroidal (vascular layer of the eye) haemorrhage. A momentary slip of concentration may also have contributed to the junior anaesthetist connecting the epidural infusion to a peripheral intravenous cannula in Case L (Table 3). The senior anaesthetist was unavailable to supervise this procedure as she was assisting an emergency caesarean section and was the only on-call consultant on during that shift.

Time pressures may have also contributed to Case D above, as staff stockpiled specimens in the specimen pots till the end of the operating room list before printing the required labels, which was likely to have saved them time. In Case G above, the experienced anaesthetic registrar was also distracted by both the surgeon inserting a urinary catheter and the noises in the anaesthetic room, while inserting a central venous pressure catheter, which led to the guidewire being retained.

4.3.5 Organisational and management factors:

Inadequate medical staffing levels and the management of faulty equipment were two organisational and management factors that contributed to the occurrence of surgical incidents. For example, in Case L (Table 3), there was only one consultant anaesthetist responsible for both labour ward and the elective caesarean section list; she was called away and unable to supervise the less experienced member of staff (core trainee doctor) which led to wrong drug route error. The registrar, who was on-call, was also called away to help with another case. The wording of certain hospital documents (e.g., RIG protocol and aftercare sheet) were found to be ambiguous. For example, in Case I above (Table 3), the external RIG tube length must be documented by the Radiologist at the time of insertion and double checked by a member of ward staff before commencing hydration. According to the RIG protocol, this length should also be subsequently checked prior to future RIG use to ensure that no movement has occurred, and RIG use stopped if there have been any change in the patient's condition. The aftercare sheet did not highlight the need for subsequent checks or the need to stop RIG use if the patient complained of severe abdominal pain, as was the case in Case I (Table 3). In addition, the investigation reports also suggests that there was no clear guidelines and protocols for operating room staff to report faulty equipment or request for new surgical instruments.

4.4 Discussion:

Fourteen serious surgical incidents were identified in this study, with contributing factors relating to: task, equipment and resources, teamwork, work environmental, and organisational and management. Operating room protocols were found to be either unavailable, outdated, or not followed correctly in eight of the 14 incidents studied. The WHO surgical safety checklist was not adhered to in eight of the included surgical incidents, with the surgical and anaesthetic team not informed about faulty equipment or product shortages prior to surgery. The lack of effective communication and integration within multidisciplinary teams, and inadequate medical staffing levels were perceived to have contributed to the occurrence of some surgical incidents.

The five steps of safer surgery is one of the fundamental safety systems in operating rooms.[23, 35] It includes briefing and debriefing before and after the surgery, along with three steps of WHO surgical safety checklist, *sign-in, time-out and sign-out*; [7] eight of the fourteen surgical incidents reviewed in this study were found to not have adhered to these five steps. Previous literature reported similar findings, with staff resources, workload and pressure all contributing to non-adherence.[27, 28, 39, 168, 169] The hierarchical culture within the field of surgery, where surgeons see themselves as the sole leader in the operating room team, also contributed to poor operating room practices.[43, 170] As highlighted by health improvement research, healthcare organisations need to foster a systems-oriented approach, and implement and design any safety initiatives with the aid of organisational leadership.[168, 171, 172]

The study found some surgical instruments were reported to have been faulty or in short supply. Previous research has also highlighted how equipment-related factors were a main contributing factor of surgical incidents.[18, 162, 163, 173] Our study also revealed, however, that the surgical and anaesthetic teams were not informed about faulty equipment or product shortages at the '*briefing and sign in' phase.* This is an important finding, since the multidisciplinary team as a whole are responsibility for ensuring that the operating room procedures are followed and

completed for every case. The use of faulty equipment needs to be recognised as a major risk factor within departments, documented in their risk registers, and promptly addressed. Our study also found that staff appeared to be unaware of the process for reporting faulty equipment or requesting new surgical instruments. Previous studies have described how the management decisions made around the amounts and servicing of surgical equipment have contributed to the occurrence of equipment-related incidents.[18, 173] Staff need to be more assertive and challenge higher authorities about poor practices, which include feeling pressurised to use faulty instruments due to equipment shortages. HROs, such as aviation and military, have used initiatives like Crew Resource Management to training staff in challenging their higher authority in unsafe practices.[174] More effort needs to be made by the NHS to help staff speak up and prioritise these safety initiatives so as to improve safety. [46, 175]

The study found the lack of effective communication and integration within multidisciplinary teams was perceived to have contributed to the occurrence of some surgical incidents. Previous research and national reports from the Health Foundation and NHS England have all highlighted the need for effective leadership and communication to help promote multidisciplinary team working in operating rooms.[23, 176-178] This includes continuously reviewing key operating room policies and procedures,[23] and ensuring that the roles and responsibilities of individuals within the team are clear.[179] The Royal College of Surgeons of England has developed training courses, such as *Safety and Leadership for Interventional Procedures and Surgery* for surgical teams to improve their inter-disciplinary working.[180] More interventions such as these need to be explored for the non-medical leadership teams so as to promote their roles and responsibilities in improving the safety culture in operating rooms

The study identified that interruptions and distractions impacted on individuals' performance and concentration in operating rooms. Previous studies have demonstrated higher levels of mental and physical effort during cases in which distractions have occurred.[181, 182] However, it is difficult to eliminate any sound or noises completely in operating rooms, due to the number of people involved and equipment used. The "sterile cockpit" principle has been piloted in healthcare

studies, involving cardiac surgeons and anaesthetists, where all but essential conversations or distractions were stopped during a critical phase of surgical procedure, such as in obtaining vascular access or intubating a patient, similar to the take-off and landing of a flight in the aviation industry.[181] [182] Every step in invasive procedures either in surgery or anaesthesia are deemed critical, efforts need to be made from all staff levels to keep noises and distractions to minimum.[13]

Based on the findings from the study the researcher proposes recommendations, illustrated in Table 4 below.

Table 4: Brief recommendations from the retrospective review.

Recommendations	**Content**
New or revised Trust policies or guidelines	A multidisciplinary working group needs to be set up to revise all theatre procedures and policies and develop standard operating procedures to clarify each theatre staff roles and responsibilities. This should be an ongoing process
Reinforcement in theatre practices with education and training	Reinforcing theatre practices to all operating theatre staff should be encouraged. Multidisciplinary team learning through education tools such as simulation.
Audit	Audits should focus on measuring the quality of implementation of procedures/processes, not just compliance vs non-compliance.
New systems and processes for surgical equipment and instruments	This includes robust maintenance and servicing of equipment and surgical instruments. Registers set up to track the servicing, maintenance, staff training and utility of each instrument in theatres.

	Integration and installation of all essential equipment in theatres should be robust and effective implementation of these services within theatres such as laboratory printers, theatre electronic records and in outbound integral areas such as in clinical laboratories.
Effective leadership	There should be open communication between the management and the frontline staff on safety practices and priorities. Interventions such as investment in inter-professional leadership training programmes should be explored.

Limitations

Only fourteen surgical incidents and related information recorded on the DATIX system was considered. This study also only included incidents which occur in either anaesthetic room or operating theatre room. Future research could consider incidents that occurred in the post-anaesthetic care or recoveries areas, which in turn might provide additional insights.

4.4 Summary and Conclusion

The study found multiple factors contributed to the occurrence of serious surgical incidents included this study, many of which related to human failures. Staff need to be more assertive and challenge higher authorities about poor practices, which include feeling pressurised to use faulty instruments due to equipment shortages. The use of faulty equipment needs to be recognised as a major risk within departments, documented in their risk registers, and promptly addressed.

The researcher further investigated the impact of these incidents on the staff involved, by carrying out a set of semi-structured interviews (chapter 6) at this research site. He explored the support staff received following an incident, and their change in attitude and behaviours. The following chapter provides further details about the methods used and the rationale for using them.

Chapter 5: Research Strategy: Methods, Design, Data and Sample Size

5.1 Introduction

Previous systematic reviews and empirical studies have shown how surgical incidents can have a profound impact on staff, which can negatively influence on their clinical performance and their provision of patient care.[52, 58, 66, 70-72, 89, 183-188]. The systemic review, detailed in chapter 2, identified three key significant gaps in literature: firstly, very little had been published on the impact of surgical incidents on the wider operating team beyond surgeons and anaesthetists. Secondly, it was unclear in what ways the surgeons, or any healthcare professionals might change their attitude or behaviour following a surgical incident. Thirdly, exploring what structured support systems are currently in place to help second victims to cope with surgical incidents.

The researcher conducted a qualitative study to explore the impact of surgical incidents on operating theatre staff (both medical and non-medical) and investigate how staff can learn from and be better supported following a surgical event. This included understanding the personal, professional and behavioural impact of surgical incidents on operating theatre staff and the challenges they faced while working in the operating theatre environment. The researcher also examined what follow-up support was offered to 'second victims' following a surgical incident and provided key learning points for healthcare organisations. This chapter describes the research methods used in this study.

5.2 Aim

To understand the personal, professional, and behavioural impact of surgical incidents on operating theatre staff (medical and non-medical) and support received following the event.

5.3 Qualitative research methods

A qualitative research methodology was chosen to address the study aims and objectives. This methodology allowed the researcher to explore operating theatre staff experiences of surgical incidents and the challenges they faced while working in this environment.[98, 108]

As the researcher is an experienced practitioner working in operating theatres, a constructivist-interpretative paradigm was chosen to enable the realities to be constructed through interactions between the researcher and operating theatres staff about the surgical incidents and their subsequent impact. The researcher's role was to consider the significance, meaning and implications of the data rather than starting the analysis with a pre-existing or existing theory.

The researcher considered the different qualitative methods that could be used to meet the research aim and objectives and align with the paradigms identified above.[189] Firstly, the use of surveys and questionnaires with textual responses can yield useful information about staff experiences of surgical incidents, but the opportunity to enquire further, based on staff responses, would not necessarily be present.[190] Furthermore, the likely low response rate and non-response bias within sampled healthcare professionals were also potential limitations of this approach.[190, 191] Secondly, as the study aim was to explore operating theatre staff experiences and the support they received following surgical incidents, performing observations of staff would not be particularly relevant or useful.[192] Focus groups with the multidisciplinary team could potentially yield rich narratives.[98, 190, 191, 193] However, due to the sensitive and confidential nature of the research topic, many operating theatre staff may not wish to disclose their emotions and feelings in front of work colleagues.[98, 193] In addition, the power dynamics within focus groups, such as having senior surgeons, theatre managers and senior theatre nurses along with more junior staff might make it difficult to facilitate. [98, 190, 191] Finally, operating theatres are busy working environments, and the scheduling of such focus groups may be challenging, due to staff shift working patterns, staff shortages and sickness.

5.4 Semi-structured interviews

For this qualitative study, the researcher chose face to face, semi-structured interviews to collect data as it offered flexibility and the potential for rich narratives.[190, 191] The researcher used a topic guide, which provided some structure during the interview alongside the flexibility to probe further for more specific information, if needed.[98, 191] This was particularly useful when obtaining a range of operating theatre staff perspectives across different surgical specialities. [189, 192]

5.5 The Study Site

This study was conducted at five teaching hospital sites within one large NHS Trust that provides multi-specialty surgical services, including emergency and major trauma, for around a million and a half people every year. This NHS Trust has over 12,000 staff and close to 2,000 bed capacity, spread over all hospital sites, and performed 40,000 elective and emergency operations in the year 2018/19.

5.6 Recruitment of participants

Inclusion criteria:

Any member of the multidisciplinary team working in operating theatres within the NHS Trust. This included any surgeons, anaesthetists, ODP's, Theatre nurses, Health Care Support workers with different levels of expertise working in different surgical specialities. These staff members did not have to have been involved in a surgical incident previously.

Exclusion criteria:

NHS staffs who do not work in theatres were excluded from this study.

The researcher targeted a range of healthcare professionals *i.e.*, surgeons, anaesthetists, theatre nurses, ODPs and theatre support workers, working at different levels across all specialities in

operating theatres for participation in semi-structured interviews. An email (Appendix 14) together with an information leaflet (Appendix 15) was sent by the researcher to all 976-theatre staff working across all hospital sites at the Trust inviting them to participate in the study. Purposeful sampling was employed to recruit relevant health professionals with varied experiences across the five hospital sites.[194, 195] Some 129 operating theatre staff were also identified through investigation records as being involved in a surgical incident and were contacted by e-mail. Posters were displayed on Trust noticeboards and restrooms promoting the research study, and a summary of the study was also presented to medical and non-medical staff who attended any one of four different audit days, and three quality and safety meetings. These meetings were also attended by patient safety advisors and managers involved in risk management and incident investigations between March and November 2018. A summary of the study was presented to the Trust's Safer Surgery Committee and Trust's Safety Culture Committee, chaired by the Trust Board of Directors, encouraging them to both promote and participate in the study. The Heads of Departments also attended these meetings; they were responsible for clinical governance, policy making, and overseeing the effectiveness of incident reporting and investigations within their own specialties, *i.e.*, a chief of service from anaesthetic department, chief of service or representative for all surgical specialties and lead nurse for theatre for all hospital sites.

5.7 Conducting the interview:

All interviews took place at a location of the interviewee's choice, and without the presence of any other individual or member of operating staff. Participants were given a detailed information sheet (Appendix 15) prior to the interview date and have the opportunity to ask the researcher any questions about the study before signing an informed consent (Appendix 16) and filling in participant demographics form (Appendix 17) prior to conducting the interview. It was explained to the potential interviewees that entry into the study was entirely voluntary and that they could withdraw at any time. Interviews were conducted with participants at a convenient time, taking into account their clinical commitments within theatres. A standard interview topic guide

(Appendix 18) was used to help guide the interview. Questions in the topic guide were informed by a literature review, and consultation with patient safety and qualitative research experts. The interview schedule was piloted with four experienced theatre nurses for face validity, and included general questions on the possible causes of surgical incidents, the effects these incidents had on the participant, strategies they used to cope with the incident, any change in attitude and behaviour following the event, and their perspectives of the culture of learning from incidents at both an organizational and individual level, and relevant prompts. All interviews were conducted by a single researcher (NS), audio recorded, transcribed verbatim, and analysed.

5.8 Sampling:

Theoretical sampling was used at the later stages of the participant recruitment process when more significant unconsidered issues within the research context were emerging during the data collection process.[98, 191] For example, when a majority of participants mentioned the impact and lack of transparency within the investigative process following incidents, the researcher further purposefully recruited clinical governance lead and patient safety managers within the department. Furthermore, the participants sometimes guided the researcher towards potential recruits (snowball technique) who had previously been involved in surgical incidents and / or were perceived to possess more knowledge in the area of study.[196]

A summary of participant details, including identification code and experience, is given in Table 5. Direct quotes from the participants were used and written in chapter 6 (Results and themes). The quotes used are entered using italics and in quotation marks. Following each quote, participant profession and their code (their unique ID number) will be signposted in brackets to maintain anonymity, for example (Anaesthetist, P18). To improve the flow and legibility within the participant's quotes, brackets such as (….) were used within a quotation. Likewise, to add meaning or correct grammar from few quotes, additional information is included in square brackets '[…]' to aid readers understanding. E.g., *"We can accept that it [surgical incident] is a one-off and we aim to learn from the incident.*

5.9 Data Saturation

The concept of data saturation is an important consideration in terms of study sample size and depends on a number of different factors, including how homogenous or heterogeneous the population is that is being studied, the resources available to carry out the study, and whether there are any key stratifiers (e.g., surgical roles and specialities in this case) that are important for an in-depth understanding of the topic being examined.[191, 194] A number of different articles and book chapters have recommended anywhere between 5 to 50 participants, as adequate.[194] We took the approach to continue data collection until identified themes started to repeat themselves and no new themes emerged.[197, 198]

5.10 Eligibility criteria

Operating theatre staff, both medical and non-medical staff, working in different surgical specialities at the study site (NHS Trust) were eligible to participate in the semi-structured interviews. Any NHS staff who did not work in theatres were excluded.

5.11 Ethical Approval

The study was classified as a service evaluation by a University Ethics committee and Health Research Authority and registered as such within the organisation (research site) concerned (IRAS ID: 237980/1158905/37/907). Relevant approval forms are provided in Appendix 12(service evaluation) and Appendix 13(University Ethics Committee research approval).

5.12 Data analysis

The researcher conducted a reflexive thematic analysis with the aid of the qualitative data analysis software, NVivo Version 12.[199, 200] This type of analysis was selected (and other

types of approaches ruled out) for a number of reasons. Firstly, the researcher already had some preconceived ideas and knowledge in the research area, having worked previously as an ODP, and so the use of grounded theory was considered less appropriate.[98] Secondly, an interpretative phenomenological approach could yield rich narrative descriptions of operating theatre staffs' lived experiences on the impact of surgical incidents.[98] However, the aim of this study was to go beyond simply describing staff experiences following surgical incidents, but also explore the support offered to the staff following incidents and generate future recommendations. Unlike other qualitative approaches, a reflexive thematic analysis enabled the researcher to use a flexible theoretical approach in analysing data.[198] The steps involved in this analysis process are discussed below:

5.12.1 Step 1: familiarisation with the data

This phase involved the researcher initially reviewing, sorting and managing the data using the NVivo software. The researcher listened to the audio recordings and read the field notes multiple times to familiarise himself with the depth and breadth of the content. The researcher also checked the transcripts, which were transcribed by the expert transcriber, against the original audio recordings for accuracy. This first step helped the researcher get closer to the data and get a sense of the key perspectives and opinions shared by staff.

5.12.2 Step 2: Generating initial codes

After familiarising himself with the data, the researcher generated a list of labels or codes for the data. This involved the researcher identifying a feature of the data that they considered important or relevant, tagging or coding the selected text using the NVivo software. An inductive coding method was used, creating a list of first order and second order codes, which was stored in the NVIVO database.[201] This helped structure the data for further analysis. Appendix 19 gives an example of the codes applied. A selection of transcripts were also coded independently by the researcher's supervisor, and the codes compared and further discussed.

5.12.3 Step:3 Generating initial themes

This phase involved the researcher sorting the long-list of codes into potential themes or patterns. This involved reading the data in fine detail and making a decision about whether single or multiple themes existed. Consideration was given throughout this reviewing process to the study objectives. A workable list of main and sub-themes was compiled and applied systematically to the whole dataset. This index or thematic framework was continually refined and applied again to the already labelled data in all interviews to ensure consistency.

5.12.4 Step 4: Reviewing themes and interpreting the data

The researcher tried to make sense of the data by looking across each theme, for example `personal and professional impact', and understanding the range of views and experiences shared by interviewees. Patterns were investigated and relationships between the different staff levels (*e.g.*, personal and professional impact and nature of the incident) were noted. Eight main themes where identified, discussed with study supervisors and further refined. The researcher was particularly concerned about whether the data within each theme came together in a meaningful way, identified linkages in the data and explored why such linkages had occurred. These linkages were displayed on a series of maps to further improve understanding and clarity. [201] The researcher began to build explanations for these recurring patterns and associations in the data.

5.12.5 Phase 5: Defining and naming themes.

This phase involved the final refinement of each theme by analysing each theme in detail. The researcher actively re-read the data set within each theme and identified the essence of each

theme and their relationship to other themes generated. Each theme is then defined and named based on the ‘story’ each theme conveyed.

5.12.6 Phase 6: Writing up or producing the report:

The write up of the themes generated are provided in chapter 6. The chapter provides the narrative analysis with data extracts embedded within them. Further, it provides sufficient evidence of the themes within the data with data extracts to demonstrate the prevalence of each theme. O'Brien et. al (2014) reporting guidelines were used to design and report the findings. The Standards for Reporting Qualitative Research (SRQR) aims to improve the transparency of all aspects of qualitative research proposed by providing clear standards for reporting qualitative research.[195] A strength of these approaches and methodologies enabled for flexibility and adaptability throughout the research process especially during the data collection and analysis process. [195]

5.13 Reflexivity

The researcher kept a research journal when carrying out data collection and analysis. He recorded personal reflections and noted any biases or preconceptions that he may have held on ‘second victims’ so that these could be considered when analysing the data. The researcher worked in operating theatres for more than 16 years and this experience has very likely influenced his thought processes. As a healthcare professional, he was also involved in a surgical incident and felt empathy towards those who shared similar experiences. He took time to reflect on his transcripts and discussed the content with his supervisors, three being healthcare professionals and the other a non-health professional. The researcher also presented his findings to safety experts in attendance at both national and international conferences.

5.14 Summary

This chapter outlines the qualitative research study aim and objectives. It provides an overview of the researcher's choice of methods and his rationale to use them in order to achieve his research goals. The chapter further briefly outlines the researcher's consideration of validity, reliability, reflexivity, and applicability throughout his research process. At the end, the researcher described his different phases he took to analyse his data.

The results of the qualitative study with participant details and themes extracted from the data analysis will be described in detail in the subsequent chapter (chapter 6)

Chapter 6: Results, Themes and Main Findings

6.1 Introduction

Following the data analysis from chapter 5, this chapter will outline the number of participants recruited for the research study, their job title in a tabular column (table 5) followed by a detailed focus on the main themes generated from analysing the data.

6.2 Results

Forty-five face-to-face interviews were conducted between February 2018 and December 2018, with each interview lasting between 30 to 75 minutes, with an average duration of 45 minutes. Participants represented a wide range of theatre roles and specialities, included eight surgeons, eight anaesthetists, twelve theatre scrub nurses, nine ODP's and eight theatre support workers from different surgical specialities and across all five hospital sites. Seven respondents who were senior managers in operating theatres and involved in clinical governance, patient safety incident investigations, and staff management, were also selected. Table 5 gives details of the specialities and grades of the different types of healthcare professionals interviewed.

Table 5 below gives details of participants in the qualitative study.

Participant number	Staff job title	Age	Years qualified
Participant 1	Theatre Scrub Nurse	40-44	12
Participant 2	ENT Consultant Surgeon	55-59	22
Participant 3	Trauma and Emergency Consultant Anaesthetist	55-59	24
Participant 4	Vascular Theatre Nurse	30-34	09

Participant 5	Senior ODP	45-49	18
Participant 6	General Surgery Consultant	50-54	20
Participant 7	Theatre Support Worker	45-49	06
Participant 8	Obstetrics Surgical Trainee	30-34	06
Participant 9	ODP	20-24	04
Participant 10	Theatre Support Worker	55-59	28
Participant 11	Theatre Scrub Nurse	20-24	02
Participant 12	Anaesthetist, Senior Registrar	35-39	12
Participant 13	Theatre Support Worker	55-59	22
Participant 14	General Surgery Registrar	35-39	12
Participant 15	Theatre Scrub Nurse	20-24	01
Participant 16	Orthopaedic Consultant Surgeon	55-59	19
Participant 17	Theatre Support Worker	25-29	02
Participant 18	Anaesthetist, Junior Registrar	30-34	09
Participant 19	Theatre Scrub Nurse	35-39	10
Participant 20	Vascular Consultant Surgeon	50-54	16
Participant 21	Theatre Scrub Nurse	45-49	05
Participant 22	Theatre Support Worker	60-64	29
Participant 23	Trauma and Emergency Anaesthetist, Junior Registrar	45-49	12

Participant 24	Theatre Support Worker	20-24	01
Participant 25	Paediatric Consultant Anaesthetist	44-49	08
Participant 26	Senior Orthopaedic Nurse, Theatre Co-ordinator	55-59	12
Participant 27	Vascular Consultant Surgeon	55-59	16
Participant 28	Theatre Support Worker	35-39	08
Participant 29	Paediatric Theatre Nurse	35-39	06
Participant 30	Theatre Scrub Nurse	20-24	01
Participant 31	Obstetrics Senior Nurse	45-49	12
Participant 32	ODP	20-24	02
Participant 33	Paediatric Consultant Anaesthetist	50-54	09
Participant 34	Orthopaedic Theatre Nurse	35-39	05
Participant 35	Consultant Anaesthetist	55-59	12
Participant 36	Senior ODP	55-59	35
Participant 37	ODP	35-39	14
Participant 38	Theatre Support Worker	25-29	05
Participant 39	Senior ODP	30-34	10
Participant 40	Obstetrics Surgeon, Registrar	40-44	12
Participant 41	ODP	45-49	09
Participant 42	Senior ODP	40-44	12

Participant 43	Consultant Anaesthetist	55-59	26
Participant 44	Lead Theatre Nurse	55-59	29
Participant 45	Senior ODP	60-64	34

6.4 Generation of themes

Finally, four overarching themes were generated from the data:

1) the profound impact of surgical incidents.
2) the support offered to operating theatre staff following a surgical incident.
3) the practices and challenges of working within operating theatres; and
4) Learning Process : learning from surgical incidents and participants' recommendations for policy and practice development.

This chapter further will focus on the above four overarching themes that were generated from the data. The ***first*** of these four themes have been published (The researcher is the main author and contributed to all the sections of this published work with the support of fellow authors): ***Serou, N., Slight, S.P., Husband, A.K., Forrest, S.P., & Slight, R.D. (2020). Surgical incidents and their impact on operating theatre staff: qualitative study. BJS Open, 5(2). Doi: 10.1093/bjsopen/zraa007*** (Appendix No: 20) The ***second*** theme has been published (The researcher is the main author and contributed to all the sections of this published work with the support of fellow authors): ***Serou, N., Husband, A.K., Forrest, S.P., Slight, R.D., & Slight, S.P. (2021). Support for Healthcare Professionals After Surgical Patient Safety Incidents. Journal of Patient Safety, Publish Ahead of Print. Doi: 10.1097/pts.0000000000000844*** (Appendix No: 21)

6.5 The profound impact of surgical incidents on operating theatre staff

Operating theatre staff, both medical and non-medical, expressed a range of different negative emotions following their involvement in surgical incidents. These included anxiety, concern,

awkwardness, increased self-doubt on their abilities, confusion, disgust, empathic pain, fear, extreme guilt, nostalgia, and sadness. These negative emotions appeared to affect medical and non-medical theatre staff both personally and professionally and were related to the cause and severity of the incident, the outcomes for the patient, the investigation process and the support they received following surgical incidents. However, a few participants reported on how surgical incidents have helped them in terms of increasing their awareness, attentiveness and being more cautious, thus having a potentially positive effect on their overall ability to perform their role.

6.5.1 Personal and Professional impact

Most of the theatre staff interviewed felt that surgical incident(s) impacted on them both personally and professionally. One member of the junior theatre staff described how it had a *"very big impact on [my] personal life and on [my] professional life"* (Theatre Scrub Nurse, participant 15), influencing the way she worked and the subsequent work-related decisions that she made. A junior ODP also described how it affected her on a *"professional and a personal level"* and caused her to question her, *"…ability to do my [her] job [and] therefore [I] had a low esteem"*.(ODP, participant 32) Another junior theatre staff member also described how it, *"…made me doubt in my abilities to be a scrub nurse, to count, to see with [my] eyes, to trust what my eyes are seeing".*(Theatre Scrub Nurse , participant 19)

Several participants in the study highlighted how the negative emotional impact could be either short or long lived. In the short-term, the negative impact included loss of confidence, personal life interference (social impact), anger, anxiety, sadness, worrying about their job and career progression, sickness and depression. In the long-term, the incident appeared to impact negatively on the health professional with a loss of trust and/or confidence in their own abilities and/or being over cautious or risk-averse in clinical practice. One general surgery consultant described feeling quite sad about surgical incidents that had happened in the past and having to deal with it on his own and in his own way:

"All surgeons have their own personal cemeteries as I call them. There are things that happened to [in] my career that I feel quite sad about in terms of poor patient outcomes, I may have made a bad decision, the wrong call or given a patient a complication or something may have happened that's completely out of my control, but you know as a consultant, you know you have to basically 'carry the can' so to speak, which is what we do and you have to deal with it in your own way, by yourself".

(General Surgery Consultant, participant 6)

A vascular theatre nurse described how recalling the past incident evoked feelings of anger and frustration:

"Last year a patient was anaesthetised and is on the operating table and all of a sudden during the 'time-out' phase of the Surgical Safety Checklist we realised that the patient did not sign the consent form. Surgery was cancelled and the patient was rescheduled. It is a massive surgical incident due to negligence from the team as no one checked the patient consent form before putting her to sleep. It really infuriated me; I was really mad on that day and even now".

(Theatre Scrub Nurse, participant 4)

It was noted how the same or similar surgical incidents could occur more than once, with one consultant anaesthetist recalling that:

"we can accept that it [surgical incident] is a one-off and we aim to learn from the incident. If the same incident happens again in a month and again in a two-months' time, then it is very depressing".

(Consultant Anaesthetist, participant 43)

The consultant also felt a duty of care towards these patients, explaining how:

"…the very reason these patients are on the operating table is for the surgeon to take a tissue or part of the body for further investigations and they rely on it for their treatment and prognosis, and we lost them [specimens]".

(Consultant Anaesthetist, participant 43)

A theatre support worker in the same theatre also described the range of emotions he experienced when a cancer specimen was lost, including guilt, sadness, anger and rage. He recalled how the patient was:

"A very, very big gentleman who was singing NHS praises, he was like "you guys are amazing, you know you're so valued" and what not and then unfortunately [he's] the one patient who actually says these things [and] ends up having his sample [cancer specimen] lost".

(Theatre Support Worker, participant 24)

This theatre support worker felt that staff were reluctant to admit responsibility due, in part, to the apportion of blame:

"For members of the team sometimes I think people think "I'm glad it's not me that did it" or that they can start to think "well I'm not to blame" and "I'm not taking the blame" and they may sort of like put the blame on others."

(Theatre Support Worker, participant 24)

Another senior ODP described feeling "extremely guilty" when a child was anaesthetised, and their operation was subsequently cancelled due to a lack of equipment in theatres:

"The team members that were involved in it, I know we felt extremely guilty for the fact that the child was put to sleep and woken up again. We felt that we had overlooked our responsibilities" and "*felt like we were going to get in trouble because of what had happened so there was quite a negative impact on us as a team".*

(Senior ODP, participant 39)

One ENT consultant described building up a *"professional relationship with patients"* when he met them in clinic, prior to surgery. He drew a comparison with *"theatre staff, who would [only] have seen the patient on the day of surgery",* (ENT consultant Surgeon, participant 2) and consequently felt that the impact of a surgical incident might be greater for medical staff both emotionally and professionally.

An anaesthetist registrar recalled how the impact of surgical incidents felt by theatre staff might be related to the associated risks of the procedure. She gave two examples, one where the patient had an American Society of Anaesthesiologists (ASA) risk grading of 4 *(i.e., patient with a severe systemic illness that was a persistent threat to life)* and passed away during the procedure. She recalled how *"even though, the death in theatres was termed as a surgical incident, my emotional reaction was less negative as we did everything for the patient and is surgically a [high] risk patient".* (Anaesthetist Registrar, participant 12) However, in the second incident, the patient, whose ASA grade is low (less than 2) had been given *"a regional block on the wrong side of his leg before surgery. The surgery was performed, and the patient had severe post-operative complications. I was devastated, speechless and the negative emotions I had at that time were severe because it should have not happened".* (Anaesthetist Registrar, participant 12)

6.5.2 The impact of the investigation process

Several participants highlighted that they felt that there was a lack of transparency in how the investigative process was conducted following surgical incidents. One junior member of theatre staff explained how she was "*not asked to do anything, not scrub, not even for simple cases"* (Theatre Scrub Nurse, participant 11) after she was involved in an incident and worried about the long-term implications that this would have on her career. Another junior member of theatre staff

explained how she *"did not know what was going on"* (Theatre Scrub Nurse, participant 30) during the investigative process, with *"the most stressful bit [being] because there's a belief around that the surgeons will always try and wriggle themselves out of it and then lay the blame on the scrub staff or on the theatre staff"* .(Theatre Scrub Nurse, participant 30) One junior ODP felt that the investigative process had impacted on their professional relationships with other staff as well, explaining how the:

> "*investigation outcome had created a huge barrier between the anaesthetist and us. It was morally very wrong, all theatre management knows about it, but no one wants to raise this, as the investigation is done by a senior clinician"* .
>
> (ODP, participant 41)

6.5.3 Positive consequences or impact

It is important to also note that despite the overwhelmingly negative experiences of surgical incidents, several participants emphasised how surgical incidents had helped them in terms of increasing their awareness, attentiveness and/or being more cautious, with one junior ODP recalling:

> *"I took a positive spin on it [surgical incident] of being more cautious the next time, over checking and being more thorough in my checks and I think it had a positive effect on my overall ability to perform".*
>
> (ODP, participant 32)

One senior ODP explained how it had a positive long-term impact on their professional practice:

> *"Professionally, it developed me as a practitioner, which I am now, out of that adversity it made me cautious, and from early point of my career, I was able to measure what is [was] expected of me. I always reflected on this incident and always happy to share this incident with people"*.

(Senior ODP, participant 5)

A junior ODP described how she became *"more conscious at checking and rechecking expiry dates, equipment availability, just overall patient safety and safeguarding"*.(ODP, participant 37) One anaesthetic registrar spoke about how he initiated "the Stop before you block" initiative after the surgical incident and this was included in theatre practices:

> "…*I was thrilled and pleased as my incident had a positive effect on the theatre practices. I have even given a speech in conference on my project. It really helped me to cope with my initial negative emotions".*
>
> (Anaesthetic Registrar, participant 18)

6.6 Support operating theatre staff received following surgical incidents

Operating theatre staff received different amounts of support following a surgical incident. Three sub themes emerged from the data within this theme, including (a) the sources of support: peers, friends and family, (b) the timing of the support, and (c) the challenges of the investigation process.

6.6.1 Sources of support: peers, friends, and family

Medical and non-medical theatre staff pointed out that the first 'go to' person after a surgical incident was their peers. One senior ODP described the theatre staff like *"…a close knit…"* community and how discussing the incident with colleagues really helped her (Senior ODP, participant 45). One obstetric surgical trainee explained how she had *"a good chat"* with her senior consultant, who had been *"involved in a similar incident."* (Obstetric Surgical Trainee, participant 8). A junior Ear Nose and Throat (ENT) surgeon also recalled how his senior surgeon described

"his own experience and the lessons he [had] learnt" from previous incidents and how it made him feel that he was not alone. (ENT surgeon, participant 2).

Surgeons and anaesthetists felt that the Mortality and Morbidity (M&M) meetings were places where surgical incidents could be discussed, and support provided to those who were involved. However, one general surgeon highlighted how these meetings were *"more as team learning exercise, which is good, but not enough for individual emotional support*".(General Surgical Registrar, participant 14) One trauma consultant anaesthetist noted how several members of the multidisciplinary team did not appear to be invited to her M&M meetings and she wondered what their opinions would be on a particular incident:

> *"…what a surgeon, theatre nurse or an ODP or even a HCA take [would be] on this particular incident. Because we work in theatres as a team and when an incident happens it is good to learn as a team as well."*
>
> (Trauma and Emergency Consultant anaesthetist, participant 3)

In most centres, medical staff have their own separate M&M meetings during audit days. In the study many participants, especially the anaesthetists found these meetings helpful to learn from incidents. One anaesthetist registrar expressed her positive experience in being part of M&M meetings.

> *"I think the M&M meetings are very useful, the clinical lead reads out each incident recorded for the last two months and we discuss about those incidents one by one and few senior anaesthetists give their view point and experiences in relation to each incidents. We learn as a team and share our viewpoints individually, it's a very good learning exercise"*
>
> (Anaesthetist registrar, participant 12)

Many surgical team members highlighted that their M&M meetings vary in consistency depending upon the speciality clinical leads workload and priorities. One Obstetrics and gynaecology surgical trainee expressed his experience of M&M meetings.

> *"Honestly, it all depends upon our boss (speciality clinical lead), if he wants, he calls for a quick working meeting to discuss incidents. In addition, if the meeting does happen we discuss incidents which happen only in our speciality, not often we hear about incidents reported in other specialities. It is important, as we can relate those incidents and learn from them"*
>
> (Obstetrics and Gynaecology surgical trainee, participant 8)

Most non-medical theatre staff who attended the M&M meetings did not really feel like they discussed the surgical incidents in any great detail, but rather focused on *"theatre efficiency, utilisation and targets"* (ODP, participant 37). However, another theatre lead nurse felt that, as an organisation, the hospital had *"moved on and they are [were] now taking incidents seriously" (*Lead Theatre Nurse, participant 44). He was aware of a group of people*:*

> *"…called CONTACT who are [were] independent to your [her/his] department and they can offer you support in terms of listening to your concerns and show where you need to go [for support]."*
>
> *(*Lead Theatre Nurse, participant 44).

Some surgeons and anaesthetists reflected on how it was sometimes very difficult to accept support following incidents as they felt that it may be perceived as a "*weakness in not being tough enough to handle things"* (General Surgery Consultant, participant 6). Similarly, a consultant anaesthetist explained how: *"We got used to working in this tough competitive professional*

culture and I can understand why my fellow colleagues and juniors might not accept to receive support" (Consultant Anaesthetist, participant 43).

He also pointed out how:

> *"This is when the seniors need to step up and talk to them individually and give them support […] again [hospital] trusts need to do their part in regulating practices to support these staff"*
>
> (Consultant Anaesthetist, participant 43).

Although family members played an important role in supporting second victims, some participants felt unable to discuss the incident with them, as they felt that they would not understand. One senior ODP highlighted how his *"wife and university friends really helped [him] and reassured me [him], allowing me [him] to cope with what was a difficult period"* (Senior ODP, participant 5). The same senior ODP also reflected on how he was only three weeks into his job at the time of the incident and felt that he was not close enough to colleagues to discuss the incident with them. A junior anaesthetist also recalled how she needed the *"emotional support"* from her *"loved ones"* (Junior Anaesthetic Registrar, participant 18) to help her through it.

6.6.2 The timing of the support

Theatre staff emphasised the importance of receiving personalised support soon after their involvement in a surgical incident. We found variation in the support received by medical and non-medical theatre staff, with most non-medical staff receiving little support and guidance when compared to surgeons and anaesthetists. One junior ODP described feeling completely isolated, not knowing *"… who to speak to"* (ODP, participant 41), with a senior ODP recalling how *"no one came to talk"* to her or give her any emotional support that she "so desperately" needed.*(*Senior ODP, participant 36) A theatre nurse explained how she would have appreciated a *"…one-to-one chat with my [her] manager and get some assurances that everything will be OK" (*Theatre Scrub Nurse, participant 30) In fact, instead, she recalled being told by her manager to speak to her

union. In contrast, one surgical registrar described how she felt *"very supported and reassured"* when her senior colleague, a consultant surgeon, who took her aside to their office and suggested that she *"take a day off and get relieved from the on-call and night duties in coming months".*(Obstetrics Registrar, participant 40) Many participants described how having a debrief with team members following a surgical incident was helpful for them. One junior ODP recalled how her team *"discussed and reflected"* (ODP, participant 9) on the particular incident and felt better afterwards as she was "*not the only one who is [was] feeling this way"*.(ODP, participant 9) Similarly, a theatre nurse described how "*an excellent anaesthetist, who is well respected by all and always looks after theatre staff and advocates for safety in theatres"* had facilitated the debriefing and she felt *"very supported"* (Theatre Scrub Nurse, participant 1). A consultant anaesthetist also described how the support needs to be personalised and include emotional, professional or both. One vascular surgeon emphasised how the welfare of those involved in the surgical incident needs to *"be followed up on [a] consistent basis"* (Vascular Consultant Surgeon, participant 20). This was echoed by a senior orthopaedic theatre nurse who described the need to *"constantly check"* whether colleagues involved in the incident were *"coping well"* (Senior Orthopaedic Nurse, participant 26).

6.6.3 The challenges of the investigation process

Theatre staff, both medical and non-medical, expressed frustration both at the lack of support they had received and how the investigative process was conducted following surgical incidents, with some finding it quite stressful. They described the need for a transparent investigative process, with clear steps and what support they can expect to receive during it. They also felt it would be helpful to know who is leading the investigation, who is the point of contact, and the timeframe over which it was going to be carried out. One theatre support worker recounted how the investigative process was not explained to her and that *"a little bit more clarification in [about] what steps will be taken"* would have been helpful; in particular, she sought for reassurances that she would not lose her job (Theatre Support Worker, participant 28). One junior ODP recalled her

frustration in completing the required investigation reports and how she was repeatedly asked for more details:

> *"Irrespective [of] how many times I write it, it is going to be the same thing, that frustrated me a lot and [for] once I haven't seen this investigator apart from receiving emails."*
>
> (ODP, participant 32).

Some participants were instructed not to discuss the details of the surgical incident(s) with anyone outside the investigative team. This left one theatre nurse feeling very isolated:

> *"I was not allowed to share it [incident] with anyone […] it had an adverse emotional impact on me. My manager does not want to discuss the incident nor want me to talk to anyone about it as it is under investigation, and I didn't know who to approach to and talk to"*
>
> (Theatre Scrub Nurse, participant 15).

A senior anaesthetist also described feeling: *"All alone in the whole process"* and recalled how she *"didn't know what to do or who I can [she could] speak to. […] It looked like at the time no one wants[ed] to talk to me or support me"*

*(*Consultant Anaesthetist, participant 35).

A theatre nurse received guidance from his theatre clinical educator, who advised him to stick to the facts when completing the necessary paperwork: *"it's not any wishy washy stuff because if you don't put out the truth or you don't put out the facts and it doesn't stand up to scrutiny you're going to be in a big mess".*(Theatre Scrub Nurse, participant 30) Non-medical staff felt that investigations following surgical incidents were often biased towards the medical theatre staff and that a blame culture existed. One senior theatre nurse described how she was *"completely shocked"* when she read the investigation report:

"The surgeon completely blamed the incident on my poor theatre nurses, when it was the medical team's responsibility to position the patient prior to surgery. Pointing the finger at one group of staff following an incident is very unethical, it happens a lot in theatres, surgeons get away with murder and they blame us for whatever happens (theatre nurses)"

(Lead Theatre nurse, participant 44)

Non-medical theatre staff described how a member of the medical team usually led the investigations following a surgical incident and this could possibly lead to bias:

"The biased and discriminative nature of these investigations is too obvious, it is not about what happened during the incident, it is who you know in Medical Director's office".

(Senior ODP and theatre manager, participant 36)

One senior anaesthetist expressed her disbelief in the allocation of the investigators and the lack of transparency in the investigation process following a surgical incident.

"I know one instance, few years ago, where an incident happened in theatres, where a well-known surgeon was involved and guess who carried out the investigation for the incident, his very dear medical pal, we all know they go for drinks every Friday night and we all were in disbelief and one can understand how the incident might have been conducted. No learning points and we didn't even hear about it in our M&M meetings or team meetings"

(Consultant anaesthetist, participant 43)

There was also a feeling amongst participants that managers could treat individuals differently following a surgical incident. One junior theatre nurse recalled being treated differently to another colleague who was involved in a similar type of incident:

> *"nothing happened to that colleague; they were not given any competencies to work on and given a day off the next day, for me nothing".*
>
> *(Junior theatre staff, participant 34)*

All participants stressed that investigations should be fair and transparent and conducted in the presence of a lay person to reduce bias. One senior orthopaedic theatre nurse said:

> *"I strongly believe that the investigations are very biased towards surgeons and anaesthetists because their colleagues (medical) conduct the investigations and at the end the blame falls to the nurses and ODPs. The trust needs to appoint a lay member for each serious incident and be open and transparent at every stage of the investigation process".*
>
> (Senior Orthopaedic Nurse, participant 26)

Furthermore, many participants felt the need for managers to explain the investigation process to their staff that have been involved and provide regular updates. One theatre nurse who was involved in the surgical incident explained how:

> *"I need to know what going to happen now, what's the process? Who is going to contact me, can I come to work tomorrow? How long the investigation takes? What are the steps in investigation? These points need to be discussed to staff so that they are well informed and it is likely to reduce stress and anxiety levels"*
>
> (Theatre Scrub nurse, participant 30)

Most of the participants felt that the trust (healthcare organisation) needs to have a clear guideline or policy on serious incidents and never events, which provides details on how they will be investigated and the point of contact for any queries. They have also stressed the importance of making it mandatory to support staff. One vascular surgeon said;

> *"The Trust needs to put forward a policy in how serious incidents will be handled and supporting affected staff following incidents need to made mandatory with the lists of support available according to individual circumstances and choice. More often staff support gets diluted or not even seen as priority following surgical incidents"*
>
> (Vascular Consultant Surgeon, participant 20)

6.7 The practices and challenges of working within operating theatres

In many cases, the depth of negative emotions and the support received was perceived to be related to the practices and challenges specific to individual operating theatres. This relates to communication , teamworking , leadership, staffing , workload, and maintenance of surgical equipment in operating theatres.

6.7.1 Communication and teamwork in operating theatres

Many participants highlighted how inadequate communication between members of the multidisciplinary team in theatres were contributing factors. One senior theatre nurse described one particular surgical incident that occurred, where "*all of a sudden*", in the middle of the patient operation, the surgeon "*asks for things which are [were] not discussed and starts [started] shouting, "you should know this, this is basic".* (Theatre Scrub nurse, Participant 21) She reflected on how there was an opportunity during the morning briefing "*to discuss the theatre list for the day and the instruments and care needs for the patient" (*Theatre Scrub nurse, Participant 21*)* prior to the patient case; however, the need for this specific piece of equipment was not highlighted or discussed. She felt able to address the situation but worried about her junior staff,

explaining how *"they will [would] be terrified and there will [would] be no one to protect them if I was not there (in operating theatres) as their leader" (*Theatre Scrub nurse, Participant 21*).* Another nurse who worked in trauma and orthopaedic theatre also described a similar incident whereby:

> *"All of a sudden in middle of the surgery the surgeon wants [wanted] an x-ray, but there is [was] none available in the department as they are booked by other operating lists and all of a sudden they started shouting at us and get[ting] impatient".*
>
> (Theatre Scrub nurse, participant 11)*.*

She described herself as a *"junior nurse"* who looked around to see if she could find any *"…senior member to address this"* and in the end took it on herself to *"try to manage"* the situation (Theatre Scrub nurse, participant 11). She recalled feeling guilty and worried about the patient as *"the patient is [was] anaesthetised"* (Theatre Scrub nurse, participant 11). Again, this incident came without any advanced warning and she recalled how the need for a possible x-ray should have been discussed during the briefing at the start of the theatre list. Many participants felt that briefings prior to and debriefings after the surgery were not always conducted, with one theatre support worker expressing his frustration:

> *"In theatres, by law, you're meant to debrief and it doesn't happen. There are so many times we have to call surgeons or bring them back in [theatres] because debrief has not been completed at the end of all surgical procedures. The reason the surgeon was called back is because at that time we had a good team leader and made the surgeon to comeback...can you imagine (the surgeons reaction) if me or junior staff calls them back from changing room?"*
>
> (Theatre Support worker, participant 38)

One junior ODP interviewed in emergency theatres felt that managers needed to show leadership and support their junior staff by communicating effectively with them about whether they had received the necessary training and appropriately followed theatre policies and procedures.

> *"Whether it be a manager or senior staff, they need to communicate with you such as "do you need support?" "What's happened?" "What's going on?" Or someone even saying to you "Have you guys received training for this? Have you guys done this and that?" I think going forward then you definitely have to look into communicating far more, managers maybe sitting down with senior nurses and members of staff and saying "Please ensure that this and that is being done".*
>
> (Theatre Support Worker, participant 28)

Some participants highlighted how they had experienced a breakdown in communication during crucial phases of patient handover within the operating department. A senior anaesthetist explained how they thought that poor communication could have a huge impact on patient safety in theatres.

> *"If there's a break down in the communication chain, A will have told B about patient's allergy, but B forgets to tell C, C didn't hand over to D and then the whole chain it's like whose fault is it? Oh, I was not told I did not know about it but B was informed, oh that's B but B didn't tell anybody. So, there are so many things that we could prevent with communication and you find out that once we miss a tiny bit of it, even if it's that 1% communication breakdown can cause harm, serious even near death to the patient".*
>
> (Senior Anaesthetist, participant 35)

Some participants felt that any policy or procedural change should be communicated clearly to all levels and in a timely manner. One consultant anaesthetist described how he had received an email from the clinical lead requesting that a "no brief, no start" policy be implemented. He

supported the change saying how it was a *"very good concept",* but highlighted how he received the e-mail *"on a Friday afternoon to be implemented from Monday morning";* this created a problem as:

> *"By Monday morning not all consultants were made aware of this and there were huge miscommunications and arguments within the teams at the time".*
>
> (Trauma consultant anaesthetist, participant 03)

A senior theatre nurse also expressed similar concerns about how the communication needed to *"happen better"* across different hierarchical levels, including "*from the Medical Director's office to the Division" and from the "Division to the Speciality Leads" with the "Speciality Leads [needing] to ensure that every single one of their consultant body is aware of what the rules mean".*

(Senior theatre nurse, participant 44)

6.7.2 Leadership in operating theatres

Both medical and non-medical theatre staff felt that having an effective team leader or co-ordinator in theatres had a positive impact on communication. All participants stressed that effective leadership in theatres was important and resulted in a feeling that things "were under control", and that safety procedures were being followed. Junior theatre staff felt that there was a change in attitude from surgeons and anaesthetists when the theatre co-ordinator, team leader or an educator was present. A newly qualified ODP described how:

> *"I couldn't believe [it], my co-ordinator was working with us on that day we had briefing and debriefing at the start and finish of the theatre list and normally it would not happen with this surgeon, it is usually a hit and miss!!".*
>
> (Junior ODP, participant 41)

Staff also experienced what they regarded as *"effective leadership"* from anaesthetists in emergency and trauma scenarios. One anaesthetic registrar described how good communication was not just vital amongst the theatre team, but also the wider team in the hospital, and explained how:

> *"I have seen consultant anaesthetists to get all members of the theatre staff to stop what they are doing and facilitate a quick brief of any changes in emergency theatre list and what we planned to do next. That's very vital when we are working in a fast paced environment [in theatres] I am very lucky to work with efficient anaesthetists in this hospital who are very good at this and take charge and importantly communicate vital information to all staff in theatres. Quite brilliant".*
>
> (Anaesthetist registrar, participant 12)

6.7.3 Staffing in operating theatres

Many surgeons and anaesthetists felt that the lack of adequate staffing and /or experienced staff in theatres had a detrimental impact on the level of care provided to patients. One ENT surgeon highlighted how working *"in theatres requires a lot of technical and non-technical skills and we need the staff on [a] consistent basis to work in [the] same speciality".*(ENT surgeon, participant 02) He reflected on the lack of consistency in his own speciality: *"one day I work with excellent scrub nurses and ODP's with great skills, and [then] I will not see them again". (ENT surgeon, participant 02)* Similarly, a senior anaesthetist also expressed her frustration in working with different theatre personnel explaining how *"sometimes I will be forced to work with this newly qualified ODP and I need to keep an eye on their work, letting them know what to do next every time"* (Consultant anaesthetist, participant 43). The participant also stressed that as a mentor and trainer, she is *"duty bound to train and support new staff"* but argued that there should be *"more structure in training them [newly qualified staff] by allocating them to less busy theatres to start*

with and then have a smooth transition to specialised theatres such as Obs and Gynae [Obstetrics and Gynaecology]". (Consultant anaesthetist, participant 43) She also emphasised the need to *"boost confidence in new staff"* by consistently working in one theatre with similar surroundings before being rotated to other speciality theatres. (Consultant anaesthetist, participant 43)

A paediatric anaesthetist explained how theatre staff need to be *"well equipped with knowledge and skills to perform their duties, as things [can] go awkward very quickly with children. The last thing I need is newly qualified personnel assisting me who isn't confident in helping me out". (*Paediatric anaesthetist, participant 25*)* A trauma consultant anaesthetist also emphasised the importance of having a consistent team in theatres so that *"you understand how people work, you understand people on a personal front and you kind of get a flow"* (Trauma and Emergency Consultant anaesthetist, participant 3). According to her, errors were more likely to happen "*if you don't really know who you're working with or they don't know who they're working with and they don't know what they're doing"* (Trauma and Emergency Consultant anaesthetist, participant 3). She described working with the same ODP in the day care unit who was "really good" as she could be relied upon:

> *"I don't have to think that much I just have to concentrate on my job and he concentrates on his job. I don't have to ask them to send for a patient, I don't have to ask them to put the patient on the trolley, I don't have to say look can we do fluids, I don't have to ask them to help me put a drip in, I don't have to ask for my drugs, I don't have to ask for some suction, I don't have to ask for oxygen tubing, … it's just done".*
>
> (Trauma and Emergency Consultant anaesthetist, participant 3).

One senior theatre coordinator described how staff shortages can impact on the consistency of the team, as "*with the current staff levels I need to allocate at least two newbies with a senior staff to learn from them, I know it is not ideal and adds pressure to my senior staff but that's how*

it is" (Senior Orthopaedics nurse, theatre coordinator, participant 26). Another senior ODP and theatre manager recalled how some surgeons have complained to him about how they *"have never seen this theatre nurse working with me [them] before" and how they "don't want her".* (Senior ODP and theatre manager; participant 36). He was of the opinion that "*every health professional has a duty to share knowledge and support the team, rather than complaining that they did not work with their favorite ODP"* (Senior ODP and Theatre manager, participant 36).

One junior ODP described what it was like to get moved around from one theatre to another, and how he became frustrated when "*all of a sudden in the middle of the week"* he was assigned to a different theatre and found that it *"was not stocked up with enough drugs and theatre products"*. (Junior ODP, participant 09) Another junior qualified nurse also expressed her frustration at being asked to work nights in emergency theatres, when she felt that she had not been allocated enough time to consolidate her basic theatre skills in general surgery theatres.

> "*Everyone has a different learning curve, as a newly qualified nurse I am doing well in general surgery theatres and all of a sudden I was assigned to work at nights in emergency theatres, I was really cautious that night and was shouted [at] by a fellow night staff colleague, who expected me [to] know everything while working at nights, I don't blame her, all the confidence I restored was completely diminished in one night".*
>
> (Theatre Scrub Nurse, participant 15).

Another newly qualified nurse highlighted the importance of effective mentoring and support for new staff members for their smooth transition to working nights and on-call duties. She described how she was:

> *"lucky to work with a very good senior sister who always have [had] time for learners, I learnt a lot. Within months I was able to work at nights and participate in on-call duties. I think it is all to do with effective mentoring and support for new staff members in theatres during initial stages"*

(Theatre Scrub Nurse, participant 04).

Several staff, however, welcomed the chance to be rotated between theatres as they felt it gave them opportunity to learn and develop new skills. One junior ODP pointed out how she *"like[d] staff rotation policy"* as she perceived it important for career progression: *"I don't want to be in Band 5 in one theatre for the rest of my career, I want to move on quickly by learning new skills"* (ODP, participant 32). Another theatre nurse was of the opinion that being multi-skilled was *"a curse"* and described how *"the staff current perception is that we will get used and abused if you are multi-skilled".* (Theatre Scrub Nurse, participant 30) Conversely, a theatre coordinator acknowledged how she relied upon her senior staff who were multi-skilled but acknowledged how:

> "*it is not fair to overburden my staff, staff shortages are always discussed in theatre management meetings, it is not just this trust, it is everywhere".*
>
> (Senior Orthopaedics Nurse, Theatre coordinator, participant 26).

6.7.4 Workload in operating theatres

Both medical and non-medical theatre staff felt that tiredness or even exhaustion was one of the key contributing factors of surgical incidents. One senior anaesthetist reflected on her experience of doing *"on average 14 gynecology cases a day"* and how they needed to work at a *"constant quick pace"*. (Consultant anaesthetist, participant 43) She acknowledged that this can lead to the team getting tired and it only takes *"one member of the team to lose concentration for an error to happen".* (Consultant anaesthetist, participant 43) Other participants also pointed out how staff did not often receive their allocated rest time but felt pressurised into completing their operating lists rather than stopping for a break. One junior ODP described starting at 8 a.m. in the morning

and working until 4 p.m. with no break. He was told that "*due to staff shortages",* there was no one that could cover his break and that he would need to organise his own breaks:

> *"…but how? Other members had their own work commitments, if it was not for my resilience, I could have quit this job or even profession"*

(ODP, participant 41)

Theatre staff also highlighted that many of the surgical incidents that occurred may have been due to surgeons and anaesthetists rushing between cases. One theatre nurse explained how she felt pressurised by surgeons to complete important tasks, such as the count process quickly, as they:

> "*always want to finish the list in a hurry and do not wait for the count process or specimen labelling to be completed. Without the count process been [being] completed, they send for the next patient [to be] anaesthetised in the anaesthetic room and they rush everyone up"*.

(Theatre Scrub Nurse, participant 15)

6.7.5 Surgical Equipment

Almost all of the participants in the study pointed out that the lack of appropriate equipment or equipment failures contributed to the occurrence of surgical incidents; some of these failures were perceived to be due to poor maintenance and servicing, although this was not confirmed. One senior anesthetist recalled a surgical incident where:

> *"the surgical scissors needed to incise the neonate larynx was not sharp enough so the surgical team need[ed] to open and use 12 different scissors, which led to surgical bleed and resulted in airway compromise and that nearly led to fatal death to the kid. "*

(Paediatric Anaesthetist, participant 33)

The ENT surgeon, who was involved in the same surgical case, described how he had:

> "…*raised this issue numerous times to [the] theatre manager and theatre in charge about the blunt scissors but nothing was done, we nearly lost the kid"*
>
> (ENT surgeon, participant 2)

A theatre scrub nurse, who was also involved in the same incident, explained how she

> "*filled in DATIX [incident forms] numerous times regarding blunt instruments but no action had been taken, I nearly quit that job after that incident"*
>
> (Theatre Scrub Nurse, participant 15)

One junior ODP explained how there was "*always an issue with infusion pumps either one or the other does not work" (ODP, participant 32)* and she found it very frustrating as she had to *"run over [to] different theatres or sometimes different department to borrow the equipment".* (ODP, participant 32) Similarly, a senior anesthetist found it *"very infuriating"* when the anaesthetic machine she was using would often break down during surgery. She explained how they used these machines day in day out and "*so it is a basic necessity for the theatre management to service these machines every often"*. (Consultant anaesthetist, participant 43)

6.8 The Learning process

6.8.1 Learning from surgical incidents

All participants in the study highlighted the importance of learning from surgical incidents. They stressed how learning should happen at all levels: individuals, teams, managers, departments and organisations.

6.8.1.1 Individual learning

It was viewed as important for health professionals to reflect on their own actions and practices following the occurrence of surgical incidents. One senior orthopaedic theatre nurse stressed how individuals should reflect on the incident(s) but take responsibility for their actions:

> *"When incidents happen, theatre staff need to question themselves on what happened? What [is] supposed to happen? Why that did not happen? and what would I do and improve in future that this kind of incident will not happen again? These simple reflection processes will help staff to learn from incidents. I did it and I am doing it for the past 30 years, it worked for me, and I keep telling everyone"*
>
> (Senior orthopaedic theatre nurse; participant 26)

A senior cardiovascular surgeon also emphasised how individual reflection was key to learning from these incidents; this included the 'soft' or non-technical skills, such as poor communication and poor situational awareness.

> *"It's not just the technical aspects of the incident where one can say you need more training, what about the non-technical skills?? Like poor communication, poor situational awareness which could have led to that incident. Theatre staff needs to reflect on these soft skills, improve and relate them to their daily work activities to reduce surgical incidents"*
>
> (Senior Vascular consultant, participant 20)

One of the junior anaesthetic registrars highlighted a specific patient safety case which was reported in the media (Bawa-Garba case); she pointed out how the reflections of a specialist registrar on the care that she had provided to a child (recorded in her own e-portfolio) were used against her in Court and led to their removal from the General Medical Council (GMC) register (This was later overturned).

> *"What about the current Bawa-Garba case? She got stuck off from GMC and the reflections she written in her own e-portfolio were used in the court to strike her*

off. This is awful, and how one could even think of reflecting in future following incidents?"

(Anaesthetist registrar, participant 18)

One junior theatre nurse, who was involved in a surgical incident soon after qualifying, took the perspective that human errors cannot be avoided, and that the most important thing was to learn from them:

"In university, we had lessons and then had an exam, in health care we have the exams [experience of getting involved in an incident] first and then we got to learn from them"

(Theatre Scrub Nurse, participant 15)

6.8.1.2 Team learning

All participants emphasised the need for shared learning (as a team or group) following a surgical incident. This could be conducted in a formal or informal way, and in a timely manner after the incident. One general surgery consultant highlighted the importance of the debriefing process to facilitate team learning.

"We have the debriefing process which we need to do at the end of each theatre session or end of the theatre list. That time will be an ideal opportunity to discuss if any incidents happen during surgery and thus, we could learn from incidents as a team, we often do this in our theatres when I am the chief operating surgeon"

(General surgery consultant, participant 6)

Several staff highlighted how the morning briefing prior to the commencement of surgery might also provide an opportunity to discuss incidents that happened the day before and the principle learning points. One senior anaesthetic trauma consultant highlighted how such discussions can be valuable in identifying recommended changes to improve practice:

> *"We in emergency and trauma theatres when we are having this multidisciplinary team meetings in the morning, we discuss the patients to be seen for the day but also discuss if there were any incidents from yesterday or any other incidents investigated and are there any learning points from them, recommended change in policies and procedures etc. It helps everyone to learn from these incidents and I always make sure that it happens"*
>
> (Trauma and Orthopaedics Consultant Anaesthetist, participant 3)

The quality of these briefing and debriefing sessions was also questioned, with one theatre nurse highlighting the importance of engagement from key medical staff:

> *"we had this wonderful multidisciplinary team meeting before and after the theatre list, briefing and debriefing, we discussed about the incidents and our practices etc., it really motivated me, and I have learnt a lot about incidents and how we can improve our practices. The reason I believe it happened is because we got very good anaesthetist and surgeon who promote briefing and debriefing, and they have very good leadership qualities. In another theatre, it is very inconsistent; we do not have these sessions [briefing and debriefing]"*
>
> (Theatre Scrub nurse, participant 11)

A senior ODP and theatre manager described how these "constructive and useful" discussions could also take place during theatre audit days: *"I make sure important learning comes out of*

those discussions". (Senior ODP and Theatre Manager, ODP participant 33) However, attendance at these theatre audit days was questioned by one theatre scrub nurse who recounted how she had *"been in this theatre department for 6 years and I have attended audit theatre meetings only once"* (Theatre Scrub Nurse, participant 30); this was mainly due to service requirements, allocations and shift patterns. Another theatre nurse shared a similar perspective and highlighted how it would be useful to share the minutes of these meetings with those theatre staff who could not attend:

> *"I usually work nights and weekends because of my personal reasons, and I feel isolated from what happened in theatre meetings. It will be useful if someone could email the minutes of the meetings, incidents reported and safety messages"*.
>
> (Obstetrics theatre nurse, participant 31)

One vascular theatre nurse highlighted how it might be useful to share the learning points with staff who work in other theatres:

> *"We heard that a serious incident did happen in general surgery theatres, we in vascular theatres would like to know what the learning points from the surgical incidents are and how we could relate them to our theatres moving forward. It is always a hit and miss, some incidents will be shared to us, and some will be not"*
>
> (Vascular theatre nurse, participant 4)

Many theatre staff stressed the importance of learning from near misses and moderate incidents rather than just serious incidents and never events. One general surgery consultant explained.

> *"In our M&M meetings and quality and safety meetings we usually highlight the serious incidents and spend time on it. Whilst they are important, it is also*

important to look at the near misses and investigate the patterns, they would lead to serious incidents"

(General Surgery Consultant, participant 6).

6.8.2 Participants' future recommendations:

All participants made some recommendations on how health professionals affected by surgical incidents should be better supported. One senior anaesthetist described how she was not *"in favour of a structured supporting system"* but that managers should provide personalised support *"based on their [the individual's] needs"* (Consultant anaesthetist, participant 43). Others felt that a structured supporting system would be beneficial, and recommended that counselling services, a mandatory break following the surgical incident, and pastoral care be offered to the individual, if necessary. Such support should not be viewed as a "one off"; one senior orthopaedic nurse suggested that the individual should be followed up over time:

"We need to make sure that the staff are handling the situation [aftermath of the incident]. We should constantly check whether they are coping well with the incident, it should be soon after the incidents, couple of hours after the incident, a day after the incident or a week after the incident or even a month after incident. The incident will have a knock-on effect for the rest of their lives"

(Senior Orthopaedic Nurse, participant 26)

Several participants suggested how managerial staff should also nurture a more open culture by spending more time on the "shop floor" and listening to the views and concerns of staff.

"Managers need to come down to clinical areas and look at what happening, they need to address the issues at ground level and deal with them. They need to show effective leadership skills to listen to us and address our concerns"

(Theatre Scrub Nurse, participant 21)

They also recommended a robust training programme for new staff members to ensure competence and familiarity in the relevant surgical specialities together with the availability of a peer mentor for guidance. One orthopaedic surgeon said:

> *"We as clinicians are happy to help the new theatre staff, but there should be a smooth and structured transition of the new staff coming into the surgical specialities and make sure they are assigned to one theatre surgical speciality on a consistent basis before they could be rotated elsewhere. What is the point in keeping them for one week in orthopaedic and next week in vascular theatres, what are they going to learn?"*

(Orthopaedic surgeon, participant 16)

Most participants recommended clear guidelines on how theatre instruments, equipment and the theatre environment are maintained. One junior ODP described how it is important to keep *"a record of when the instrument [has] being serviced. Are there any repairs? Is it been reported, who is going to follow it up?"*

(ODP, participant 32)

Most participants recommended the need for theatre staff to take appropriate breaks, with one lead nurse stating that these breaks should be made mandatory:

> *"Staff breaks should be mandatory, irrespective [of whether] you are surgeon or a HCA they need to take periodic breaks and not rush to complete the theatre lists. Managers and policy makers need to incorporate this in our theatre standard operating procedures"*

(Lead Theatre Nurse, participant 44)

Most of the participants recommended managers and investigators be trained in how to deal with serious incidents and to support staff. A few participants recommended training from human factors experts in how they deal with incidents and how they learn from them. One trauma consultant anaesthetist said;

> *"We need to have patient safety experts and human factors experts in healthcare to train our managers in how we manage and learn from incidents. Research and documentaries have proved that they make a significant impact on team learning and shared learning following incidents".*
>
> (Trauma and Emergency Consultant anaesthetist, participant 3)

Finally, it was also recommended that the undergraduate curriculum for other medical and nursing students needs to place an emphasis on clinical governance and the occurrence of medical errors. One lead theatre nurse described how students "*need to be given examples or stories from medical staff about the incidents and what they have done following the incident and how it [the incident] had an impact on them".* (Lead Theatre Nurse, participant 44)

6.9 Summary

This chapter described the four overarching themes and sub-themes from the interviews conducted with medical and non-medical theatre staff who were involved in surgical incidents. The following chapter highlights the significance of these research findings in light of what was already known about the research problem being investigated, the strengths and limitations of the study, and the key recommendations and implications for policy and practice that have emerged.

Chapter 7: Review of the Main findings, Discussion and Conclusions

7.1 Introduction

This chapter considers the findings from our qualitative study (Chapter 6) along with the other studies conducted as part of this PhD, and how this work has contributed to this growing research area. The findings highlight the substantial impact incidents had on participants, the challenges faced working in operating theatres, and the need for support and learning following surgical incidents. This chapter describes the main findings of this PhD study and interprets and highlights the significance of the research findings in light of what was already known about the research problem been investigated, explaining any new understanding or insights that emerged. This Chapter also reflects on the strengths and limitations of the study, and the researcher's role during the whole research process. Finally, practical recommendations for support and learning following surgical incidents are listed and ideas for future research discussed. Few sections in this chapter are used in the five published research articles mentioned above (Page 16), to which the researcher is the first author and contributed to all sections of the published articles with the contribution from fellow authors (PhD supervisory team)

Several key findings emerged from this PhD work including:

1) the profound impact surgical incidents can have on operating theatre staff, both at a personal and professional level. This related to both the incident itself and how incident was handled. Many participants experienced negative emotions associated with the surgical incident, irrespective of their professional role and years of experience (Chapter 2, 6).
2) the lack of adequate emotional and professional support provided to staff following surgical incidents. Non-medical operating theatre staff appeared to receive less or no support when compared to that provided to medical staff. Although family members played an important role

in supporting second victims, some participants felt unable to discuss the incident with them, fearing that they might not understand (Chapter 2, 6).

3) a culture of blame was felt to exist. Some investigations were clinician-led, which created suspicion amongst those being investigated and staff questioning how much information they should disclose (Chapter 2, 6).
4) challenging and disruptive behaviour from surgeons and theatre management staff. These behaviours seemed to negatively impact on communication amongst team members, team performance and contribute to low staff morale (Chapter 2, 4, 6).
5) hesitancy amongst operating theatre staff to raise concerns and challenge poor theatre practices. These concerns centred about using faulty equipment before the start of surgery and non-adherence of Surgical safety checklist by the medical and non-medical operating theatre staff(Chapter 2, 4, 6).

7.2 Consideration of this PhD study findings in relation to previous research

7.2.1 The impact of surgical incidents

Consistent with previous research, participants described their negative emotions associated with surgical incidents. This was irrespective of their profession and their years of experience.[52, 58, 66, 67, 70, 89, 187, 202, 203] These negative emotions could be mapped to the six stages of recovery for second victims described by Scott *et al*.,(2010) with most participants experiencing confusion shortly after a surgical incident, followed by the need to re-evaluate the incident before seeking support, worrying about what others might think of them in clinical practice, and finally moving on or *surviving* the surgical incident. [204] Appendix 22 provides examples from the data mapped to each of the six stages of recovery.[53, 204] Previous studies have also used this post-event trajectory to compare staff responses to patient safety incidents and showed many similarities.[51, 53, 66, 67, 204] Policy makers and healthcare leaders can use this post-event

trajectory, which is largely predictable, as a basis to implement interventions at each stage of recovery, from immediate support to long term support, while developing second victims support programmes. A recent report from the Healthcare Safety Investigation Branch (HSIB), hosted by NHS England and NHS improvement, has suggested addressing not only the emotional needs of staff but also the root cause of the incident during the investigative process.[205] This can be beneficial to those affected, as they have the opportunity to provide their perspectives on both the incident and ways to improve practices within the department. [205]

The majority of study participants (Chapter 2, 6) described the overall impact as long-lasting, with some referring to the incident as a memory that will linger with them forever. The severity of the negative emotions experienced appeared to depend on the nature and severity of the incident, patient outcomes include any harm to the patient or readmission to surgery, causative factors, support received and investigative process. Participants felt that the negative impact following a 'preventable' or avoidable surgical incident was very profound, when compared to incidents that were perceived as non-preventable or inevitable. The above aspects are a consistent finding in the literature in other clinical specialities such as medicine and paediatrics.[66, 67, 70, 72, 89]

Operating theatre staff adopted different coping strategies following the surgical incidents, with the most frequent being talking to or obtaining support from their peers. Some participants chose to be extra vigilant in their future clinical practice and aligns with the findings of a cross-sectional online survey, which showed that more than 80% of doctors were keen to improve their practices following an event.[206] Consistent with previous research, some participants in the study (chapter 6) highlighted how surgical incidents had helped increase their awareness and attentiveness, and was related to the support they received.[67, 70, 185, 207] Previous literature emphasised the importance of critical reflection on one's own professional practice following errors and how this is relevant for professional growth and development.[208-211]

7.2.2 Support following incidents.

This PhD study highlighted that staff need to be supported immediately after an event, during the investigation process, and also over the long term. Most participants highlighted a lack of adequate emotional and professional support following these incidents, similar to other studies in the literature.[64, 65, 72, 85, 88, 183, 184, 186, 206, 212-214] When provided, the support was not felt to have been personalised to the individual's needs, with non-medical theatre staff appearing to receive little or no support when compared to their medical colleagues. This might be due to the organisational hierarchy structure within the NHS, where nursing and allied health professionals can be underrepresented at senior managerial levels or on Trust Executive Boards.[215] It is important that all professional groups are represented, with leaders sensitive to healthcare professionals' concerns. However, the existence of bureaucratic leadership and disciplinary culture has also been reported amongst nursing and allied health professions when compared to medicine and surgery.[216] It may be that nursing leadership is too hierarchical and finds it difficult to endorse transparency as opportunities for learning rather than fall into a name-blame-shame cycle and needs to move away from a rigid disciplinary culture. [216]

Consistent with previous research, participants turned to their peers for both emotional and professional support. [65, 72, 85, 217] Colleagues shared an understanding of the professional responsibilities, work environment, challenges, and pressures that one could face in operating theatres. The support of work colleagues has been recognised in the literature as important, and understanding for those placed in an unfamiliar position.[86, 218] Senior healthcare professionals should be proactive in offering support to junior colleagues, and empathise with their own experience(s). [64, 65, 219, 220] These experiences appeared to resonate with participants who felt comforted by the fact that they were not alone.[221-229] This sharing of experiences and 'open discourse of incidents', especially by senior medical and surgical colleagues, has been encouraged to promote learning.[221-229]

NHS Improvement has recommended training managers and senior clinicians on key leadership skills, with more emphasis on empathy so as to support staff health and wellbeing.[12] This training was provided to staff in peer support programmes, such as Resilience in Stressful Events (RISE), for second victims in USA.[230] However, some participants in this study (Chapter 6) described their reluctance to seek support as it could be perceived as a sign of weakness. It is important to recognise that most surgical incidents occur due to multiple contributing factors,[231] and managers and senior clinicians need to reassure colleagues and stress the importance of learning from events.

Both medical and non-medical staff in this study described how they needed emotional and professional support soon after the incident occurred. The Scott Three-Tiered Interventional Model of Support highlighted the need to provide individuals with immediate emotional support following an incident, followed by peer-to-peer or one-to-one support, and then further access to professional counselling and guidance during the investigation and legal processes.[232, 233] This could take the form of a 24/7 rapid response call line run by trained healthcare professionals on victim support, such as the *forYOU team* established by University of Missouri Health Care, which is available 24/7 for staff. This was operationalised by training 10% of hospital staff as peer supporters with all shifts, specialities and disciplines represented.[233]

As Scott *et al*. (2010) highlighted, second victims could either (a) *drop out*, by leaving the profession or workplace, (b) *survive*, by living with the discontent that an error has been made and/or (c) *thrive*, by coping with the negative event and help to make a positive change. Inadequate support systems hamper the reconciliation process, as it can potentially damage the second victim's self-confidence to practice and lead to apprehension and seclusion.[53] Equally, a supportive culture helps second victims discharge negative emotions, admit accountability, and make positive changes in practice.

Many participants (chapter 6) mentioned the lack of written guidelines on support for staff following surgical incidents. The NHS long term plan recommended all NHS Trusts work with regional Integrated Care Boards (ICBs) ,previously called Clinical Commissioning Groups

(CCGs) ,on protocols for the management and support of staff in such situations, under their Health and Wellbeing Framework.[234] The US based Medically Induced Trauma Support Services (MITSS) Toolkit contains a range of resources for organisations interested in providing emotional support to their staff following a patient safety incident[51]. Organisations could adapt similar peer support programmes and resources and formulate their own support programmes for second victims.

7.2.3 Investigations

Most of the participants in the study (chapter 6) reported inadequate organisational support during investigations and, when support was received, they felt it was often disorganised and incoherent. Ullström et al described how staff should be provided with an overview of the investigation by giving them adequate information on the steps of this process, the support they need during investigation, professional reassurances and arrange for a follow up after the conclusion of the investigation.[89] The Serious Incident Framework published by NHS England in 2015 described the importance of developing an investigation process within organisations for identifying serious incidents correctly, investigating them thoroughly, and learning from them so as to prevent similar incidents happening again.[3] This study found that, even though organisations may have developed these processes, there were still challenges around how they were carried out. The Patient Safety Incident Response Framework by NHS England and NHS Improvement stressed the importance of transparent investigations with clear set time frames and a strong focus on learning throughout the process.[68] It further highlights the importance of adopting a systems approach and appointing lay members to conduct and facilitate investigations.[68] Stewart et al(2015) described recruiting well-trained investigators, who were in a neutral relationship to the management and department, from different clinical areas, where the incident has taken place.[58]

7.2.4 Staff Behaviours, Challenges and Practices in operating theatres.

Participants witnessed challenging and disruptive behaviour from surgeons and theatre management staff, which appeared to negatively impact on team performance and staff morale. Aveling et.al (2018) and Keller et.al (2019) described how surgeons can target those who work close to them, making team members feel anxious and reluctant to speak up or raise concerns.[235, 236] Stone et. al (2019) in his mixed method study on surgeons behaviour, further highlighted the negative impact of disruptive behaviours and negative criticism on staff performance and burn out.[237] Shouting and bullying of theatre staff have previously been reported in cardiac theatres, with surgeons taking more of an authoritative leadership style , which is interpretated as negative or aggressive approach inducing fear and anxiety on operating theatre staff, giving less opportunity to raise concerns and opinion that might relate to patient safety.[235, 237] Flin et.al.(2007) and Yule et.al. (2006) indicated that there are no formal systems or tools for tackling disrespectful behaviours and further identified gaps in surgical training, which lack focus on non-technical skills. Previous quality improvement (QI) work in healthcare, such as Aveling et.al. (2012), emphasised the use of interventions such as clinical community approaches for collecting and acting on team members feedback, teamwork and culture assessments along with robust performance appraisals to tackle healthcare professionals technical and non-technical competencies.[171] NHS England in their Healthcare Leadership model, also emphasised inclusive, co-ordinating learning and above QI innovations to influence local culture.[238] This PhD findings highlighted how frontline staff often failed or struggled to speak up on poor practices in operating theatres. Previous studies have highlighted how speaking up and challenging authority can put frontline staff in a vulnerable position.[239] Education interventions, such as simulated scenarios, have increased the likelihood of speaking up. [239, 240] These interventions on speaking up and challenging higher authority need to be incorporated within both undergraduate and postgraduate training courses.[241]

7.2.5 Use of Simulation for non-technical skills

The Royal College of Surgeons of Edinburgh established a non-technical skills for surgeons (NOTSS) programme in 2006, in which they focus on five main categories: situation awareness, decision making, communication ,teamwork, and leadership.[106] This training programme was not mandatory, and efforts need to be made in terms of how such programmes could be promoted and/or implemented locally and perhaps extended to other medical and non-medical theatre staff. Higham et.al (2017) focused on the use of simulation training for non-technical skills in anaesthetic practice and found that it delivered significant benefits in team performance and patient outcomes.[143] Parsons et.al (2018) proposed simulation-based CRM course in emergency resident trainee curriculum, which showed marked improvement in their CRM skills such as problem solving, communication, teamwork, resource utilisation and leadership. [144]

7.2.6 Lack of consistency or continuity within operating theatre teams

Many surgeons and anaesthetists in this PhD study felt that the lack of adequate staffing and/or experienced staff in theatres had a detrimental impact on the level of care provided to patients. Aveling et.al. (2018) and Stone et.al. (2017) found that the surgeon's behaviour was influenced by the lack of confidence in the technical competence of non-medical theatre staff and working with unfamiliar theatre staff, with some surgeons adopting authoritarian interpersonal behaviours.[235, 237] Consistency in teams, where team members work together on a regular basis, improved team bonding and provided positive outcomes in clinical environments.[9, 242, 243] Staff shortages and high staff turnover in the NHS makes it challenging to have continuity in teams, especially in operating theatres.[234] Moreover, disagreements between the medical theatre staff and management can have negative impact on the team dynamics.[147, 235]

7.2.7 Operational issues and lack of surgical equipment

Almost all of the participants in this PhD study pointed out that the lack of appropriate equipment or equipment failures contributed to the occurrence of surgical incidents. Reason J (2005) described how non-medical theatre staff were unfairly blamed by surgeons because of the equipment problems caused by system defects, which were out-with their control[244]. This caused considerable strain on interpersonal relationships and behaviour when reported issues were unresolved.[244] National Patient Safety Agency (NPSA) encouraged management staff to use a risk register to detail all risks identified in the department.[245] In addition to the DATIX recording systems, these risk registers identify patterns in, for example, the ordering, storage or servicing of equipment, the potential likelihood of their reoccurrence, action taken and the personnel or team responsible for overseeing them.[245] Decision-making and priorities in theatres should be more safety driven i.e., the emphasis being more on increasing safety in theatres rather than on reaching theatre targets in productivity and utilisation. HROs prioritise safety over other goals, allocating extra staff and resources where needed, and relaying a consistent messaging that safety is equally or more important than other business objectives.[75]

7.2.8 Non-adherence of five steps of safer surgery

The PhD study found that there are inconsistencies in the adherence of five steps of safer surgery, which resulted in poor communication and team work contributing to surgical incidents and poor staff morale. NHS England (2014), Vickers (2011), Bergs (2014), Hill et.al (2015), Giddins (2010), Kaderli et.al (2013), and Norton et.al(2015) highlighted how the five steps of safer surgery are intended to address or control many of the challenges listed above in operating theatres.[23, 25, 27, 34, 35, 246, 247] These five steps have been shown to improve communication, teamwork, staff morale and patient safety [32, 33, 36-42]. The briefing is the ideal opportunity for the operating team to share patient specific information, equipment required, and discuss any complications anticipated during surgery. [29]These sessions will help the theatre team to prepare and plan for the right equipment and the required staff needed with appropriate skill mix for the

procedure. Debriefing after surgery can provide an opportunity to clarify any misunderstandings that occurred.

7.2.9 Interpersonal team learning

This PhD study found that 'interpersonal team learning' following surgical incidents had a positive influence on operating theatre staff. This finding is consistent with the literature, where healthcare professionals wish to express their personal views about the incidents and obtain reassurances, as well as learn from incidents. [54, 56, 57] Participants found M&M meetings useful to openly discuss incidents; others believed that they should be interprofessional and questions why some non-medical colleagues were not included in these discussions.[54, 56, 57] Medical and non-medical staff work together as a team in operating theatres and, as such, all surgical incidents should be discussed as a team in order to understand *where* errors might have occurred and *what* changes need to be put in place to prevent these occurring in the future.[248] The segregation of medical and non-medical staff at M&M meetings at the study site needs to be reviewed and a more collaborative approach taken to promote cross-disciplinary learning. They need to restore these M&M meetings as educational forums where medical and non-medical theatre staff have the opportunity to share their perspectives.[248] Further, studies from Keller et.al (2019), Mitchell et.al (2013), Stewart et.al (2011) and Wakefield et.al (2010) found that the complexity of the surgical procedure and degree of urgency contributed to the tensions within the teams and triggered aggressive behaviours, especially from the surgeons.[236, 249-251] Further, Stone et.al. (2017) suggested that the surgeons gain a deeper understanding of the impact of their behaviours.[237] Not all operating theatre staff who participated in this PhD study were fully aware of theatre meeting updates or safety messages following investigations and had limited access to training programmes, due to their working patterns *i.e*., being part time and working nights .Technology such as e-learning was proven to be efficient for staff learning and dissemination of important messages in large organisations.[252-254] All theatres policies and theatre updates could be embedded within an e-learning platform and make it mandatory for all

theatre staff (medical and non-medical) to complete them, with compliance monitored and discussed during their annual appraisal or revalidation.

7.2.10 Leadership

This PhD study found that there was a lack of openness and transparency in how the investigative process was conducted following surgical incidents leading to a loss of confidence in managers. As Pinto A (2013) and Reason J (2005) highlighted, adverse incidents are rarely the fault of any one individual, but instead result from the combination of human and organisation failures working within a faulty system and culture.[56, 244] Participants highlighted that whenever pressure built up, surgeons wanted staff to work faster, even if it means taking shortcuts. This pressure to get more done in less time can led to surgical incidents and some of these incidents resulted in harm to patients. If staff are being encouraged to work unsafely then one might question whether it is unjust to discipline them when things go wrong.

Participants highlighted that poor system failures, poor theatre resources equipment, and leadership contributed to most of the surgical incidents in some way. For example, when the theatre management was faced with a situation where they was a lack of theatre resources and a shortage of staff, they tended to focus on operational targets and goals.[129, 161, 255, 256] NHS England guidelines on just culture emphasise that there should be a change in behaviour in healthcare staff to make safety a priority.[12] For this, effective leadership is required, where frontline staff feel able to share concerns with management on safety practices and priorities. Organisations themselves need to foster a work ethos of 'psychological safety' in theatres, whereby any member of staff can openly discuss poor practices and challenges that they have faced without being reprimanded, so that new ways of working can be considered.

The Royal College of Surgeons of England has developed training courses, such as *Safety and Leadership for Interventional Procedures and Surgery* for surgical teams, to improve inter-disciplinary working.[180] These training courses focus on improving open communication, transparency, adaptability and importance of setting a positive example to others in theatres.

These are the fundamental principles for effective inter-disciplinary working and interventions such as these need to include non-medical colleagues to address and support their roles and responsibilities in promoting safety culture in theatres. This study further found that operating theatre staff prefer to discuss and to get reassurance from their peers, friends and family following a surgical incident. The Healthcare Safety Investigation Branch also highlighted the importance of leaders recognising the 'moral injury' that results following incidents, and the anxiety and fear that follows while being investigated after an incident. [205]

Applicability and Relevance

The findings from this qualitative study cannot be generalised. However, an attempt has been made to increase the applicability or transferability of the findings by recruiting a large sample of multidisciplinary healthcare professionals with varied experiences and staff grade working in five different teaching hospitals within one large NHS trust.

7.3 Strengths and weaknesses of the study

This research provides detailed insights into operating theatre staff experiences following a surgical incident. This is the first qualitative study in UK to explore the impact of surgical incidents, not only on surgeons and anaesthetists, but on the wider operating team such as theatre nurses, ODPs and theatre support workers. Our findings have been supported by previous research in the wider field and highlight issues around the support second victims received and the underlying organisational cultural issues, which had a detrimental effect on the operating theatre staff. However, there were also some important limitations as we only included staff who worked in either the anaesthetic room or operating theatre room. It is possible that staff working in pre-assessment and post-anaesthetic care units or recoveries might have given further insights on the topics explored. That said, we included a range of multidisciplinary health professionals of different grade and with varied experiences. Even though the research work was conducted in

one of the largest Academic Health Science Centres in the country, it is acknowledged that the findings may not be generalisable to other hospital trusts or settings.

7.4 Reflexivity and the role of researcher

The researcher worked for 16 years in operating theatres and across several different specialities, including General Surgery, Orthopaedics, Plastics, Paediatrics, Obstetrics and Gynaecology, Ear Nose and Throat, Cardiothoracic, Vascular, Urology, Emergency and Major Trauma. He started his role as a Senior Clinical Practice Educator in operating theatres at the research site in May 2014 and reviewed near 100 critical incidents reports prior to starting and alongside his PhD programme of work. The researcher can vividly recall the frustration and anxiety experienced by staff who were investigated following a surgical incident, and these experiences have very likely influenced his thought processes. Furthermore, the researcher also experienced being involved in a surgical incident and feel empathy towards those who have had similar experiences. The researcher drew on these experiences as a healthcare professional when interpreting the data collected as part of his PhD programme of work and regularly discussed them with his supervisory team.

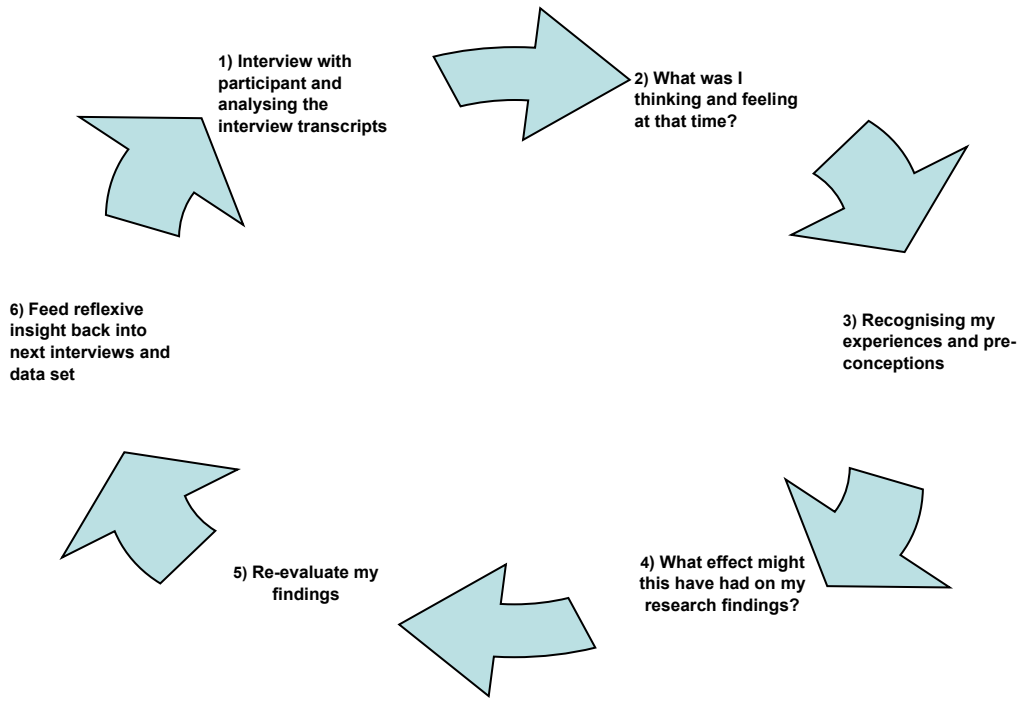
The researcher have considerable experience at all grade levels in operating theatres and acknowledge that this experience has also very likely influenced his thought processes while conducting this research study. As Finlay (2002) highlighted, it is important to articulate the similarities and differences between my position as a healthcare professional and researcher to both himself and others (participants and readers), and the importance being aware of his unconscious bias.[257]

Writing the systematic review at the start of this research journey helped the researcher to refine the specific nature of this inquiry. Data collection was conducted at a Trust where he had close working relationships with operating theatre staff and had asked them about highly sensitive events that had career-defining implications for some of them. The researcher started as a health services researcher at the Patient Safety Translation Research Centre (PSTRC) in May 2018.

When carrying out the interviews, he presented himself not as an ‘investigator’ but as a researcher, explaining to them his new role and responsibilities, and that the research was confidential and focused on improving and advancing the field of surgical safety. During the interviews, participants appeared to be trusting and candid in their responses, with some crying or cursing about their experiences. After each interview, the offered to assist any participant in seeking further help and support through the current reporting and escalation process, whilst maintain confidentiality. In thinking about this response, the researcher was very familiar with the reporting and escalation process and prepared for the various emotions and feelings that might be expressed during these interviews.

The also kept a research journal in which he recorded his own personal reflections and any biases or preconceptions that he might have held when conducing these interviews and analysing the findings. During the analysis stage, he included a column in his research journal where he documented his own emerging thoughts and ideas. This helped ensure that the analysis process was transparent and allowed the supervisors to evaluate how themes were formed. The researcher’s supervisors also undertook some initial data coding of these transcripts, compared, and discussed these codes with the researcher to potentially reduce any researcher bias.

Figure 3: The diagram below summaries the researcher reflexive thinking throughout his research journey.



7.5 Recommendations

Several key recommendations and implications for policy and practice have emerged from this PhD programme of work:

7.5.1 Support systems

This study recommends healthcare organisations to create supportive environments for staff following incidents. Several leading institutions in the USA and Europe have developed formal second victim support programmes that allow health professionals to obtain timely support in an empathetic, confidential, non-judgmental environment.[58, 66, 230, 258-260] They can be adapted to the individual staff needs i.e., immediate debrief following incident, time off work, one-to-one counselling or support during investigations.

Incident support programmes in aviation, military services, railroads and fire department use similar analogues termed as Critical Incident Stress Debriefing (CISD) in small groups as a 'psychological first aid' for their staff soon after the critical incident.[95] These debriefings are mandatory sessions and aim to improve resistance to stress reactions, build resiliency or the ability to 'bounce back' from a traumatic experience, and facilitate both a recovery from traumatic stress and a return to normal, healthy functions. These may be transferable in some way to the healthcare setting. The UK NPSA developed the 'Incident Decision Tree' for health organisations to regulate a fair and consistent course of action for staff involved in patient safety incidents.[96] The second victim experience and support tool (SVEST) was developed to enable healthcare organisations around the world to assess the experiences of healthcare staff who have been involved in incidents.[38] It can also provide healthcare organisation leaders with evidence on which support resources were most taken up and favoured by staff. Healthcare leaders within organisations should recognise this and should encourage frontline staff to actively participate in designing and development of support systems for second victims. This helps in improving staff working relationships, morale and culture.

7.5.2 Complex adaptive theory in the management of patient safety incidents

'Just culture' is another model that could be used to promote a supportive environment. In a just culture, after an incident, the question asked is, 'What went wrong?' rather than 'Who caused the problem?' and it is therefore very different to a blame culture.[261, 262] Previous research on second victims and patient safety stressed the importance of promoting 'just culture' in organisations following incidents. [261-264] NHS improvement recently published just culture guidelines for NHS leaders and managers to consider wider systemic issues following incidents, enabling health care professionals and those operating the system to learn without fear of retribution.[12] The aviation industry and military possess trained human factors experts, and psychologists to support organisations, managers and staff during the investigative and learning process following safety incidents.[46, 79, 82, 265] NHS organisations should also explore how

these roles might help promote effective investigation and safe learning systems within healthcare organisations.

Studies in patient safety have highlighted the importance of leaders engaging in ‘walk rounds’, which involves the leaders and managers engaging with staff as a daily routine practice to understand the challenges they are facing and further feedback on the actions that may be taken, arising from the discussion had in previous walk rounds. [266, 267] They are in practice in various medical settings such as in intensive care units and emergency departments and they can be adopted in operating theatres to have a positive impact on staff well-being and culture.

This PhD study propose NHS organisations to use complex adaptive systems thinking while managing patient safety incidents. This requires NHS hierarchy to move away focus on the relationships between various elements, such as unpredictability in healthcare system and the adaptability of individuals who are working in.[268] Healthcare leader and policymakers need to understand how these complex adaptive systems work to further improve the wellbeing of second victims now and in the future. They need to acknowledge the complex nature of everyday clinical work and how far more things get done correctly than wrongly.[268-270] Further, as highlighted by Riley et.al (2016) healthcare leaders should recognise and value the emotional labour that front line staff need to deal with and make sure the appropriate support and resources are available for staff to manage various emotional demands, which present in complex healthcare settings.[271]

7.5.3 Psychological Safety

Most of the participants in the study highlighted the incidence of poor theatre practices and expressed their frustration about a lack of learning from previous incidents and little action being taken. This resulted in repeated errors being made. We need to encourage a culture of ‘psychological safety’, whereby any member of staff can raise issues without fear of retribution, so that future surgical safety incidents can be avoided. Psychological safety is related to enhanced team learning, workplace inventiveness and team performance.[272] When health care

teams are psychologically safe, they have a mutual trust that they can speak up and ask questions. Further, healthcare leaders need to support staff to speak up, discuss errors that they have observed, and promote improved ways of working. Leaders could also encourage staff to get involved in local quality improvement projects.

7.5.4 Undergraduate training programmes

Most of the study participants highlighted how they felt anxious and fearful following surgical incidents as they were not prepared for such events. Undergraduate training programmes for healthcare professionals need to reflect the reality of healthcare, including work pressures, staffing shortages, multidisciplinary team dynamics and the potential for safety incidents to occur. They need to understand how incidents like this can happen in clinical practice and the coping strategies that could be employed. The experiences of second victim should be shared with those at an undergraduate and training level. They also need to be made aware of the various supporting networks that are available. Professional socialisation is described as the process or acquisition of skills for a new professional role and environment.[273] This can involve allowing a junior member of a team to observe a more experienced colleague, their behaviour and values, and replicate those that are deemed to add value and strengthen learning.[273] They need to have opportunities to discuss expectations and practices with their more experienced peers, how challenges in everyday work can be managed, and provide them with supporting systems or mentors during difficult times. This could help enhance the clarity of their role, staff relationships, teamworking, and reduce fear and stress of making errors following qualification.

7.5.5 Second victim network

Since the introduction of the term ‘second victim’ in 2000, various national and international organisations have developed programmes or systems to help support their members that have been involved in incidents. However, these programmes tend to be siloed and there needs to be more collaboration within institutions from various countries, such as in USA and Europe, and a network for sharing learnings and providing support.

7.6 Summary of ideas for future research

1) Future research should explore the workplace culture in different surgical departments and identify target areas where changes could be made. It is anticipated that knowledge of these target areas will lead to the development of a system-based approach that could potentially improve the quality and safety of care provided to patients.
2) We need to also explore breaking down the hierarchical team structures to recognise that expertise can be team-based as opposed to purely an individual concern. In this way, outcomes become a team responsibility and that, by its very nature, could lead to a more supportive environment when surgical incidents occur.
3) There needs to be effective mentoring and support for new staff members in theatres during the initial stages. Further research should explore what mentoring programme should be offered and how it should be tailored to those working in theatres.
4) Individuals who are involved in patient safety incidents need to be followed up over time. Future research could explore what support should be offered and how this should be delivered over time.
5) The lack of appropriate equipment or equipment failures contributed to the occurrence of surgical incidents. Future work should concentrate on how such equipment failures can be avoided.

7.7 Conclusions:

Surgical incidents are common and can have a profound impact on healthcare staff. We found a significant knowledge gap around what structured support systems were currently in place to support theatre staff involved in surgical incidents. The lack of effective communication within multidisciplinary teams, and inadequate medical staffing levels were perceived to have also contributed to incidents. This study revealed the need for clear support structures to be put in

place for theatre staff who have been involved in surgical incidents. Healthcare organisations also need to offer timely support to front-line staff following these incidents. Healthcare organisations need to encourage multidisciplinary team investigation process to promote fairness and transparency. Senior clinicians should be proactive in offering support to junior colleagues and empathise with their own experiences, thus shifting the competitive culture to one of openness and support. Healthcare organisations should find ways to adapt the learning tools or initiatives used in high reliability organisations following safety incidents. However, the way these tools or initiatives are implemented is critical and so further work is needed to explore how to successfully embed them into healthcare organisations.

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Appendix 1: WHO Surgical Safety Checklist

Surgical Safety Checklist

World Health Organization | Patient Safety

Before induction of anaesthesia

(with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?
- ☐ Yes

Is the site marked?
- ☐ Yes
- ☐ Not applicable

Is the anaesthesia machine and medication check complete?
- ☐ Yes

Is the pulse oximeter on the patient and functioning?
- ☐ Yes

Does the patient have a:

Known allergy?
- ☐ No
- ☐ Yes

Difficult airway or aspiration risk?
- ☐ No
- ☐ Yes, and equipment/assistance available

Risk of >500ml blood loss (7ml/kg in children)?
- ☐ No
- ☐ Yes, and two IVs/central access and fluids planned

Before skin incision

(with nurse, anaesthetist and surgeon)

- ☐ **Confirm all team members have introduced themselves by name and role.**
- ☐ **Confirm the patient's name, procedure, and where the incision will be made.**

Has antibiotic prophylaxis been given within the last 60 minutes?
- ☐ Yes
- ☐ Not applicable

Anticipated Critical Events

To Surgeon:
- ☐ What are the critical or non-routine steps?
- ☐ How long will the case take?
- ☐ What is the anticipated blood loss?

To Anaesthetist:
- ☐ Are there any patient-specific concerns?

To Nursing Team:
- ☐ Has sterility (including indicator results) been confirmed?
- ☐ Are there equipment issues or any concerns?

Is essential imaging displayed?
- ☐ Yes
- ☐ Not applicable

Before patient leaves operating room

(with nurse, anaesthetist and surgeon)

Nurse Verbally Confirms:
- ☐ The name of the procedure
- ☐ Completion of instrument, sponge and needle counts
- ☐ Specimen labelling (read specimen labels aloud, including patient name)
- ☐ Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- ☐ What are the key concerns for recovery and management of this patient?

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.

Revised 1 / 2009

Taken from: https://www.who.int/patientsafety/topics/safe-surgery/checklist/en/

Appendix 2: Systematic review of psychological, emotional, and behavioural impacts of surgical incidents on operating theatre staff.

Systematic review

BJS Open

Systematic review of psychological, emotional and behavioural impacts of surgical incidents on operating theatre staff

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Background: Adverse surgical incidents affect both patients and health professionals. This study sought to explore the effect of surgical incidents on operating theatre staff and their subsequent behaviours.

Methods: Eligible studies were primary research or reviews that focused on the effect of incidents on operating theatre staff in primary, secondary or tertiary care settings. MEDLINE, Embase, CINALH and PsycINFO were searched. A data extraction form was used to capture pertinent information from included studies and the Critical Appraisal Skills Programme (CASP) tool to appraise their quality. PRISMA-P reporting guidelines were followed and the review is registered with PROSPERO.

Results: A total of 3918 articles were identified, with 667 duplicates removed and 3230 excluded at the title, abstract and full-text stages. Of 21 included articles, eight focused on the impact of surgical incidents on surgeons and anaesthetists. Only two involved theatre nurses and theatre technicians. Five key themes emerged: the emotional impact on health professionals, organization culture and support, individual coping strategies, learning from surgical complications and recommended changes to practice.

Conclusion: Health professionals suffered emotional distress and often changed their behaviour following a surgical incident. Both organizations and individual clinicians can do a great deal to support staff in the aftermath of serious incidents.

Funding information
No funding

Paper accepted 30 August 2017
Published online 26 October 2017 in Wiley Online Library (www.bjsopen.com). **DOI:** 10.1002/bjs5.21

Introduction

Medical errors affect up to 16 per cent of patients admitted to hospital[1,2], with 50 per cent of these occurring when surgical or invasive procedures are performed[2]. Common examples include wrong site surgery, retained foreign objects, and insertion of the wrong implant or prosthesis[3]. Patients and health professionals are both affected, the latter group being recognized as secondary victims of medical error[4,5]. A secondary victim has been defined as 'a health care provider involved in an unanticipated adverse patient event, medical error and/or a patient related-injury who becomes victimised in the sense that the provider is traumatised by the event'[5,6].

Surgical incidents are those events that occur during a surgical or invasive procedure in an operating theatre. They may or may not result in patient harm (near misses, serious adverse events), but still affect the health professionals involved. Surgeons have reported both emotional distress and depression[5,7,8]. Emotional distress symptoms have been likened to those of post-traumatic stress disorder[9]. Operating theatre nurses and allied health professions involved can also suffer loss of self-confidence and job dissatisfaction[10]. In the UK, the Care Quality Commission recommended that organizational support be offered to staff at this time and stressed the importance of actively supporting the health and well-being of staff[11,12].

Appendix 3: A list of MeSH terms and text words used in electronic databases

1. surg* error*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

2. Medical Errors/

3. surg* mistake*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

4. surg* fault*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

5. surg* failure*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

6. adverse event*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

7. never event*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

8. operat* error*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

9. surg* complication*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

10. catastrophic error*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

11. surg* pitfall*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

12. surg* incident*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

13. surg* event*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

14. (wrong* adj2 surg*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

15. (surg* adj2 error*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

16. (surg* adj2 event*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

17. (surg* adj2 incident*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

18. (surg* adj2 complication*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

19. exp Surgeons/

20. surgeon*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

21. physicians/ or exp surgeons/

22. surg* trainee*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

23. resident*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

24. an*sthetist*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

25. operating personnel.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

26. operating staff*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

27. theatre staff*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

28. exp Operating Room Technicians/

29. Operating department practitioner*.mp.

30. theatre nurse*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

31. health professional*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

32. health personnel/ or faculty, nursing/ or nurse anesthetists/ or exp nurse clinicians/

33. exp Emotions/

34. attitude/ or exp "attitude of health personnel"/

35. personal qualit*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

36. personal attribute*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

37. personal perception*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

38. professionalism.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

39. exp Professionalism/

40. exp Stress, Psychological/

41. psychosocial.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

42. Behavior/

43. behav*r*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]

44. exp Psychosocial Deprivation/

45. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18

46. 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32

47. 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44

48. 45 and 46 and 47

Appendix 4: Data extraction form

Author and Time of study	Country, Sample and Setting	Design or Methods used	Type of errors	Aims and Objectives	Outcomes/recommendations	Quality Appraisal Score/CASP score/Triangulation (Yes/No)
Aasland, O. G. and R. Forde (2005).	**Location:** Norway **Sample size:** 1318 doctors with various specialities	Quantitative methodology: postal questionnaires	Surgical and all other type of errors	To explore the responsibility felt by the senior and junior doctors upon adverse incidents and its impact on their life and their experience in accepting criticisms aftermath.	Study shows that severe patient injury is more prevalent in doctors working in surgical specialities and it has a negative impact on their personal and professional lives. **Recommendations:** -If the work environment encourages a shared and communal criticism with constructive feedback , then the negative impact experienced my doctors followed by adverse event will be lessened	CASP score -8/10 **Triangulation:** No
Amato, P. E., et al. (2010)	**Location:** USA, **Sample size :** 659 Anaesthetists	Quantitative and qualitative methodology: postal survey and semi-structured telephone interviews	Perioperative errors	Emotional impact on anaesthetists upon perioperative catastrophic errors and their long term ability to provide care to patients in operating room	-Study indicated that upon experiencing a catastrophic error , most of the respondents experienced a high degree of emotional impact with a majority of respondents experiencing guilt, depression, anxiety, sleeplessness, fear of	**CASP score**- 8/10 **Triangulation**-Yes

					litigation, fear of judgment by colleagues and anger. **Recommendations** -Recommended to design and process protocols and standard procedures explaining the support and guidance required for the practitioners upon experiencing a catastrophic error and a need to embed training programmes for all medical practitioners in handling adverse events to not only to protect the well-being of anaesthetists but also helps to prevent harm to patients.	
Balogun, J. A., et al. (2015).	**Location:** Tertiary care hospital in Toronto, Canada **Sample size:** 23 surgery residents: Neurosurgical, general, Vascular and ENT specialities.	A Qualitative Study	Surgical Catastrophic errors	To explore various coping mechanisms of surgical trainees upon experienced with catastrophic surgical errors To recommend support strategies or schemes for surgeons affected by surgical errors.	The study found that most errors are due to system failures. Surgical trainees where not trained in how to cope with medical errors. There is lack of communication relationships between senior surgeons and surgical trainees to discuss about their medical errors. Some trainees use surgical complications as learning experiences for future practices and most of them felt that seeking emotional support is always perceived as personal weakness and it	**CASP score:** 9/10 **Triangulation:** No

					underlines the attitude of the surgical profession. **-Recommendations:** Some surgical trainees upon impact with an error might need counselling or debriefing sessions to support them. At the beginning of their surgical careers they need to be taught in how to cope with medical errors and senior surgeons need to fill the communication gap between themselves and their juniors and discuss their experiences and provide unconditional support when trainees are experienced with catastrophic surgical errors.	
Bognar, A., et al. (2008)	**Location:** Three academic teaching hospitals, Boston, USA Paediatric Cardiac Surgical team members. **Sample size:** 61 24:anaesthetists, 15 :nurses or technicians (scrub, circulating, and one physician assistant)	Quantitative Methodology. Surveys, Questionnaires involving open ended questions, Scaled questions and questions regarding Clinical scenarios of Adverse Event	Clinical errors in Perioperative Care-Surgical Errors	To explore the impact of real and prospective surgical errors on Paediatric surgical teams (PCS) and its effect on their performance individually and as a team. To explore their attitude and perception of safety culture.	Most of the participants feel burden when errors occur. Only a small percentage of participants reported that debriefing occurs after an error has occurred and resulted in patient harm. 70%of participants felt heavy workload and fatigue affect their individual and team performance. **Recommendations** -Team members to be given responsibility and power to address safety issues to the health management in order to	**CASP: 7/10** **Triangulation:** Yes

	10: perfusionists, 7 surgeons, and 5 participants did not indicate their profession.				reduce errors and patient harm. Briefing and debriefing need to be done before and after an error has occurred.	
Chard R(2010)	**Location:** USA **Sample Size:** 272 Perioperative registered nurses	Quantitative methodology, Questionnaires	Intraoperative errors, surgical errors	-To investigate the definitions, conditions, and perceived causes of intraoperative nursing errors -Impact of Intraoperative errors on perioperative nurses, and examine coping strategies	-Inexperience, lack of supervision, work overload, and faulty judgement are the factors found to be causes of intraoperative errors. Perioperative nurses experienced emotional distress, angry to themselves, angry at others, and embarrassed following an error in theatre **Recommendations:** Need for qualitative study to explore perioperative nurses' personal experiences following an error and the need for theatre nurses to understand the meaning of "error" to report.	

Engel, K. G., et al. (2006).	**Location:** USA, 600-bed teaching hospital. **Sample size**:26 residents: 5-Surgery 17-Medicine 4-Obs/Gynaecology	Qualitative methodology with semi-structured interviews	All types of errors include Surgical errors	-To examine the challenges facing physicians upon experienced with medical errors and their perception to medical errors - To explore their coping strategies once faced with these medical errors	-Study shows the residents upon experiencing a medical error, feel emotionally distress, guilt, fear, anger and isolated -Residents cope with these experiences by talking to medical professionals, friends, family and patients itself. -Few residents cope by getting involved in physical activities such as in sports. **Recommendations:** - Need for education and training to educate residents to cope after been affected by medical errors, -Need for more formal and informal conference forums to discuss the errors with fellow experienced colleagues -Need for more structured programmes to provide emotional support to residents after medical or surgical complications.	**CASP score**-9/10 **Triangulation**- No
Harrison, R., et al. (2015).	**Location:** two large teaching hospitals in UK and USA	Quantitative methodology, Cross-sectional	All type of medical errors including	To investigate professional and personal impact on	UK professionals experience more physical and personal interference than professionals in USA after involving in an	**CASP score-** 6/10 **Triangulation:** Yes

	Sample size: 265 physicians and Nurses: 120 physicians and 145 nurses (total 265). UK sample 61 physicians and 65 nurses (total 126), and the U.S. sample 59 physicians and 80 nurses (total 139). Senior physicians included consultant physicians (50); junior physicians included house officers, senior house officers, registrars, interns, residents, and fellows (70); senior nurses included band 7 and 8 nurses and nurse specialists (49); and junior nurses were band 5 and 6 or registered nurses (96).	and cross country survey	surgical errors	physicians and nurses after an error. To explore various emotional responses based on type of error, location and copying strategies shown by health professionals, whether they are different based on location? Awareness of supporting systems by professionals and their willingness to seek support from organisation	error. Nurses tend have more negative impact emotionally than physicians from both countries. Most of the professionals from both countries were not aware of the supporting services available in their organisation and they are willing to use the services if the support is given by their peers or seniors in a supportive and confidential environment. **Recommendations:** Health organisations need to develop a clinical support programme which is more structured and encourages supporting the affected professionals in a supportive environment which enables the professionals to have an open and honest discussion about their errors. This will help in increase in staff morale, error reporting and opportunities to learn and develop.	
Heard, G. C., et al. (2016)	**Location**: Australia. **Sample size:**	Quantitative methodology, postal questionnaires	Adverse incidents in operating theatres	To study the support required for the anaesthetists when there is a	The study shows that the anaesthetists do need emotional support when there is catastrophic death which might involve error or not. They need peers support and	**CASP score-** 7/10 **Triangulation:** No

	766 anaesthetists of varied experiences.		involving anaesthetists	catastrophic death in operating theatre. Compare the support required when the death occurs due to an anaesthetist error or without.	counselling guidance when affected by it. The respondents in the study who are affected with a death in theatre due to their error recommended to have a day off work from duty, out of hours counselling services when needed, peers support and professional advice	
Hu, Y. Y., et al. (2012)	**Location:** A large tertiary care academic hospital **Sample size:** 108 residents and attending physicians in the department of surgery, emergency medicine and anaesthesia	Quantitative methodology include survey questionnaires	Medical errors including surgical errors	To explore the physicians needs in coping with the emotional stressors (include medical errors) To examine the willingness of physicians to seek institutional support designed for physicians who in distress	The study shows that most of the respondents seek support when affected with adverse events when compared to other distress caused during every day work such as complaints or conflicts at work place. Lack of time and fear of confidentiality breach is a barrier for the professionals in not seeking help when affected with medical errors. Anaesthetists and surgeons are more likely to seek support when affected with adverse events when compared to residents from emergency medicine.	**CASP score -**6/10 **Triangulation:** No

					Most of the physicians and residents are not aware of the support services available in their organisations and to the health professions in general when affected with an medical error or any other distress caused in the work place	
Luu, S., et al. (2012)	**Location:** three academic hospitals in large urban setting in Canada. **Sample:**20 surgeons 13 general surgeons, 3 neurosurgeons, one cardiac surgeon, one urol ogy surgeon, one gynaecology surgeon, one vascular surgeon	Qualitative methodology. Grounded Theory. Semi-structured and structured interviews.	Surgical errors	To explore surgeons' response and reactions to surgical errors. Their effect on further surgeons clinical decision making	The study shows that all surgeons have shown four phases of reactions when affected by adverse events. Kick: It is the initial phase where there is physiological and emotional effect Fall: Soon after the initial phase the extent of error and their contribution the error will be analysed Recovery: This period is where the surgeons reflect on the error and pick up learning points Long-term impact: is when the surgeons experience the impact of error throughout their profession based on individual characteristics and personalities. Need for more support on individual basis to surgeons affected by errors or adverse events to improve their well-	**CASP**:9/10 **Triangulation:** Yes

					being and future clinical decision making.	
M. Skevington, S., et al. (2012).	**Location:** Royal United Hospital, UK **Sample size:** 11 consultant surgeons with varied speciality: orthopaedics, obstetrics, otolaryngology, urology, vascular and general surgery.	Qualitative methodology , Semi structured interviews	Surgical errors	The aim of the study is to investigate senior consultant surgeons perspective and views of adverse surgical events (ASE)	The study highlighted the environmental, organisation and social factors contributing to the adverse surgical events (ASE). Strategies in dealing with ASE are diverse and pragmatic. **Recommendations:** Good and self-confident leadership is needed at hierarchies to promote solutions during ASE's within the organisation	**CASP:** 8/10 **Triangulation:** No
Mira, J. J., et al. (2015).	**Location:** 8 Primary care health centres and Hospitals in Spain. **Sample**: 1087 health professionals Medical and Surgical , 610 from Primary care and 477 from hospitals.	Quantitative methodology, Cross-sectional survey	All type of medical errors include surgical errors	The aim of the study is to explore the effect of adverse events on Spain health professionals personally and professionally.	Study shows 6 out of 10 health professionals in Spain encounter adverse events either directly or indirectly. They experience fear, anxiety and guilt aftermath. In Spain doctors worry more than nurses about the negative consequences after adverse events, professionally and personally. Spain health professionals hardly receive any training and	**CASP-** 6/10 **Triangulation:** Yes

					support when compared to other countries in coping with adverse events. **Recommendations:** Institutional support mechanisms need to be enforced to support second victims, I, e Health professionals after an adverse incidents in Spain Hospitals.	
Patel, A. M., et al. (2010)	**Location:** Michigan State University, USA **Sample Size:** 123 surgeons with varied speciality General surgery 75/123 Trauma 40/123 Critical care 29/123 Vascular surgery 18/123 Orthopaedic surgery 15/123 Specialised breast surgery 13/123	Quantitative methodology, Cross-sectional survey	Surgical errors	Aim of the study is to investigate the effect of surgical errors on surgeons emotionally and their effect on performance in clinical practice. The study also aims to identify the coping mechanisms used by the surgeons once involved in a surgical adverse event.	The study highlights that surgeons have an emotional professional impact once experienced with first major patient complication in practice after leaving residency. Same amount of support or guidance is lacking in practice compared to being in residency **Recommendations:** efforts need to be made to make all clinicians aware of the supporting systems for surgeons and recognise unrecognised emotional effects following patients complication	**CASP score-**7/10 **Triangulation:** No

	Other surgical specialties-less than 10%					
Pinto, A., et al. 2013).	**Location:** 2 NHS teaching hospitals in London, UK **Sample:** 27 surgeons: General and Vascular surgeons both consultant and vascular surgeons.	Qualitative methodology, Semi-structured interviews	Surgical errors	-The study aims to explore the effect of surgical errors on surgeons and their coping strategies and perception of support. -Adverse incidents impact on surgeons well-being	The study shows that the surgeons are affected emotionally after a surgical complication. Immediate reactions include anger and anxiety about their career and the consequences of an error. Senior surgeons deal with complications effectively when compared to junior surgeons. Peer support and relationship after surgical event is vital and the need for structured debriefings after the surgical event is important as well. **Recommendations:** Mentoring is key to support	**CASP score:** 9/10 **Triangulation:** No

					surgeons after affected by surgical complication Morbidity and Mortality meetings need to be reformed as educational forums Teamwork in dealing with complex cases during critical clinical decision making and Psychological support including a structured clinical support programmes need to be developed to provide emotional support for surgeons affected with surgical complications	
Pinto, A., et al. (2014).	**Location:** 3 NHS trusts in London, UK **Sample:** 47 general and vascular surgeons	Quantitative methodology. Survey questionnaires	Surgical errors	To explore surgeons level of acute traumatic stress after surgical complications and their coping strategies. To investigate surgeons perceptions of institutional safety culture on surgical complications	Surgeons do experience acute traumatic stress following a surgical complication. Self-distraction is one of the coping strategies used by the surgeons. **Recommendations:** Institutions to develop support training programmes to provide support to surgeons affected with surgical complication	**CASP-** 7/10 **Triangulation:** Yes
Scot S D et al (2009)	**Location:** Columbia, USA **Sample:**31 second victims.	Qualitative methodology, Semi-structured interviews	All type of medical errors include surgical errors	To explore the recovery stages of second victims in health care after	Reported six stages of recovery (1) chaos and accident response, (2)	**CASP score:** 8/10 **Triangulation: No**

	10 physicians, 11 registered nurses, 10 other includes managers, therapists, physician assistants and scrub technicians			adverse patient events	intrusive reflections, (3) restoring personal integrity, (4) enduring the inquisition, (5) obtaining emotional first aid and (6) moving on. The sixth stage, moving on, led to one of three outcomes: dropping out, surviving or thriving. Recommendations: The study recommended the need for trained supervisors and front line peers to provide and target support to the affected staff (second victims) at the early stages following an event rather than at later stages where the second victims can get support from other established support which most of the institutions acquire such as risk managers, palliative care practitioners, chaplains, social workers etc.	

Ullström, S., et al. (2014).	**Location**: Swedish University Hospital, Sweden **Sample:** 21 Health professionals. Physicians:10 Nurses: 9 Allied health professionals:2	Qualitative methodology, semi-structured interviews	All type of errors include surgical errors	To explore the effect of adverse incidents on Swedish health professionals and the support they require from the organisation and the support they receive.	The study shows the health professionals experience emotional distress. They are affected by the organisation reaction to the adverse event. There is lack of structure or support during formal investigative process; it is much unstructured and not systematic. The feedback on investigation is not given to the second victim on a timely manner. **Recommendations:** Organisation and policy makers need to develop well structure supporting programmes for staff affected with adverse events and promote a culture of openness and transparency so that the affected second victims can be open and honest in discussing the errors to their peers and managers and thereby promote learning opportunities to develop	**CASP score:** 9/10 **Triangulation:** No

Vinson, A. E. and J. D. Mitchell (2014).	**Location:** American Colleges of Graduate Medical Education (ACGME), USA **Sample:** 67 Programme director for anaesthesia residency programmes	Quantitative methodology, Survey.	Errors in operating theatres	The aim of the study is to determine the incidence, efficacy and utilisation of supporting programmes in place for the anaesthetic residents during their training when affected with adverse incidents	The study shows peer support and department meetings are extremely helpful for the residents. The morbidity and mortality forum conference forums after adverse incidents are useful. Residents utilise the department led supporting programmes and few residents are not aware of institutional supporting programmes when affected with adverse incidents	**CASP score-** 6/10 **Triangulation:** Yes
Waterman, A. D., et al. (2007).	**Location**: USA and Canada. **Sample:** 3,171 of physicians :internal medicine, paediatrics, family medicine, and surgery	Quantitative methodology, cross-sectional survey.	All type of errors including surgical errors	Study aims to investigate the effect of medical errors on physicians job related stress and the support needed to cope with medical errors	Many physicians experience emotional distress following medical errors. They feel anxious about future errors due to lack of confidence, experience reduced job satisfaction and feel that the error and near misses has bought harm to their reputation. **Recommendations:** Significant organisational support need to developed to guide physicians while experiencing with medical errors	**CASP score -**6/10 **Triangulation:** Yes

Appendix 5: the tabular elaboration of the themes extracted from each individual selected articles in the review.

Articles	Initial themes Emerged	Themes Emerged at the end
Aasland, O. G. and R. Forde (2005).	Negative impact, Needed professional support, criticism and peer support	The emotional impact on health professionals Organisation culture and support
Amato, P. E., et al. (2010)	Emotional and professional impact, peer and manager support, recommendations.	The emotional impact on health professionals Organisation culture and support Recommended changes to practice
Balogun, J. A., et al. (2015).	Errors due to system deficits, lessons learned from incidents, support for surgical trainees, counselling services to be offered, culture of surgery	Learning from Surgical Complications Organisation Support Recommended changes to practice
Bognar, A., et al. (2008)	Work environment and attitudes lead to surgical incidents, psychological impact following an event , recommendations to improve communication and increase education and training, manager and peer support	Emotional Impact on health professionals Organisation culture and support Recommended changes to practice
Chard R(2010)	Emotional distress following an event Coping with intraoperative errors and relationship to change in practice, learning from perioperative errors	Emotional Impact on health professionals Coping Strategies Learning from incidents
Engel, K. G., et al. (2006).	Emotional response, Coping mechanisms, learning and change of practice, recommendations	Emotional Impact on health professionals Learning from Surgical Complications Recommended changes to practice
Harrison, R., et al. (2015).	Personal and professional disruptions, Negative impact, emotional distress, inadequate organisation and peer support, problem focused coping methods	Emotional Impact on health professionals Organisation culture and support

		Coping strategies
Heard, G. C., et al. (2016)	Support from managers and peers after error, need for counselling , Emotional response	Emotional Impact on health professionals Organisation support and culture
Hu, Y. Y., et al. (2012)	Physical or mental illness, lack of confidence, personal management after incident, recommendations	Emotional Impact on health professionals Coping strategies, Recommended changes to practice
Luu, S., et al. (2012)	Emotional and professional impact, immediate and long term impact gain knowledge and expertise and learning from events.	Emotional Impact on health professionals Coping strategies, Recommended changes to practice
M. Skevington, S., et al. (2012).	Negative emotions following an error, organisation and peer support needed, education and training , learning from errors	Emotional impact on health professional Organisation culture and support Learning from incidents
Mira, J. J., et al. (2015).	Varied emotional responses, organisational support , education and training needed for coping , recommendations	Emotional impact on health professional Organisation culture and support Coping strategies Learning from incidents
Patel, A. M., et al. (2010)	Emotional and Professional Impact, Need for support systems.	Emotional impact on health professional Recommended changes to practice
Pinto, A., et al. (2013).	Emotional and professional impact, factors effecting surgical reactions after an error, Organisation culture, Coping methods, Learning and support following complications	Emotional impact on health professional Organisation culture and support Coping strategies Learning from incidents
Pinto, A., et al. (2014).	Post traumatic distress, organisation support and recommendations	Emotional impact on health professional Organisation culture and support

Scot S D et al (2009)	Emotional and personal impact, coping and supporting systems-recommendations	Emotional impact on health professional Recommended changes to practice
Ullström, S., et al. (2014).	Emotional distress, long term and short term impact, organisation support, recommendations	Emotional impact on health professional Organisation culture and support Recommended changes to practice
Vinson, A. E. and J. D. Mitchell (2014).	Recommendations and organisation support after an event	Organisation culture and support Recommended changes to practice
Waterman, A. D., et al. (2007).	Personal and professional impact, organisation support, recommendations	Emotional impact on health professional Organisation culture and support Recommended changes to practice
Review Articles	**Themes Emerged**	
Sirriyeh R et .al (2010)	Response and impact, Coping and learning, Attitudes in the context of culture, Moderating factors and implications for practice, recommendations	Emotional impact on health professional Organisation culture and support Recommended Changes to practice
Seyes, D et. al (2013)	Support for second victims and recommendations	Recommended changes to practice

Appendix 6: A Learning from safety incidents in high-reliability organisations: a systematic review of learning tools that could be adapted and used in healthcare

International Journal for Quality in Health Care, 2021, 33(1), 1–9
doi: 10.1093/intqhc/mzab046
Advance Access Publication Date: 17 March 2021
Systematic Review

Systematic Review

Learning from safety incidents in high-reliability organizations: a systematic review of learning tools that could be adapted and used in healthcare

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Received 23 September 2020; Editorial Decision 3 March 2021; Revised 26 January 2021

Abstract

Objective: A high-reliability organization (HRO) is an organization that has sustained almost error-free performance, despite operating in hazardous conditions where the consequences of errors could be catastrophic. A number of tools and initiatives have been used within HROs to learn from safety incidents, some of which have the potential to be adapted and used in healthcare. We conducted a systematic review to identify any learning tools deemed to be effective that could be adapted and used by multidisciplinary teams in healthcare following a patient safety incident.

Methods: This review followed the Preferred Reporting Items for Systematic Reviews and MetaAnalyses for Protocols reporting guidelines and was registered with the PROSPERO (CRD42017071528). A search of databases was carried out in January 2021, from the date of their commencement. We conducted a search on electronic databases such as Web of Science, Science Direct, MEDLINE in Process Jan 1950-present, EMBASE Jan 1974-present, CINAHL 1982-present, PsycINFO 1967-present, Scopus and Google Scholar. We also searched the grey literature including reports from government agencies, relevant doctoral dissertations and conference proceedings. A customized data extraction form was used to capture pertinent information from included studies and Critical Appraisal Skills Programme tool to appraise on their quality.

Results: A total of 5921 articles were identified, with 964 duplicate articles removed and 4932 excluded at the title (4055), abstract (510) and full-text (367) stages. Twenty-five articles were included in the review. Learning tools identified included debriefing, simulation, crew resource management and reporting systems to disseminate safety messages. Debriefing involved deconstructing incidents using reflective questions, whilst simulation training involved asking staff to relive the event again by performing the task(s) in a role-play scenario. Crew resource management is a set of training procedures that focus on communication, leadership and decision-making.

Appendix 7 List of MeSH terms and Boolean operators used in the electronic databases

1	learning.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
2	education.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
3	teaching.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
4	tutoring.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
5	organi*ational learning.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
6	workplace learning.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
7	individual learning.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
8	team learning.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10	framework*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
11	intervention*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
12	model*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
13	tool*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]

14	design*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
15	innovation*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
16	invention*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
17	improvement*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
18	development*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
19	method*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
20	approach.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
21	principle*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
22	10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21
23	safety.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
24	care.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
25	security.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
26	protection.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
27	23 or 24 or 25 or 26
28	incident*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]

29	error*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
30	mistake*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
31	fault*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
32	blunder*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
33	slip*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
34	slipup*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
35	complication*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
36	failures*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
37	event*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
38	adverse event*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
39	undesirable event*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
40	hazard*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
41	problem*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
42	pitfall*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
43	catastrophic.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]

44	28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43
45	"high reliability organi*ation*".mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
46	Resilient organi*ation*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
47	Error free organi*ation*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
48	High stable organi*ation*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
46	organi*ation*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
48	high reliability industrie*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
49	high reliability bodies.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
50	high reliability association*.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
51	high reliability company.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
52	companies.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
53	aviation.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
54	"air industry".mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
55	military.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]
56	engineering.mp. [mp=ti, ab, ot, nm, hw, fx, kf, ox, px, rx, ui, an, sy, tn, dm, mf, dv, kw, dq, tc, id, tm, mh]

57	45 and 46 and 47 and 48 and 49 and 50 and 51 and 52 and 53 and 54 and 55 and 56
57	9 and 22 and 27 and 44 and 57

Appendix 8: Data extraction sheet

Serial no:	Author & Year	Country	Research methods	Practical tool	Purpose and the population the tool is used	Results and outcomes (How tools are used for learning)	Risk of bias (quality) assessment of each article using CASP
Research Articles							
1)	Allen, J. A. et al (2010)	USA	Quantitative	Debriefing : After Action Review (AAR)	This study investigated the role of after-action reviews on perceptions of safety climate at the group and organisational levels by promoting team learning **Population:** Fire Fighters	After-action reviews create a definite setting through which managers can promote safety climate in high-risk environments.	Triangulation :No

2)	Crowe J et al (2017)	USA	Mixed Methods: Quantitative study and Qualitative	After Action Review (AAR) –Debriefing tool	To investigate what makes for good and bad after-action reviews (AARs) **Population:** Firefighters	AARs provides a venue for team building and potentially enhancing the safety climate on crews.	Triangulation: Yes
3)	Eddy, E. R et al. (2013)	USA	Quantitative	Debriefing	Aim of the research is to compare two types of team-led debriefs: 1) Unguided version 2) Guided version that integrates lessons learned from research and practice. The study investigated how team-led debriefs	"Guided" team-led debriefs can yield greater benefits than unguided debriefs. The study shown moderate boosting team processes and performance.	Triangulation: No

					influence team processes and, in turn, team effectiveness and individual-level outcomes **Population:** Business students for strategic management course		
4)	Ellis, S., & Davidi, I. (2005)	Israel	Quantitative	Debriefing : After action review	Using Quasi-field experiment the study aim to examine the importance of AAR in debriefing both failures and success following an event for team learning and performance. **Population**: Military, soldiers	Performance of soldiers doing consecutive navigation exercises improved considerably when they were debriefed through AAR on their	Triangulation: No

						failures and successes after each training day, compared with others who reviewed their failed events only	
5)	Ford. J et al (2014)	New Zealand	Quantitative	Crew resource management	The study aim to explore the effects of Crew Resource Management (CRM) training on flight attendants' safety attitudes and team learning **Population:** Aviation- Flight attendants	CRM training for flight attendants is a valuable learning tool for increasing positive teamwork behaviours between the flight attendant and pilot sub-groups.	Triangulation: No

						- Joint training sessions, where flight attendants and pilots work together to find solutions to in-flight emergency scenarios, provide a particularly useful strategy in breaking down communication barriers	
6)	Garvin D.A (2000)	USA	Qualitative review	Debriefing: After Action Review	To explore the facilitation of AAR in Military **Population:** Military	The study has given number of recommendations in how to facilitate AAR which included broad participation,	CASP: 8/10 Triangulation: No

						structured process, skilled facilitation , need for attention to recordings of th event and dissemination. -The study also recommended a climate of openness and candour along with consistency while facilitating AAR's	
7)	Lardner R & Robertson I (2011)	UK	Quantitative	Simulation: Simulation Scenarios	The study aim to investigate whether individual learning occurred, leading to changes in	The feasibility of constructing a simulated incident scenario, with the	Triangulation: No

					individual knowledge, routines and performance following simulation exercises - Whether team and organisational learning occurred, leading to changes in team and organisational knowledge, routines and performance following simulation exercises . **Population**: Engineers and managers from British Pertoleum	same generic features as real incident. -The scenario was successfully used to determine the extent to which individual and team/organisational learning had occurred via post-incident briefings. Further the study found that using the more active scenario	

						method, coupled with group discussion and individual and group feedback on performance, led to new knowledge and a changed approach towards situations with similar features.	
8)	Marquardt, N et al (2010)	Germany	Quantitative	Crew resource management	The aim of the study is to develop, implement, and evaluate crew resource management (CRM) training program specifically designed for employees	The results showed a significant improvement in a wide range of CRM-relevant categories, especially in teamwork-related attitudes, in addition	Triangulation : No

					within the automotive industry **Population**: Staff within automotive industry	to an increase in the workers' situational awareness after the training program.	
9)	Mastaglio .T et al. (2011)	USA	Qualitative	Debriefing tool: After Action Review	The study aim to explore the current practice and theoretical foundations of the After Action Review **Population**: Military	The key findings from this research show that AAR is a fundamental part of the Army training culture with recognised value at the trainer and trainee level. A reference model, the Integrated Theory of AAR (ITAAR) is described together	CASP:7/10 Triangulation: No

						with educational and information dissemination recommendations that will strengthen Army-wide expertise. .	
10)	Mavin J. T, Kikkawa Y & Billett S (2018)	Australia	Qualitative	Simulation	-The study aims to explore the effect of simulation followed by debriefing and analysed over 32 biannual simulator training and assessment sessions for learning. -The study further explored the quality and outcomes of	-Simulation sessions are useful to practice the real event. -Factors such as personal readiness of the pilots and situational factors during the training need to be considered while	CASP:8/10 Triangulation: No

					the learning experiences, particularly the efficacy of the simulator-to-debriefing ratio. **Population:** Aviation, flight crew	facilitating the debriefing sessions following simulation exercises.	
11)	Nergard V (2015)	Norway	Qualitative: Case study	Debriefing : post-flight debriefing	The purpose of this study was to explore how pilots potentially learn from their and others' experience through post-flight debriefing **Population:**	The post-operative debriefing, helped the crew to create an emotional distance to the event and allowed the participants to reflect	CASP:8/10 Triangulation: No

					Aviation ;flight crew	and learn from the event.	
12)	Roth W.M (2015)	Australia	Qualitative Observations, formal and informal interviews, recorded debriefing sessions, observed and recorded simulator sessions	Debriefing tool	-To investigate the cultures and cognition of debriefing in the aviation industry to learn from events. -Explored how the debriefing meeting was organised in terms of duration and participation following the debrief and simulation sessions. **Population:** Aviation; Pilots	-There was substantial difference on the amount of talk that the flight examiners and crewmembers contributed to the debriefing meetings. -Study showed that pilots tend to be aware that they forget much of the detail and it therefore influenced the debriefing session	CASP:8/10 Triangulation: No

						and their participation. -Less experienced pilots found it more useful to have the flight examiner narrate back to them what they had done and tell them why it had been wrong and how to improve upon it. themselves. -The study showed that the cultural practice of debriefing depends on its	

						structure, on the cognitive organisation of the flight examiner notes and memory.	
13)	Salter M. S Klein. G.E (2007)	USA	Qualitative	Debriefing: After Action Review	The purpose of this research was to examine the conduct of After Action Reviews (AARs) at the Combat Training Centers (CTCs). **Population:** Military	Even the best-trained Observer/Controllers (O/Cs) tend to err on the side of providing too much information while facilitating AAR -The study provided with	CASP: 7/10 Triangulation: No

						recommendations which Included a prototype AAR rating scale that could be used as a job aid, performance checklist, or as an instructional tool during O/C training.	
14)	Scott (2013)et.al.	USA	Quantitative	Debriefing :After Action Review	Study examined the impact of post-incident, prediscussion ambiguity and freedom of dissent on participant satisfaction with AARs **Population:** Fire Fighters	The level of post-incident, pre-discussion ambiguity was negatively related to AAR satisfaction. -- Freedom of dissent,	Triangulation: No

						however, attenuated the negative influence of ambiguity on AAR satisfaction.	
15)	Taylor .J.C &Robertson M.M (1995)	USA	Quantitative	Crew resource management	The study explored the effects of crew resource management (CRM) training in airline maintenance **Population:** Aviation, Flight crew	Following CRM training, there is significant improvement in manager's attitude towards safety, efficiency, dependability and assertiveness.	Triangulation: No

Review articles and reports							
16)	Allen, J. A(2018)	USA	Critical review article	Debriefing	Review looked at how debriefing is used in various organisations to promote learning and performance across the various services. Review also investigated the factors relevant to debrief effectiveness and the outcomes for individuals, teams, and organisations that deploy debriefs.	The article provided with recommendations in how best to implement debriefs from a practical perspectives in various high reliability organisations.	NA

					Population: the fire service, aviation, education, and in a variety of organisational training and simulation environments.		
17)	Jeffrey T. Mitchell J.T and Everly G.S (1993)	USA	Report	Debriefing tool: Critical incident stress debriefing (CISD)	Critical Incident Stress Debriefing (CISD) is a seven phase, small group supportive crisis process. It is just one of the many crisis intervention techniques which are included under the umbrella of a Critical Incident Stress Management (CISM) program.	A Critical Incident Stress Debriefing can best be described as a psycho-educational group process. It was reported to be an efficient process to learn following the event. It involves structured group	NA

					Population: Law enforcement, fire service, emergency medical, military, aviation and other specialized professions	story-telling process with applied information to group member reactions to a critical incident and facilitate their recovery.	
18)	Kaps et al (1999)	USA	Literature Review	Crew resource management	-The purpose of this study was to review and synthesize the literature and research on CRM training	-Key topics of the review included a) the current status of CRM training and research, b) evolution of CRM concepts,	NA

					-To capture and report these major changes in recent CRM programmes. **Population:** Aviation, Military	c) measuring methods, and d) application of CRM.	
19)	Helmreich RL(1999)	USA	Review	Simulation: Line – oriented flight training (LOFT)	To review the High Fidelity simulator in CRM training. The review explored the effect of high fidelity simulators in CRM training	-High-fidelity simulators consist of a cockpit with working instruments and controls, the sensation of motion and a visual representation of the environment outside the cockpit windows.	NA

						-CRM has expanded the use of the simulator as a training tool. It enabled crews to test themselves in tackling complex problems—ranging from bad weather to mechanical failures—that cannot be resolved by simply following a procedure outlined in the flight manual.	

20)	Helmreich RL (2000)	USA	Report	Simulation	To explore the how lessons are learned in aviation **Population:** Aviation	In aviation, accidents are usually highly visible, and as a result aviation has developed standardised methods of investigating, documenting, and disseminating errors and their lessons	NA
21)	Megan TD et al (2017)	USA	Feature Article	The Safety Reporting and Learning System for Radiotherapy (SAFRON)	The Safety Reporting and Learning System for Radiotherapy (SAFRON)aims to increase safety in radiation therapy facilities by learning from	Allowed users to submit their own incident reports to the system, as well as search and review reported incidents	NA

				-Advanced Incident reporting system	reported events and decreasing the likelihood of a similar event occurring. - Use near misses and incidents to promote a culture of safety in the radiation therapy department **Population**: Staff within Radiation therapy department	and near misses at other facilities.	
22)	Oudheusden et al (2017)	Belgium	Review article	Technology for reporting and learning : Retour	Documentary analysis of incident	Retour d'Experiences (REX) to share reported incidents	NA

				d'Experiences (REX)	reports, interviews, and focus groups with personnel, it illustrates how REX enacts a safety governmentality centered on identifying incident causes and for learning **Population**: Staff within Nuclear plant	and safety messages to staff within their Nuclear centre, thus promoting collective learning and safety governance. Staff expressed their satisfaction in using the system as key learning points and active causes of the incidents are often analysed.	
23)	Rolfsen J (2013)	Norway	Review article	**Operational (Crew) Debrief:**	**Purpose:** Tool for preventing the accumulation of bad experiences and the development of over-	The tool is used to give the air company a wealth of	Not applicable (NA)

				The model is named “APPROACH” **A** -Debrief **ASAP**, if necessary on the aircraft and away from distractions **P- Participation** with all crew involved **P- Purpose**,. The purpose is to provide accurate, factual and objective operational information after an incident to ensure	determined reactions following an adverse event in aircraft and for team learning. **Population:** Aviation ;flight crew	information on incidents - The tool gave the crew an opportunity to discuss about the event and gave qualified personnel present in the debrief the chance of identifying if the crewmembers need any additional support -It gave each crewmember valuable information	

				mutual understanding **R Review** the known particulars about the incident **O** Explain the **operational** significance of the incident, including any safety implications **A Ask** if there are any questions from the crew **C Check** for understanding		about the safety related aspects of the occurrence	

				H Help crew to access company medical or psychological services if required.			
24)	Schindler M et al (2003)	Switzerland	Review article	Debriefing tool: Post Project review	This article presents an overview of proven methods to record experiences from projects and discusses their use in project management.	The article discusses central project debriefing problems such as the lacking willingness to learn from mistakes. -Gives recommendations on how debriefing processes can be	NA

						integrated successfully into project procedures.	
25)	Tannenbaum, S. I., & Cerasoli, C. P. (2013)	USA	Systematic review and meta-analysis	Debriefing	The review aim to assess the efficacy of debriefs with a quantitative review **Population**: Aviation, Military	-The review found that organisations can improve individual and team performance by approximately 20% to 25% by using properly conducted debriefs. -The review further identified that debriefs are a relatively inexpensive and quick	9/10

						intervention for enhancing performance.	

Appendix 9 represents the sub themes and themes extracted from each included article, reviews and reports

Articles	Initial subthemes/tools discussed	Overarching themes/Learning tools
Allen, J. A. et al (2010)	After Action Review, Debriefing, Incident review, post incident review	Debriefing
Crowe J et al (2017)	After Action Review, Debriefing , incident review	Debriefing
Eddy, E. R et al. (2013)	Debriefing, post brief, After incident review	Debriefing
Ellis, S., & Davidi, I. (2005)	After Action Review, after incident review, post brief	Debriefing
Ford. J et al (2014)	Crew resource management , Non-technical skills	Crew resource management
Garvin D.A (2000)	Debriefing, After Action Review, Post incident review	Debriefing
Lardner R & Robertson I (2011)	Simulation, Simulation Scenarios, technology	Simulation
Marquardt, N et al (2010)	Crew resource management, non-technical skills, crisis skills	Crew resource management

Mastaglio .T et al. (2011)	Debriefing tool: After Action Review , post brief, review after incident	Debriefing
Mavin J. T, Kikkawa Y & Billett S (2018)	Simulation, technology, Simulators	Simulation
Nergard V (2015)	Debriefing , post-flight debriefing, incident debriefing	Debriefing
Roth W.M (2015)	Debriefing, after incident review, post brief	Debriefing
Salter M. S & Klein. G.E (2007)	Debriefing, After Action Review, incident review	Debriefing
Scott (2013)et.al.	Debriefing ,After Action Review, post brief, incident review	Debriefing
Taylor .J.C &Robertson M.M (1995)	Crew resource management , non-technical skills, crisis skills, safety skills., cockpit skills	Crew resource management

Review Articles and reports		
Allen, J. A(2018)	Debriefing ,incident review	Debriefing
Jeffrey T. Mitchell J.T & Everly G.S (1993)	Debriefing , Critical incident stress debriefing, brief after trauma, supporting skills	Debriefing
Kaps et al (1999)	Crew resource management, non-technical skills, crisis skills	Crew Resource Management
Helmreich RL(1999)	Simulation, Line –oriented flight training, technology, real event activities, learning skills	Simulation
Helmreich RL (2000)	Simulation, technology	Simulation
Megan TD et al (2017)	The Safety Reporting, Learning System, Advanced Incident reporting system. Disseminating safety messages	Reporting and dissemination of safety messages
Oudheusden et al (2017)	Technology for reporting and technology for learning	Reporting and dissemination of safety messages

	and disseminating messages	
Rolfsen J (2013)	Operational Debrief, crew debrief, post incident review	Debriefing
Schindler M et al (2003)	Debriefing ,Post Project review	Debriefing
Tannenbaum, S. I., & Cerasoli, C. P. (2013)	Debriefing, incident review, post activity review, learning	Debriefing

Appendix 10: A Retrospective Review of Serious Surgical Incidents in 5 Large UK Teaching Hospitals: A System-Based Approach

REVIEW ARTICLE

A Retrospective Review of Serious Surgical Incidents in 5 Large UK Teaching Hospitals: A System-Based Approach

Naresh Serou, MSc,†‡ Robert D. Slight, PhD,§|| Andy K. Husband, PhD,* Simon P. Forrest, PhD,¶ and Sarah P. Slight, PhD*§||*

Objectives: Surgical incidents are the most common serious patient safety incidents worldwide. We conducted a review of serious surgical incidents recorded in 5 large teaching hospitals located in one London NHS trust to identify possible contributing factors and propose recommendations for safer healthcare systems.

Methods: We searched the Datix system for all serious surgical incidents that occurred in any operating room, excluding critical care departments, and were recorded between October 2014 and December 2016. We used the London Protocol system analysis framework, which involved a 2-stage approach. A brief description of each incident was produced, and an expert panel analyzed these incidents to identify the most likely contributing factors and what changes should be recommended.

Results: One thousand fifty-one surgical incidents were recorded, 14 of which were categorized as "serious" with contributing factors relating to task, equipment and resources, teamwork, work environmental, and organizational and management. Operating room protocols were found to be unavailable, outdated, or not followed correctly in 8 incidents studied. The World Health Organization surgical safety checklist was not adhered to in 8 incidents, with the surgical and anesthetic team not informed about faulty equipment or product shortages before surgery. The lack of effective communication within multidisciplinary teams and inadequate medical staffing levels were perceived to have contributed.

Conclusions: Multiple factors contributed to the occurrence of serious surgical incidents, many of which related to human failures and faulty equipment. The use of faulty equipment needs to be recognized as a major risk within departments and promptly addressed.

Key Words: London protocol, contributing factors, surgical incidents

(*J Patient Saf* 2021;00: 00–00)

Serious patient safety incidents are defined as errors or lapses in care that result in unexpected or avoidable death, unexpected or avoidable injury, or serious harm.[1,2] The most common serious patient safety incidents worldwide occur in surgery, with previous retrospective reviews suggesting that the rate of serious injury could be as high as 16%.[3–7] The National Reporting and Learning System published a report on surgical incidents in the United Kingdom that identified 379 serious surgical incidents between April 2017 and March 2018, and the associated specialities where these incidents occurred: trauma and orthopedics (34%), general surgery (29.7%), urology (5%), and others (11%).[8] More recently, 314 surgical patient safety incidents were reported between April 2019 and December 2019, of which 165 were due to wrong site surgery, 91 retained foreign object, and 58 wrong implant/prosthesis.[9] Studies have found that about 60% of surgical incidents were due to human error (such as poor communication and teamwork), faulty equipment, poor surgical techniques, and/or system errors.[6,10,11]

There are different incident analysis frameworks that can be used to investigate the root cause of safety incidents in health care.[12,13] The London Protocol is one such framework that proposes a system-based analysis of incidents to identify gaps and inadequacies in the healthcare system.[14] This protocol is an extended version of Reason's Swiss cheese model for error causation[15,16] and involves a broad exam of the incident, the people involved, and the communication between the team leading to the incident.[17] We used this London Protocol system analysis framework to review and analyze the serious surgical incidents that occurred in 5 large teaching hospitals to identify possible contributing factors and propose recommendations for safer healthcare systems.

METHODS

Data Collection

When a health professional within a UK hospital witnesses a patient safety incident, he/she is required to fill in an incident report form on the Datix system and grade the incident in terms of patient harm. The National Patient Safety Agency categorized 6 possible grades of patient harm: near miss, no harm, low harm, moderate harm, major harm, and extreme (death).[2] We searched the Datix system for all surgical incidents recorded between October 2014 and December 2016 in 5 teaching hospitals in one London NHS Trust. We were unaware of any other incidents being identified during this time frame. These 5 hospitals have nearly 1000 operating staff who provide elective, speciality, emergency, and trauma services for around 1,500,000 people every year. Nearly 80,000 surgical and interventional radiology procedures were conducted over this time period.

Our search included all incidents that occurred in any operating room, excluding critical care departments such as intensive care unit (ITU). Incidents that occur in interventional radiology and catheterization laboratories were also included. We then identified all those that were considered serious, that is, that resulted in either moderate, major, or extreme harm, and reviewed the following data for each incident: (*a*) place, time, location, and detailed description; (*b*) staff statements recorded at the time; (*c*) any correspondence the trust incident investigator had with the personnel involved; (*d*) patient care documentation such as a patient's medical notes; and (*e*) the final investigation report carried out by the designated trust incident investigator.

Data Analysis

We used the London Protocol system analysis framework to identify the factors that led to the specific surgical incident. Table 1 describes the different factor types and contributing factors that have

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Correspondence: Sarah P. Slight, PhD, School of Pharmacy, King George VI Building, Queen Victoria Road, Newcastle Upon Tyne, NE1 7RU, United Kingdom (e-mail: sarah.slight@ncl.ac.uk).

One of this article's authors (S.P.S.) is a coeditor for the journal and declares a conflict of interest. The rest of the authors do not have any conflict of interest. There is no funding for this research work and is self-funded.

Appendix 11: Impact grading of incidents in DATIX system from NPSA severity grading matrix.

Impact Grade	National Patient Safety Agency (NPSA) definition - 2004 [4]
Near Miss	Incident prevented – Any incident that had the potential to cause harm but was prevented and so no harm was caused to the patient, staff member, visitor or organisation.
No Harm	Incident not prevented – Any incident that occurred but no harm was caused to the patient, staff member, visitor or organisation.
Low Harm	Any incident that required extra observation or minor treatment (*e.g.* first aid, additional medication) of the patient, staff member, visitor or organisation.
Moderate Harm	Any incident that resulted in a moderate increase in treatment (*e.g.* return to surgery, unplanned re-admission prolonged episode of care, transfer to another area such as ITU) and that caused significant but not permanent harm to the patient, staff member, visitor or organisation.
Major Harm	Any incident that appears to have resulted in permanent harm to the patient, staff member, visitor or organisation (*e.g.* or permanent lessening bodily functions, sensory, motor, physiological or intellectual including removal of the wrong limb or organ or brain damage).
Extreme - Death	Any incident that directly resulted in the death of the patient (the death must be related to the incident rather that the patient illness or underlying conditions) staff member, visitor or organisation.

Appendix 12: Service Evaluation form from the research site

Service Evaluation Ref No: 251	Imperial College Healthcare NHS Trust

Service Evaluation Form

Please note that:

- Service evaluation projects will typically be locally based, evaluating service provision, delivery and interventions and for which publication of results is primarily internal (guidance available here)
- Before the project can start, it must first be registered with the audit team to ensure it has gone through the correct processes – some of which may be subject to Information Governance review and approval
- Any data collection tools, questionnaires or letters should also be included when sending the completed proposal forms for approval
- Once complete or if there are any questions regarding the completion of the form, please send to audit@imperial.nhs.uk

1. PROJECT TITLE	An exploration of the impact of surgical incidents on operating staff
Start Date:	12/02/2018
Completion Date:	31/03/2021
2. Project Lead	
Full Name:	Naresh Serou
Job Title:	Health Services Researcher
Directorate/Specialty:	Women's ,Children and Clinical Support
Email:	naresh.serou@nhs.net
3. Project Sponsor (manager supporting the project)	
Full Name:	Kim Brown
Job Title:	Lead Nurse Theatres
Email:	Kim.brown17@nhs.net
4. Please summarize for our records the purpose of the service evaluation:	

- To explore the effect of surgical incidents on operating theatre staff both personally and professionally,
- To understand how the affected individuals (second victims) cope in the immediate aftermath of a surgical incident,
- To explore the possible underlying causes of surgical incidents in operating theatres,
- To explore how individuals and organisations can learn from these incidents,
- To understand what support structures are currently in place to help second victims,
- To discuss what practical tools are currently available to help health professionals deconstruct safety incidents and learn from them as a team,
- To make recommendations for the future well-being of theatre staff involved in surgical incidents.

5. Please summarize for our records what the project will involve:

A mixed methodology was selected to meet the study aims and objectives. In summary, the researcher will conduct (I) a retrospective review of surgical incidents that occurred in three teaching hospitals and were recorded in one database (Datix) in one London NHS Trust, (II) a number of semi-structured interviews with operating theatre staff (both medical and non-medical) to explore (a) the effect of surgical incidents on operating theatre staff both personally and professionally, (b) how the affected individuals (second victims) cope in the immediate aftermath, and (c) understand what support structures are currently in place to help them, and (III) develop and validate a practical learning framework to help the surgical team learn as a team from incidents in the future.

6. Does the project involve a change of practice for the following groups:

Nursing? *If yes, who is the nursing/midwifery lead?*	*Yes* Kim Brown
Medical Staff?	*Yes*

If yes, who is the chief of service/divisional lead?	Helgi Johannsson

Have any training issues been addressed and documented?	*Yes*
Have any costs/financial issues been addressed?	*Yes*
Does this project impact on other divisions? *If yes, provide the contact details for the staff consulted in each involved divisions.*	*Yes*
Please give the name and date of the forum (e.g. Divisional Q&S Committee) where this project proposal was presented	Theatre Quality and Safety Meeting Sep 2017

7. Information Governance (please note that guidance for this form is available here)

a) If any paper records are used, will they ONLY be stored in secure, confidential, Trust premises (e.g. locked offices)?	**Yes**
*If **NO**, what security measures are in place for storage of hard copies?*	
b) Where Patient Identifiable Information (PII)/Personal Confidential Data (PCD) is recorded on a spread-sheet or database; please confirm that this will only be stored on the Trust infrastructure in a secure area accessible only to those within the clinical team. **YES -** *'I hereby agree that I will never store information on a personal drive or on a non-networked workstation; this includes the network of a non-Trust third party (including Imperial College London), a home PC or Laptop or any memory stick or mobile device.'* **NO -** *If No, please contact the Information Governance Team on InformationGovernanceAdvice@imperial.nhs.uk*	**Yes**
c) Does any PII/PCD leave the clinical team (e.g. external organisations/ Royal Colleges) – this is any information that may be used to identify an individual patient or carer? *If you have responded NO to question d), please continue to section 8.*	**No**

d) What is the justification for using Confidential Data? ***IG Team review only:*** *Justification Acceptable* Choose an item.	• To explore the possible underlying causes of surgical incidents in operating theatres, • To explore how individuals and organisations can learn from these incidents, • To understand what support structures are currently in place to help second victims
e) Will the data be de-identified? *'De-identification' is the process of removing elements of the data such that the individual cannot be identified – further guidance can be found in the guidance document referenced above.*	**Yes**
*If **YES**, please describe the process of de-identification below.*	Each participant during the semi-structured interviews and focus groups will be assigned a unique ID number for use on all study documents and the electronic database. The interviews will be recorded using a digital recorder (with participants' consent), and then these recordings deleted once they have been successfully transferred over to a password-protected computer. The study transcriber will transcribe the recordings verbatim, and a unique participant identification number placed on each electronic file. If the study transcriber is externally recruited "a confidential data agreement" will be in place. There will be one transcript per interview and focus group and these will be stored in the same password protected computer. To complement these interviews, study notes and documentary evidence will also be collected. They will be treated as confidential documents and held securely in accordance with regulations. Information derived from documents will be utilised either straightforwardly or interpretively to produce primary research findings or for verification purposes. In compliance with the regulations, the student researcher will maintain all records and documents regarding the conduct of this study at the ICHT Trust premises. Any personal data will be destroyed as soon as is practical and reasonable to do so. Completely anonymised research data will be kept for 7 years or for longer, if required. If the responsible investigator is no longer able to maintain the study records, a second person will be nominated to take over this responsibility. Confidential study documents shall be restricted to only those personnel approved by the Chief Investigator and recorded as such in the study records.
f) Please confirm that the spread-sheet or database holding the PCD is registered on the IAR.	**Yes**

(This is a requirement for all such information assets, more information on how to do this can be found here: http://source/ict/ictapplications/iar/index.htm)	
g) Will the PII data only be stored until the finalising of the audit report? **YES -** *'I confirm that the source data will be securely destroyed/ deleted once the report has been finalised.'*	**Yes**
*If **NO**, please give rationale for this in the box below*	

8. Communication	
If the audit involves approaching patients directly, has the audit tools/questionnaires/surveys/methods been reviewed by the Trust's Communication and Marketing manager? *This is to ensure that the content is public-friendly - If not, please email Trust.Communications@imperial.nhs.uk*	*N/A*

9. Approval Review (for audit team to sign-off)	
Approver Name:	**Louisa Pierce**
Job Title:	**Clinical Auditor**
Email:	**Imperial.audit@nhs.net**
Date Approved:	**13/02/18**
Notes	

Appendix 13: University Ethics committee research approval

Dear Naresh Serou

Ref: 3709/2018

Thank you for submitting the ethical approval form for the project 'An exploration of the impact of surgical incidents on operating staff' (Lead Investigator: Mr Naresh Serou). Expected to run from 28/02/2018 to 31/03/2021.

Based on your answers the University Ethics Committee grants its approval for your project to progress. Please be aware that if you make any significant changes to your project then you should complete this form again as further review may be required. If you have any queries please contact res.policy@ncl.ac.uk

Best wishes

Policy & Information Team, Newcastle University Research Office

res.policy@ncl.ac.uk

Appendix 14: Email/invitation letter to all theatre staff

Mr Naresh Serou

4th Floor QEQM Building, Theatres and Recovery Surgery,

Cancer and Cardiovascular Division, St Mary's Hospital,

Imperial College Healthcare NHS Trust,

Email: n.serou2@newcastle.ac.uk

Tel: 02033126421/07958493606

Dear Participant (name)

Study Title: An exploration of the impact of surgical incidents on operating staff

IRAS Project ID: 237980 **Ethical Approval Ref:** ***(to be added)***

Imperial College Healthcare NHS Foundation Trust in collaboration with Newcastle University are currently conducting a study to explore staff experiences of surgical incidents and how staff attitudes might have changed following an incident. The interviews will also explore how operating staff coped with these incidents and what support they received from the organisation following these events. As a member of staff who works in the operating theatre, I'm very eager to hear your thoughts. I hope that being part of this study will not only provide useful feedback to the research team but also improve the support staff receive in the future.

Please find enclosed an information sheet that explains the background to the study and what would be expected of you should you agree to participate. Please email n.serou2@newcastle.ac.uk indicating whether or not you would be interested in participating. If you decide to take part, you are still free to withdraw at any time in the future. All information supplied is treated in confidence. Thank you for your consideration. If you have any questions regarding this study or require further information, please do not hesitate to contact me by e-mail or on the telephone number above.

Yours sincerely,

Mr Naresh Serou

Clinical Practice Educator

Imperial College Healthcare NHS Trust,

Dr Krishna Moorthy

Senior Consultant surgeon

Imperial College Healthcare NHS Trust,

Dr Sarah Patricia Slight

Reader in Pharmacy Practice

Newcastle University

Appendix 15: Participant Information Sheet

Imperial College Healthcare NHS Trust

Newcastle University

Study Title: An exploration of the impact of surgical incidents on operating staff

Participant Information Sheet – Staff Member

Names of Investigators*:* Mr Naresh Serou, Dr. Krishna Moorthy and Dr Sarah Slight

IRAS Project ID: 237980

Invitation paragraph

You have been invited to take part in a research study. Before you decide whether or not to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. If there is anything that is unclear or if you would like more information, please ask. Thank you for reading this.

Background

A patient safety incident is an unintended or unexpected incident which could have or did lead to patient harm. After a patient safety incident, the attention and priority is rightly on supporting the patient and their family as first victims. However, these incidents can also affect the health professionals involved, both personally and professionally. Therefore, health professionals have been recognised as second victims of safety incidents. Our aim of the study is to explore the impact of surgical incidents on operating theatre staff (both medical and non-medical), and investigate how staff can learn from and be better supported following a surgical event.

What does the study involve?

We would like to hear your thoughts and perspectives on the impact and learning following surgical incidents, and how second victims could be better supported following these incidents.

Why have I been chosen to take part?

As a member of NHS staff working in operating theatres, you are in an ideal position to give us valuable first-hand information from your own perspective on the above topics.

Do I have to take part?

It is up to you to decide whether or not to take part. If you decide to take part, you will be given this information sheet to keep and will be asked to sign and return the consent form. You are also free to withdraw at any time without giving a reason.

What do I have to do?

By agreeing to take part, you may be required to participate in an interview and/or focus group. The interview will be conducted by myself at a mutually convenient time and place, and will take approximately 20-30 minutes. We would like to explore your experiences of surgical incidents, their impact, coping methods used, any support received from the organisation, and what could be learnt following surgical incidents. If you agree, the interview will be digitally recorded; if you object to this, however, we will just take notes. You can ask that the digital recorder be switched off at any time during the interview if you prefer. Following your interview, and if you wish to participate further in our study, you may be invited to take part in a focus group. This focus group will take place at a suitable time in the future.

What if something goes wrong? / Who can I complain to?

In case you have a complaint on your treatment by myself or anything to do with the study, you can approach my internal research supervisor Dr Krishna Moorthy ,Academic Surgical Unit, 10th Floor, QEQM Building,St Mary's Hospital, Imperial College Healthcare NHS Trust, Praed Street, London, W2 1NY,Email: k.moorthy@imperial.ac.uk, Telephone: 02033127640 or my main supervisor at Newcastle University, **Dr. Sarah Patricia Slight**, School of Pharmacy, Newcastle University, G5, fifth floor, Sir James Spence Institute Building

Newcastle University, Queen Victoria Road, Newcastle upon Tyne,NE1 4LP Email: sarah.slight@newcastle.ac.uk. or .Independent advice can also be sought from Imperial College Healthcare NHS trust **R&D Department**.

Will my taking part in this study be kept confidential?

All information supplied will be kept confidential. Any information reported from the interview will not enable you to be recognised. You will not automatically be expected to take part in any future research. All information, which is collected about you during the course of the research will be kept on a password-protected database and held securely in accordance with the Data Protection Act 1998. Hard copy records will be stored in a locked filing cabinet in a locked, secure office. Access to the information will be limited to the study staff and investigators only. Any personal data will be destroyed as soon as is practical and reasonable to do so (approx. 4 weeks after the date of interview). Any information about you, which leaves the research unit, will have your name and address removed so that you cannot be recognised from it. In the very unlikely event that the study team come across an incident of bad practice, these will be reported to the appropriate authorities within the hospital.

What will happen to the results of the research study?

We plan to submit the findings of this study to medical journals (papers) for publication. Direct quotations may be published but the participants will not be identifiable by name. Any other potentially identifiable information in the quote will be removed. You will not be identified in any report/publication. We are willing to provide you with a summary of our study findings, if interested.

Who is organising and funding the research?

This study is self-funded and is through Newcastle University

Who has reviewed the study?

This study has been reviewed and approved by the School of Pharmacy Ethics Committee at Newcastle University, the Research & Development Department at Imperial College Healthcare NHS trust, and the NRES committee London.

Contact for Further Information

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Thank you very much for considering taking part in this research study.

Appendix 16: Participants consent form

Imperial College Healthcare NHS Trust

Newcastle University

Study Title: An exploration of the impact of surgical incidents on operating staff

Staff Member Consent Form

Trust service evaluation registration number: 251

IRAS Project ID: 237980

Name of Researcher: _____

Name of Participant: _____

Please initial box

1. I confirm that I have read and understand the information sheet version number ……dated…… for the above study and have had the opportunity to ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. ☐
3. I understand that should I withdraw then the information collected so far cannot be erased and that this information may still be used in the project analysis. ☐
4. I understand that the interview/focus group will be recorded and that anonymous direct quotes from it may be used in the study reports. ☐
5. I understand that all information supplied will be kept confidential. Any information reported will not enable me to be recognised. ☐
6. I agree to take part in the above study. ☐

_____ _____ _____

Name of Participant Date Signature

_____	_____	_____
Name of Person taking consent	Date	Signature

2 copies: 1 for participant and 1 for the project notes

Appendix 17: Participants demographic form

Imperial College Healthcare NHS Trust

Newcastle University

Study title: An exploration of the impact of surgical incidents on operating staff

Trust service evaluation registration number: 251

Date: **Time:** **Place:**	
What is your job title?	
What is your job grade (band for nurses/ODPs and HCAs)?	
What surgical speciality (surgeons), area of work (for theatre staff- anaesthetics or theatres):	
How long you been working in operating theatres for?	
Your age (Please circle)	20 to 30 31 to 40 41 to 50 51 to 60 Over 60
Your gender (Please circle)	Male Female

Appendix 18: Interview Topic Guide

Study Title: An exploration of the impact of surgical incidents on operating staff

Participant Interview Topic guide

A common introduction will be used as follows:

As a member of operating theatre staff, we would like to gain your views on the impact of surgical incidents on staff and investigate how staff can learn from and be better supported following a surgical event. We are interested in your opinions whether these are positive or negative. If there are any questions that you do not feel you can answer, we can easily skip over that question.

QUESTIONS

(1) What do you understand by a "surgical incident"?

(2) How do think such incidents impacted on the individuals involved / the surgical team as a whole?

(3) Could you give me an example of a surgical incident?

Prompt:

- *Were you involved in this particular incident? In what way?*
- *How long ago did it happen?*
- *How did it affect you / the team? Personally / professionally?*

(4) In your opinion, what might have contributed to this surgical incident occurring (causes)?

Prompt:

- *Might this be similar or different to other incidents that occurred?*

(5) Did your attitude/ behaviour change towards patient safety following the incident? In what way?

(6) What support structures were offered to you / staff involved following the incident?

Prompt:

- *Support from your peers?*
- *Support from your organisation?*
- *Other support?*

(7) How would you describe your institution's culture in response to a surgical incident occurring?

(8) In what ways can we learn from the occurrence of such incidents going forward?

Prompt:

- *How do you think we can learn as a team?*

(9) Do you have any other comments?

Concluding remarks will end the interview:

That was the last question on this interview. As I mentioned earlier, all data are stored anonymously and you will not be identifiable from any uses of these data. If you would like any further information about the study, please don't hesitate to contact me. My details have been provided on the information sheet.

Thank you for taking part in this interview.

Appendix 19: Examples of codes applied to different data extracts.

Data extract	Coded for
When the whole investigation is being carried out I was invited to sit in front of a panel and I was not sure that the panel was trying to get out of me, so I was scared you can imagine. My manager at that time (panel interview) was there. She did speak to me at that time of the incident, how I felt about the incident, she just sat across almost to say just let the process carry on. What I was particularly happy about then during the interview was, they had our policy for the swab count and the people that who are in the panel where not theatre trained. So they are quiet open in terms of there was no judgement and they established whether the process in place written by trust were followed by me or not. (P5 , Senior ODP)	1) Investigative Process 2) Judgement 3) Trust Policy and Procedures 4) Training
I think the impact on the individual varies really; I sort of can give an example of myself where I was involved in a surgical incident. I was 2 weeks into my employment and I was asked to carry out count for surgical swabs. After 3 months the patient returned to theatre	1) Emotional Support 2) Emotional Impact 3) Learning from incidents

with a retained swab. I felt scared. I must say, knowing that it is my first job and you could potentially loose it for not having done the correct thing for your patient, however I felt lucky at that time as we had a good clinical educator at that time who came around with learning materials, I remember one study which he gave me looking at the incidents in aviation and when I asked him if he was ever involved in a surgical incident he answered never and it made me feel bit strange. But, what I got from him was the sort of support that he know what I was going through.(P11, Theatre Scrub Nurse)	
More staff education and also making sure all the teams are working well would actually minimize preventing occurance of incidence. I think I forgot to allure to you regarding my incident investigation, that there was a thought that one of the anaesthetist involved during the incident was known to always rushing operating staff and that could have contributed to us (theatre staff) sort of taking(transferring) the	1) Contributing factors 2) Staff education 3) Team working / dynamics

patient out of the table because they want to go to recovery soon.(P9, ODP)	
I think if I look back things are not the same as was before. The organisation has moved on and they are now taking incidents seriously, there is more support to also help staff when these kind of things happens. There are group of people called CONTACT who are independent to your department and they can offer you support in terms of listening to your concerns and show where you need to go. There is also an office I know within the trust dedicated to patient safety run by one of the medical directors. They have been highlighting a lot of safety issues and putting out there to everyone(to learn). So I can say the organisation has moved on really (well). We are at a good place , where everyone are encouraged to report any incidences so that we can learn from them.(P27, Vascular Surgeon)	1) Safety Culture 2) Support Structures

Appendix 20 : Surgical incidents and their impact on operating theatre staff: qualitative study

OXFORD

BJS Open, 2020, 00, 1–6
DOI: 10.1093/bjsopen/zraa007
Original Article

Surgical incidents and their impact on operating theatre staff: qualitative study

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Abstract

Background: Surgical incidents can have significant effects on both patients and health professionals, including emotional distress and depression. The aim of this study was to explore the personal and professional impacts of surgical incidents on operating theatre staff.

Methods: Face-to-face semistructured interviews were conducted with a range of different healthcare professionals working in operating theatres, including surgeons and anaesthetists, operating department practitioners, and theatre nurses, and across different surgical specialties at five different hospitals. All interviews were audio recorded, transcribed verbatim, and analysed using an inductive thematic approach, which involved reading and re-reading the transcripts, assigning preliminary codes, and searching for patterns and themes within the codes, with the aid of NVivo 12 software. These emerging themes were discussed with the wider research team to gain their input.

Results: Some 45 interviews were conducted, generally lasting between 30 and 75 min. Three overarching themes emerged: personal and professional impact; impact of the investigation process; and positive consequences or impact. Participants recalled experiencing negative emotions following surgical incidents that depended on the severity of the incident, patient outcomes, and the support that staff received. A culture of blame, inadequate support, and lack of a clear and transparent investigative process appeared to worsen impact.

Conclusion: The study indicated that more support is needed for operating theatre staff involved in surgical incidents. Greater transparency and better information during the investigation of such incidents for staff are still needed.

Introduction

Medical errors are thought to affect around 16 per cent of patients admitted to hospital, with 50 per cent of these occurring during surgical procedures[1,2]. A 'surgical incident' can occur during a surgical or invasive procedure, and may result in patient harm. A recent assessment of the problem in the UK National Health Service (NHS) identified 314 reported surgical incidents in the interval between April 2019 and December 2019, with 165 due to wrong-site surgery, 91 a retained foreign object, and 58 a consequence of wrong implant/prosthesis[3].

Health professionals have been recognized as secondary victims of medical errors[4,5], defined as 'a health care provider involved in an unanticipated adverse patient event, medical error and/or a patient related-injury, who becomes victimized in the sense that the provider is traumatized by the event'[5,6]. Studies[7,8] have highlighted that, following a surgical incident, surgeons, theatre nurses, and other health professionals can experience emotional distress and depression, with symptoms similar to those of post-traumatic stress syndrome. A survey of 7900 surgeons indicated that, following their involvement in a surgical incident, they experienced low quality of life, anxiety, burnout, and depression in the following 3 months[5,6] Such experiences not only affect surgeons and their families, but can also have an adverse impact on the provision of care, clinical performance, and patient safety[4,5]. These surgical incidents can have enduring effects and, in some instances, the individuals may never fully recover and may consider changing profession[7,9–11]. Some studies indicate that an adverse event can lead to increase in use of illicit drugs[9], addiction to alcohol, decrease in quality of life, depression, and burnout[12,13].

A systematic review[14] to investigate the impact surgical incidents can have on operating theatre staff highlighted how little had been published on the impact of surgical incidents on the wider operating team beyond surgeons and anaesthetists, or how surgeons and other a health professionals might change their behaviours following a surgical incident.

The main aim of this qualitative study was to explore the psychological, emotional, and behavioural impact of surgical

Received: May 05, 2020. Accepted: September 1, 2020

Appendix 21: Support for healthcare professionals after surgical patient safety incidents: A qualitative descriptive study in 5 teaching hospitals

ORIGINAL ARTICLE

Support for Healthcare Professionals After Surgical Patient Safety Incidents: A Qualitative Descriptive Study in 5 Teaching Hospitals

Naresh Serou, MSc,†‡ Andy K. Husband, PhD,* Simon P. Forrest, PhD,‖ Robert D. Slight, PhD,§¶ and Sarah P. Slight, PhD*§¶*

Objective: Patient safety incidents can have a profound effect on healthcare professionals, with some experiencing emotional and psychological distress. This study explored the support medical and nonmedical operating room staff received after being involved in a surgical patient safety incident(s) in 5 UK teaching hospitals.

Methods: An invitation letter and information sheet were e-mailed to all medical and nonmedical operating room staff (N = 927) across the 5 sites. Semistructured interviews were arranged with a range of different healthcare professionals working in operating rooms across a wide variety of surgical specialities. Interviews were audio recorded, transcribed verbatim, and analyzed using an inductive thematic approach.

Results: We conducted 45 interviews with medical and nonmedical operating room staff, who emphasized the importance of receiving personalized support soon after the incident. Operating room staff described how the first "go to" people were their peers and reported feeling comforted when their peers empathized with their own experience(s). Other participants found it very difficult to seek support, perceiving it as a sign of weakness. Although family members played an important role in supporting second victims, some participants felt unable to discuss the incident with them, fearing that they might not understand.

Conclusions: There should be clear support structures in place for operating room staff who have been involved in surgical incidents. Health organizations need to offer timely support to frontline staff after these incidents. Senior clinicians should be proactive in offering support to junior colleagues and empathize with their own experiences, thus shifting the competitive culture to one of openness and support.

Key Words: surgical incidents, second victims, support, operating room staff, patient safety

(*J Patient Saf* 2021;00: 00–00)

A human error in health care has the potential to cause serious patient harm. In situations where this happens, priority is rightly given to supporting the patient and their family. These incidents can also have a profound negative impact on the healthcare professionals involved.[1–4] The term "second victims" has been used to describe "a health care provider involved in an unanticipated adverse patient event, medical error and/or a patient related-injury who becomes victimised in the sense that the provider is traumatised by the event."[5] This term has recently come under scrutiny, with patient groups calling for it to be abandoned.[6] Although patients acknowledge that health professionals need support and guidance after incidents, they have also felt that the usage of this term promotes the belief that patient harm is random, caused by bad luck, and is simply not preventable. Healthcare professionals can experience emotional and psychological distress after a surgical incident, which in turn can lead to a loss of concentration, poor clinical performance, and unsafe practice, compromising patient safety.[2,3,7–9] It has been reported that nearly half of health professionals worldwide have experienced being second victims.[6,9,10]

The UK Care Quality Commission, an independent regulator of health and adult social care, recommended that healthcare organizations offer support to the healthcare professionals after a surgical incident, including counseling, professional support interventions, and well-being initiatives.[11] Despite these recommendations, not all healthcare professionals have received support.[7,9,12] Operating rooms are one of the highest risk environments in health care for errors,[3,13] with the second highest number of serious incidents in the ~~NHS~~ reported to occur there.[14] A systematic review of the literature highlighted how very little had been published on the impact of surgical incidents on the wider operating team beyond surgeons and anesthetists.[3] Operating room nurses, operating department practitioners (ODPs), and operating room assistants can all experience emotional and psychological distress when involved in surgical incidents, with a significant impact on their professional work.[15,16] We found a gap in the literature concerning the nature of structured support systems currently in place to help second victims manage surgical incidents.[3] This qualitative study explores what support operating room staff actually received after surgical incidents and what other kinds of support would have helped them in moving forward.

METHODS

We used SRQR (standards for reporting qualitative research) criteria[17] to report our research and provided a checklist as Supplementary Material 1, http://links.lww.com/JPS/A393.

Study Design, Setting, and Sample

This qualitative study involved face-to-face semistructured interviews with medical operating room staff (e.g., surgeons and anesthetists of all grades) and nonmedical operating room staff (e.g., nurses, ODPs, operating room assistants of all grades) in one large English NHS Trust. The NHS trust is composed of 5 teaching hospitals providing multispecialty surgical procedures including emergency and major trauma. A recruitment pack including an invitation letter and information sheet was e-mailed to all medical and nonmedical operating room staff (N = 927) across the 5 sites. Promotional posters were displayed on Trust noticeboards and in rest rooms. One hundred sixty-eight operating

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The authors disclose no conflict of interest.

S.P.S. is a coeditor for the journal.

Supplemental digital contents are available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.journalpatientsafety.com).

Appendix 22: Describes examples from the study mapped to the six stages to recovery for second victims.

The stages of recovery	**Stage features and its characteristics**	**Example of participants emotional responses in the study**
Stage 1: Chaos and accident response	Study participants reported becoming distracted and seeking immediate help.	*"As soon as I realised, I have given a block [regional nerve block for pain relief] on the wrong site, I was completely stunned, speechless, shocked terrified and sick". (Anaesthetic Registrar, P18)*
Stage 2: Intrusive reflections	Study participants re-evaluated the incident in self-isolation	*"made me doubt in my [her] abilities to be a scrub nurse, to count, to see with my [her] eyes, to trust what my [her] eyes are seeing".* (Theatre scrub nurse P19)
Stage 3: Restoring personal integrity	Participants are more worried and fear what others might think of them in clinical practice.	*"It was like an earth shattering feeling, there is fear and sometimes embarrassment that I have been involved in an incident. Feared of what others might be thinking of me at work"*

		(Orthopaedic senior nurse, P26)
Stage 4: Enduring the inquisition	Participant's described going through the investigation process and the impact it had on them.	*"So, as I said we all been investigated in isolation and I have no idea what they talked to the surgeon involved and the contents discussed and what the results of the discussion was. I was aware the anaesthetist who was involved was called in to explain the circumstances in which the surgery was performed, haven't got any results of what transpired between them. I did not get any detailed feedback as well after the investigation was carried out. It was very stressful experience".(Senior ODP, P5)*
Stage 5: Obtaining emotional first aid	Participants recalled seeking support from trusted colleague(s), manager(s) or supervisor and family member	*"My clinical educator had a very good influence in me, I trusted him at that time and he sort of opened my eyes*

		that these things happen and what you can get out of them is learning and that's what I managed to do."(ODP, P32)
Stage 6: Moving on (need to select one of three) Dropping out Surviving **<u>Thriving</u>**	Participants described coping after the incident, with some considering quitting the profession.	*"the Stop before you block" project, which I have initiated following the incident, was drafted within the theatre policies and procedure. I was thrilled and pleased as my incident had a positive effect on the theatre practices. I have even given a speech in conference on my project. It really helped me to cope with my initial negative emotions". (Anaesthetic Registrar, P18)*