



# The Surgeon as the Second Victim? Results of the Boston Intraoperative Adverse Events Surgeons' Attitude (BISA) Study

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**Scholarly Report submitted in partial fulfillment of the MD Degree at Harvard Medical School**

**Date:** 01 March 2020

**Student Name:** Kelsey Han

**Scholarly Report Title:** The Surgeon as the Second Victim? Results of the Boston Intraoperative Adverse Events Surgeons' Attitude (BISA) Study

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**Link to and Citation for any publications that you wrote on your scholarly project:**

Han K, Bohnen JD, Peponis T, et al. The Surgeon as the Second Victim? Results of the Boston Intraoperative Adverse Events Surgeons' Attitude (BISA) Study. J Am Coll Surg. 2017;224(6):1048-1056.

## **ABSTRACT**

### **TITLE: The Surgeon as the Second Victim? Results of the Boston Intraoperative Adverse Events Surgeons' Attitude (BISA) Study**

Kelsey Han, AB, Jordan D Bohnen, MD, MBA, Thomas Peponis, MD, Myriam Martinez, MD, Anirudh Nandan, BA, Daniel D Yeh, MD, FACS, Jarone Lee, MD, Marc Demoya, MD, George Velmahos, MD, PhD, FACS, Haytham MA Kaafarani, MD, MPH, FACS

**Purpose:** An intraoperative adverse event (iAE) is often directly attributable to the surgeon's technical error and/or suboptimal intraoperative judgment. We aimed to examine the psychological impact of iAEs on surgeons as well as the surgeons' attitude about iAE reporting.

**Methods:** We conducted a web-based cross-sectional survey of all surgeons at 3 major teaching hospitals of the same university. The 29-item questionnaire was developed using a systematic closed and open approach focused on assessing the surgeons' personal account of iAE incidence, emotional response to iAEs, available support systems, and perspective about the barriers to iAE reporting.

**Results:** The response rate was 44.8% (n=126). Mean age of respondents was 49 years, 77% were male, and 83% performed >150 procedures/year. During the last year, 32% recalled 1 iAE, 39% recalled 2 to 5 iAEs, and 9% recalled >6 iAEs. The emotional toll of iAEs was significant, with 84% of respondents reporting a combination of anxiety (66%), guilt (60%), sadness (52%), shame/embarrassment (42%), and anger (29%). Colleagues constituted the most helpful support system (42%) rather than friends or family; a few surgeons needed psychological therapy/counseling. As for reporting, 26% preferred not to see their individual iAE rates, and 38% wanted it reported in comparison with their aggregate colleagues' rate. The most common barriers to reporting iAEs were fear of litigation (50%), lack of a standardized reporting system (49%), and absence of a clear iAE definition (48%).

**Conclusions:** Intraoperative AEs occur often, have a significant negative impact on surgeons' well-being, and barriers to transparency are fear of litigation and absence of a well-defined reporting system. Efforts should be made to support surgeons and standardize reporting when iAEs occur.

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**Glossary of Abbreviations**

BISA – Boston Intraoperative Adverse Events Surgeons’ Attitude Study

iAE – intraoperative adverse event

M&M – morbidity & mortality

REDCap – Research Electronic Data Capture

## Statement of Scholarly Project Question

Iatrogenic injuries and adverse events contribute to significant morbidity and mortality. To date, a plethora of studies have been conducted on the consequences and factors contributing to *postoperative* adverse events. However, research efforts have only recently addressed *intraoperative* adverse events (iAEs) with findings detailing the unique predictors of iAEs, in addition to the effects of iAEs on both patient outcomes and hospital/institutional finances. While this discussion of intraoperative adverse events has elucidated many of its effects on patients and institutions, this conversation has left out a crucial stakeholder – the person holding the scalpel. Given that intraoperative adverse events can, in theory, be due to technical error or erroneous intraoperative judgment on behalf of the surgeon, the purpose of this scholarly project was to assess the following questions/topics:

- Surgeons' personal account of iAE incidence
- Emotional responses to iAEs
- Frequently used support systems, if any
- Surgeon perspectives and attitudes regarding barriers to reporting iAEs

Consequently, the manuscript entitled “The Surgeon as the Second Victim? Results of the Boston Intraoperative Adverse Events Surgeons' Attitude (BISA) Study” published in the *Journal of the American College of Surgeons* details our study's findings. The authors on this manuscript contributed in the following ways:

1. Study conception and design: Han, Bohnen, Kaafarani
2. Acquisition of data: Han, Bohnen, Peponis, Kaafarani
3. Analysis and interpretation of data: Han, Bohnen, Peponis, Martinez, Nandan, Yeh, Lee, DeMoya, Velmahos, Kaafarani
4. Drafting of manuscript: Han, Bohnen, Peponis, Martinez, Nandan, Yeh, Lee, Demoya, Velmahos, Kaafarani

Additionally, this scholarly project has been presented at both local and national conferences. Kelsey Han, HMS student and first author, gave podium presentations of this scholarly project at the following:

- Harvard Surgery Research Day, Boston, Massachusetts, May 7, 2016.
- 63<sup>rd</sup> Annual Meeting of the Massachusetts Chapter of the American College of Surgeons, Boston, Massachusetts, December 3, 2016.
- 97<sup>th</sup> Annual Meeting of the New England Surgical Society. Boston, Massachusetts, September 2016.

Kelsey was awarded the Harvard Excellence in Surgery Research Award (2016) and the American College of Surgeons First Place Podium Presentation Award (2016). This manuscript has been cited by the Joint Commission and data provided the impetus for creation of a surgery-specific second victim program at a Harvard-affiliated hospital.

**Link to and Citation for Published Work**

Citation: Han K, Bohnen JD, Peponis T, et al. The Surgeon as the Second Victim? Results of the Boston Intraoperative Adverse Events Surgeons' Attitude (BISA) Study. J Am Coll Surg. 2017;224(6):1048-1056.

Link: <https://www.ncbi.nlm.nih.gov/pubmed/28093300>



## **Appendix**

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# The Surgeon as the Second Victim? Results of the Boston Intraoperative Adverse Events Surgeons' Attitude (BISA) Study



Kelsey Han, AB, Jordan D Bohnen, MD, MBA, Thomas Peponis, MD, Myriam Martinez, MD, Anirudh Nandan, BA, Daniel D Yeh, MD, FACS, Jarone Lee, MD, Marc Demoya, MD, George Velmahos, MD, PhD, FACS, Haytham MA Kaafarani, MD, MPH, FACS

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- BACKGROUND:** An intraoperative adverse event (iAE) is often directly attributable to the surgeon's technical error and/or suboptimal intraoperative judgment. We aimed to examine the psychological impact of iAEs on surgeons as well as the surgeons' attitude about iAE reporting.
- STUDY DESIGN:** We conducted a web-based cross-sectional survey of all surgeons at 3 major teaching hospitals of the same university. The 29-item questionnaire was developed using a systematic closed and open approach focused on assessing the surgeons' personal account of iAE incidence, emotional response to iAEs, available support systems, and perspective about the barriers to iAE reporting.
- RESULTS:** The response rate was 44.8% (n = 126). Mean age of respondents was 49 years, 77% were male, and 83% performed >150 procedures/year. During the last year, 32% recalled 1 iAE, 39% recalled 2 to 5 iAEs, and 9% recalled >6 iAEs. The emotional toll of iAEs was significant, with 84% of respondents reporting a combination of anxiety (66%), guilt (60%), sadness (52%), shame/embarrassment (42%), and anger (29%). Colleagues constituted the most helpful support system (42%) rather than friends or family; a few surgeons needed psychological therapy/counseling. As for reporting, 26% preferred not to see their individual iAE rates, and 38% wanted it reported in comparison with their aggregate colleagues' rate. The most common barriers to reporting iAEs were fear of litigation (50%), lack of a standardized reporting system (49%), and absence of a clear iAE definition (48%).
- CONCLUSIONS:** Intraoperative AEs occur often, have a significant negative impact on surgeons' well-being, and barriers to transparency are fear of litigation and absence of a well-defined reporting system. Efforts should be made to support surgeons and standardize reporting when iAEs occur. (J Am Coll Surg 2017;224:1048–1056. © 2017 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)
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In the last 2 decades, multiple reports and studies have brought attention to the increased morbidity as well as mortality of iatrogenic injuries and adverse outcomes, including perioperative errors and adverse events.<sup>1–6</sup>

**Disclosure Information:** Nothing to disclose.

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Most surgical research has been focused to date on measuring and preventing postoperative adverse events, with little focus on intraoperative adverse events (iAEs).<sup>7</sup> Recently, several studies have suggested that iAEs have a wide range of severity, a unique set of predictors, a significant adverse effect on patient outcome, and a large financial impact on the healthcare system.<sup>8–16</sup> Specifically, iAEs independently increase the risk of morbidity and mortality of patients by more than 3-fold, the risk of hospital readmissions by more than 2-fold, and the hospital charges by >40%.

Although the patient clearly remains the person most affected by any adverse event, multiple studies have suggested that these events negatively impact physicians in general and surgeons in particular as well, a syndrome

often referred to as the “second victim” syndrome.<sup>17-19</sup> One can easily acknowledge that the cause of iAEs is often multifactorial; however, they are many times directly attributable or perceived as attributable to the surgeon’s technical error and/or suboptimal intraoperative judgment. Therefore, their emotional impact on surgeons is potentially more profound, and the subject of reporting iAEs publicly or within a quality-improvement framework remains understandably controversial in the surgical world.

In this Boston Intraoperative Adverse Events Surgeons’ Attitude (BISA) study, we aimed to assess the surgeons’ personal account of iAE incidence, emotional response to iAEs, most frequently used social support systems, and perspective regarding the barriers to iAE reporting.

## METHODS

The study was designed as a cross-sectional survey administered to practicing academic surgeons at 3 major teaching hospitals of the same medical school in Boston. For the purpose of this study, an iAE was defined as any inadvertent injury that occurs during the course of an operation. This working definition was communicated to all participants at the beginning of the survey.

### Survey design

Through multiple iterations, a 29-item web-based questionnaire was developed using a systematic closed and open approach focused on assessing 4 themes or domains: the surgeons’ personal experience with iAEs and account of iAE incidence, the surgeons’ emotional and psychological response to iAEs, the available and most commonly used surgeons’ support systems, and the surgeons’ perspective about the barriers to transparency in iAE reporting. Depending on the nature of the closed-ended question, the survey featured the ability to only select a single answer, a “check all that applies” format, as well as questions with cursors that could be placed at any value between 0 and 100%. Study responses and data were collected and managed using the REDCap (Research Electronic Data Capture) electronic tool from August to December 2015. The REDCap is a secure, web-based application designed to support data capture for research studies.

### Study participants

After obtaining institutional review board approval from the medical school, the survey was electronically sent to all practicing surgeons at 3 major teaching academic medical centers affiliated with the same medical school. These included the following specialties: general surgery, cardiac

surgery, pediatric surgery, thoracic surgery, transplant surgery, trauma surgery, and vascular surgery. Surgical trainees, non-practicing surgical researchers, and retired surgeons were excluded. Responses were aggregated and de-identified to establish anonymity and encourage honest feedback. To improve response rate, a total of 3 reminders were sent during a period of 6 weeks, and a \$5 coffee gift card was offered, if desired, for participants who finished the survey.

### Analysis

A quantitative analysis of the closed-ended answers across surgeons for the different questions was performed. When appropriate, 2 or more answers were grouped to improve data reporting. In addition, a qualitative analysis was performed and specific free text statements of surgeons were selected and reported here to illustrate several interesting concepts and recurrent themes that emerged from the survey.

## RESULTS

A total of 281 surgeons received the survey. The response rate was 44.8% ( $n = 126$ ). Mean age of respondents was 49 years, 77% were male, and 83% performed >150 procedures/year. The majority of respondents were general surgeons (51.5%) (Table 1).

### Surgeon account of intraoperative adverse event incidence

The majority of respondents (90.4%) reported having dealt with iAEs during their career. When asked how many personal iAEs they recalled during the last 12 months, 32% recalled 1 iAE, 39% 2 to 5 iAEs, and 9% >6 iAEs (Fig. 1).

### Emotional impact of intraoperative adverse events on surgeons

The emotional toll of iAEs on surgeons was significant, with 84% of respondents reporting a combination of anxiety (66%), guilt (60%), sadness (52%), shame/embarrassment (42%), and anger (29%) (Fig. 2). In addition, surgeons at all experience levels encountered these negative emotions (Fig. 3). However, of those surgeons who reported that they did not have any negative feelings after an iAE, 79% had 10 or more years of experience as surgeons. As one surgeon reported: “we all hide our grief, suffer in silence. The pain can be close to debilitating.”

### Available social support systems

Colleagues constituted the most helpful support system (42%) rather than friends or family (Fig. 4). A few

**Table 1.** Respondents Demographics, Surgical Specialty, and Clinical Experience

Participant characteristic (n = 126)	Data
Sex, n (%)	
Male	97 (76.9)
Female	27 (21.4)
No response	2 (1.5)
Institution, n (%)	
Hospital A	5 (3.9)
Hospital B	48 (38.0)
Hospital C	73 (57.9)
Age, y	
Mean	49.4
Range	33–81
Years of experience, n (%) <sup>*</sup>	
<5	25 (19.8)
5 to 9	18 (14.2)
10 to 14	22 (17.4)
15 to 19	13 (10.3)
20 to 25	20 (15.8)
>25	27 (21.4)
No response	1 (0.7)
Type of operation performed, n (%) <sup>†</sup>	
Cardiac surgery	6 (4.7)
General surgery	65 (51.5)
Pediatric surgery	12 (9.5)
Thoracic surgery	10 (7.9)
Transplant surgery	5 (3.9)
Trauma surgery	22 (17.4)
Vascular surgery	10 (7.9)
Other <sup>‡</sup>	32 (25.3)
Annual surgical volume, n (%)	
<50	4 (3.1)
50 to 150	18 (14.2)
151 to 250	43 (34.1)
>250	61 (48.4)

<sup>\*</sup>Years of experience was defined as the number of years practicing surgery after completing residency and fellowship training.

<sup>†</sup>Respondents were able to select more than 1 answer for this question.

<sup>‡</sup>“Other” responses included bariatric surgery (n = 3), breast surgery (n = 4), colorectal surgery (n = 2), endocrine surgery (n = 1), head and neck surgery (n = 1), hepatopancreatobiliary surgery (n = 1), otolaryngology (n = 4), plastic surgery (n = 5), and urological surgery (n = 4).

surgeons sought out psychological therapy/counseling to cope with the negative emotions of the occurrence of iAEs.

One of the recurrent themes raised by numerous respondents was a perceived suboptimal informal and formal/institutional support system specifically aimed at surgeons trying to cope with their emotions after an iAE. Multiple surgeons in the survey pointed to the

competitive, often unsympathetic, surgical culture and atmosphere where a discussion of surgical errors or suboptimal outcomes has repercussions on the surgeon's professional reputation. The act of seeking out support was reported to be occasionally viewed as an admission of subpar surgical skills and to be met with criticism from colleagues. Such perceived non-supportive culture has prompted many surgeons to adopt the mentality that peer/colleague support is negatively perceived when sought out, which perpetuates a cycle in which surgeons attempt to address their emotions independently through repression, self-defense, or depersonalization of the event. Representative responses include, but are not limited to, the following:

*Everyone knows about an iAE within moments. No such thing as a support system, only criticism and condemnation.*

*The competitive and stalwart culture of surgery at [this institution], makes it difficult to seek out support openly.*

*After you have been in the field for a while and have seen lots of things happen, you develop a self-defense, self-supporting system. It does not mean that you don't care. Rather, you know how to deal with things better. It takes more than 10 years to get beyond that point.*

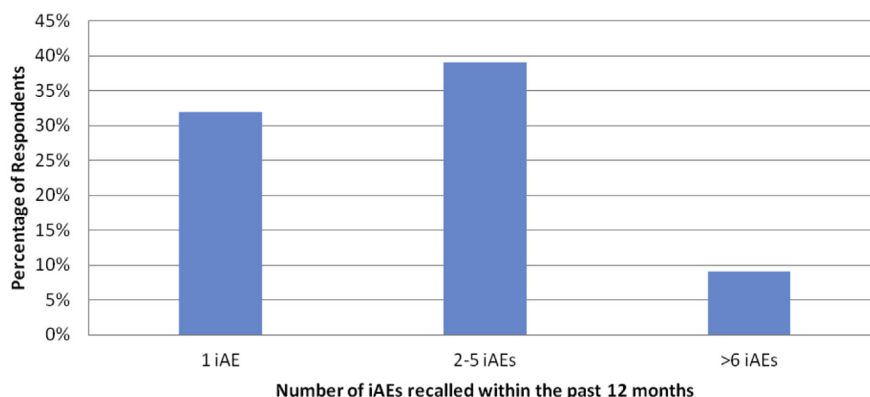
*I use the 5-second rule from NASA. I can feel whatever I want for 5 seconds then I must move on.*

### Reporting intraoperative adverse events

Almost half of the respondents (45.2%) suggested that their institution had no pre-existing reporting system for iAEs or that they were not sure if any reporting system existed. For the remaining surgeons who reported the existence of an iAE reporting system at their institution, morbidity and mortality (M&M) conferences, rather than a formal systematic database, was the suggested mechanism by which data on iAEs was recorded (Fig. 5), with many acknowledging that M&M is not the best methodology to track iAEs. Others raised concerns that the prevalent M&M culture can inadvertently discourage frank discussions concerning iAEs:

*M&M is accusatory and hostile instead of making it an academic learning environment.*

*M&M discussions don't always provide support for what happened. There is always some subliminal blame, sometimes overt blame for the mistake.*



**Figure 1.** Intraoperative adverse event (iAE) incidence. Surgeons' account of the incidence of intraoperative adverse events within the past 12 months.

*Quality and safety system is more focused on blaming surgeons than solving safety issues (despite the claims otherwise). Makes a difficult emotional time even worse.*

*We already know that voluntary self-reporting is extremely unreliable. A fraction of all complications are reported to M&M conference.*

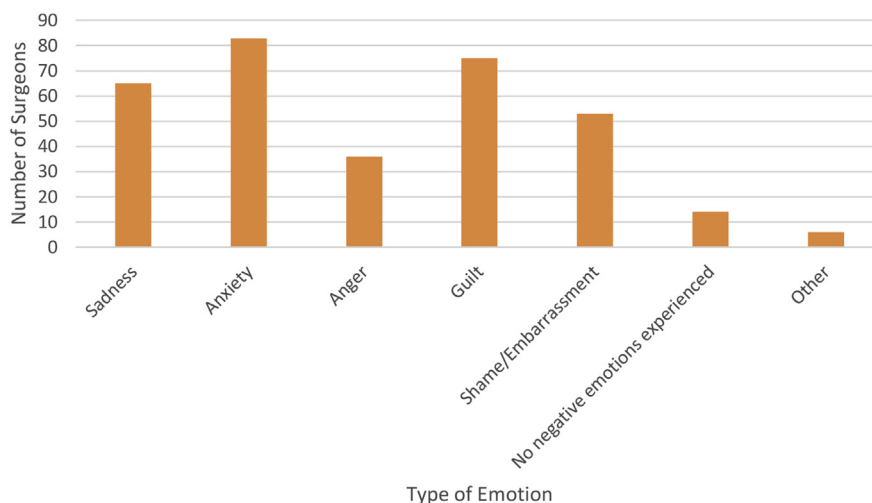
### Barriers to transparent reporting of intraoperative adverse events

When asked about transparency in iAE reporting, 26% of surgeons preferred not to see their individual rates reported at all, and 38% wanted it reported to them in

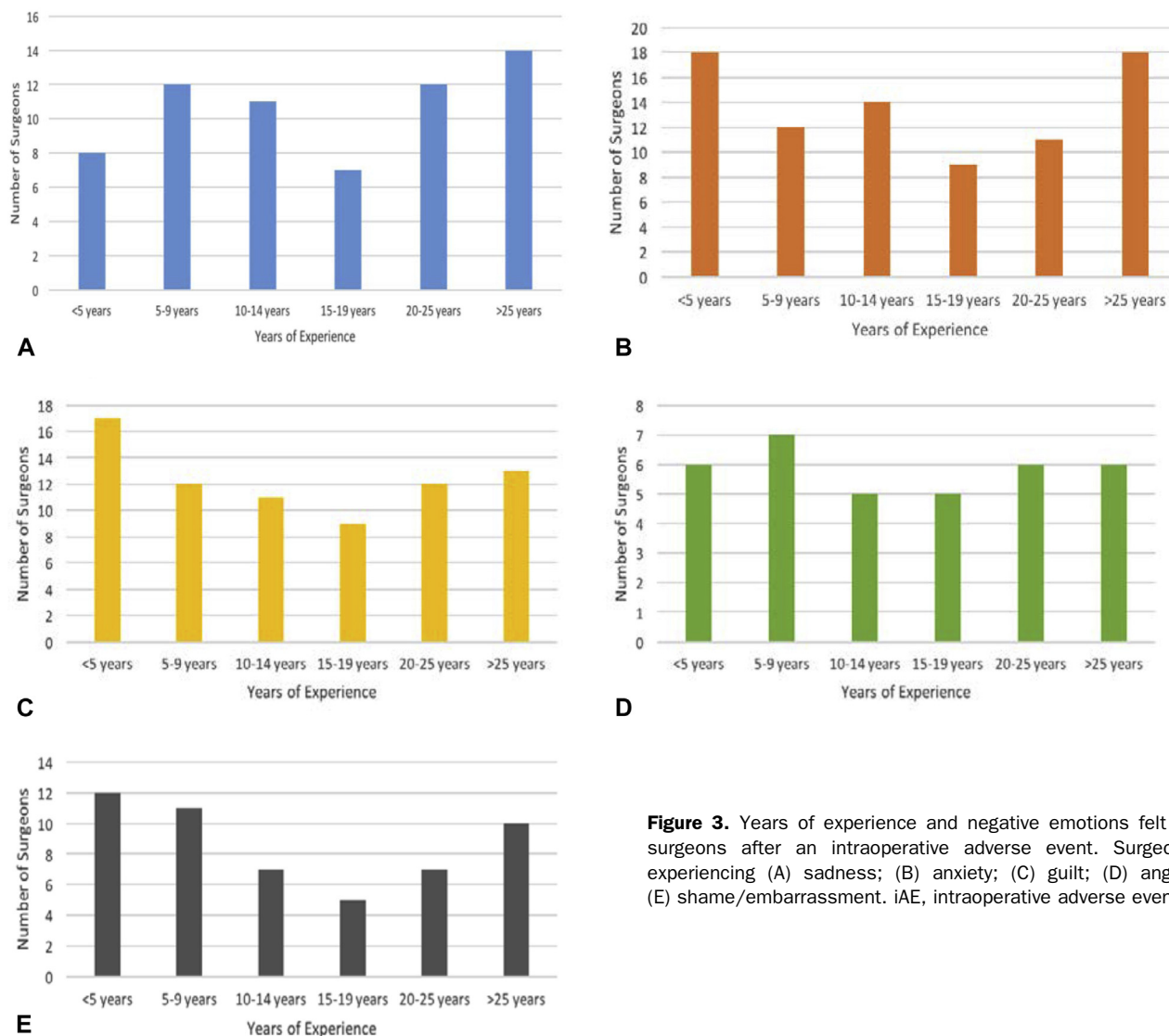
comparison with their aggregate colleagues' rate (Fig. 6). The majority (92%) did not want their individual iAE rate made available to others. The most common barriers to reporting iAEs were fear of litigation (50%), lack of a standardized reporting system (49%), and the absence of a clear iAE definition (48%) (Fig. 7). Thematic analyses and representative responses are portrayed in Table 2.

### DISCUSSION

Although immensely valuable, surgical outcomes research, including research on iAEs, has left out a crucial stakeholder—the surgeon. The research presented here examines iAEs from the lens of the surgeon. As we will discuss,



**Figure 2.** Types of emotions experienced by surgeons after a patient has an intraoperative adverse event. Surgeons could choose more than 1 answer (select all that applies). Other responses: “annoyed”; “Concern over why it happened. Discuss all involved what happened how to avoid. Concern about dealing with pt and family”; “It is not an emotion, it is a...get the patient fixed right”; “remorse for the patient”; “regret”; and “NA.”



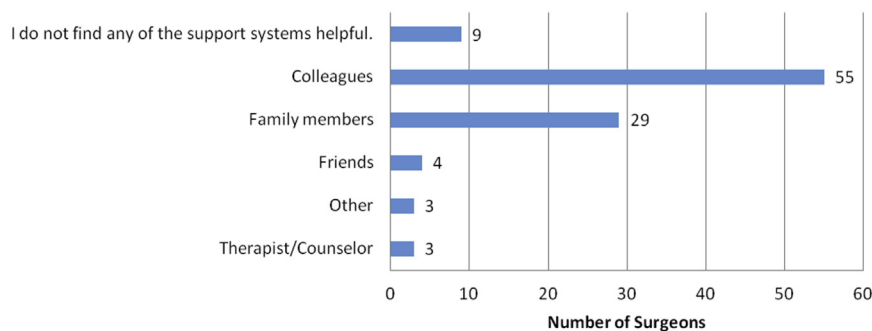
**Figure 3.** Years of experience and negative emotions felt by surgeons after an intraoperative adverse event. Surgeons experiencing (A) sadness; (B) anxiety; (C) guilt; (D) anger; (E) shame/embarrassment. iAE, intraoperative adverse event.

the following 3 major findings emerged from the survey: iAEs occur often, iAEs have a significant negative impact on the surgeons' well-being, and barriers to transparency are the fear of litigation and the absence of a well-defined reporting system.

The first major insight of this research study is that an iAE might not be as rare an event as we initially thought: 80% of surgeons recalled at least 1 iAE within the past year of their practice. Earlier reports have suggested a 1.5% to 2% incidence of iAEs, with the majority of injuries being organ lacerations, hemorrhage, and enterotomies.<sup>20</sup> Most of this existing literature is retrospective, relies on operative notes that have known

variability in documenting these events, or use administrative databases' screening tools, such as the Patient Safety Indicator "accidental puncture or laceration," with an unclear false-negative rate.<sup>21</sup> Based on our findings in this study, additional research that objectively and prospectively examines the epidemiology of iAEs is warranted; we cannot improve what we do not accurately measure.

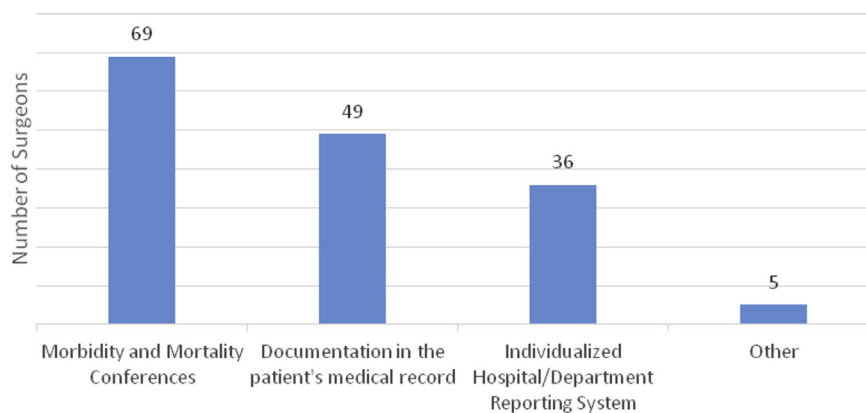
The second major finding is that iAEs have a substantial emotional impact on surgeons' well-being; many surgeons experienced strong feelings of sadness, anxiety, and shame, some to the extent that they needed formal psychological counseling. With the majority of surgeons experiencing



**Figure 4.** Most helpful existing support systems for surgeons to cope with intraoperative adverse events (iAEs).

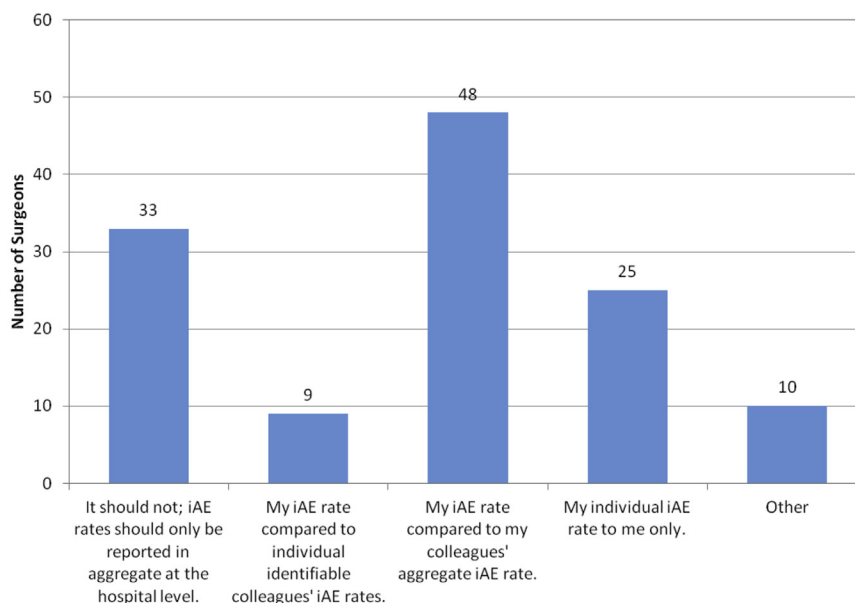
such negative (and occasionally dramatic) psychological sequelae after an iAE, more effective second-victim or peer-support programs specific for surgeons are needed. With the uniqueness of the surgeons' case among other physicians, where they often take direct responsibility for the technical or judgment error without much room for rationalization, programs that are specifically created for surgeons (or "interventionists" in general) and that understand this nuance are arguably a necessity. As per the recommendation of the surveyed surgeons, such programs should be accessible in real-time and without professional repercussions or stigmatization for the individual actively seeking out support. To the best of our knowledge, very few of the currently existing peer-support programs reported in the literature have a specialized approach for surgeons or iAEs.<sup>22,23</sup> Future research should investigate whether specific types of iAEs are especially correlated with higher rates of negative emotions, and should be specifically targeted by any peer-support program.

The third major finding of our study is that there are many barriers to iAE reporting that should to be addressed before effective implementation of any iAE reporting system in the future. Surgeons find the concept of an iAE reporting tool problematic for multiple reasons, most notably: their fear of litigation that might come hand in hand with transparency, absence of a clear definition of an iAE, and absence of a reliable risk and severity adjustment mechanism. The latter might result in perverse incentives for surgeons, where cherry-picking low-risk cases and avoidance of high-risk cases becomes rampant, and where the surgeons who take the difficult cases get unfairly penalized in quality-assessment efforts. We recommend that an iAE be defined as any inadvertent intraoperative injury, whether it is clinically consequential or not, and that severity classification, using systems such as the one recently suggested and validated by Kaafarani and colleagues<sup>8</sup> be used to differentiate the impact of different iAEs with different severity on patients. With



**Figure 5.** Surgeons' perception of existing formal processes to report intraoperative adverse events. Surgeons could choose more than one answer (select all that applies). Other: notify CRICO (malpractice) representative; patient safety report; quality assurance/performance improvement meetings; and risk management.



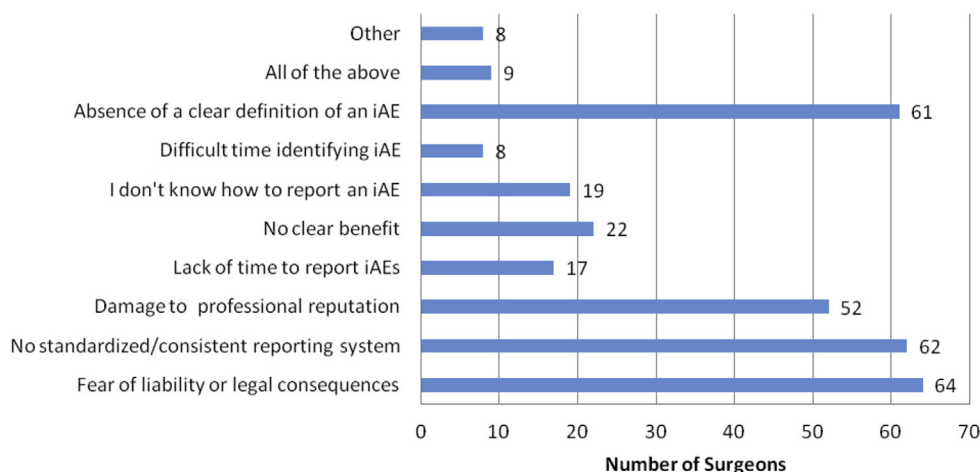


**Figure 6.** Surgeons' views about whether the rates of intraoperative adverse events (iAEs) should be transparent.

such a classification, a serosal tear in a difficult lysis of adhesions case still counts as an iAE, but its class 2 classification allows it to be clearly differentiated from the class 4 common bile duct injury occurring in a routine cholecystectomy. Clear definitions, robust risk adjustment, and more granular classification of severity can help create a reliable iAE tracking database and subsequently a more balanced and fairer quality benchmarking system. It is time that we, the surgeons, create this much-needed system that understands the surgical nuances of iAEs rather

than wait for a crude unfair system to be implemented on us.

Our study has a few limitations. First, this survey was sent to surgeons at 3 institutions of the same university, making it difficult to generalize the findings to surgeons practicing in different institutions, different healthcare systems, or different cities/regions/countries with different surgical and safety cultures. Second, the response rate was 44%, raising the possibility of a non-response and/or recall bias with non-responding surgeons being those



**Figure 7.** Surgeons' perspective about the barriers to reporting intraoperative adverse events (iAEs). Surgeons could choose more than one answer (select all that applies).



**Table 2.** Perceived Barriers to Reporting Intraoperative Adverse Events

Perceived barrier	Representative select responses
The lack of consensus on the definition of an iAE and what iAEs should be classified as “reportable”	<p>A clear definition of “reportable” iAE is necessary. Enterotomy during extensive lysis of adhesions, I would not consider a reportable iAE. Unexpected death, I would. A reporting system in the absence of clear definitions is a dangerous thing without a clear benefit to surgeon or patient.</p> <p>There are various levels of iAEs, such as reversible vs nonreversible, life threatening, or light injury; we need a clear grading system.</p> <p>Definition of an iAE is a real issue. Making an enterotomy in a bad case of adhesiolysis is not, in my opinion. Making one and not repairing it is a problem. Injuring the spleen in a colectomy is an iAE. If we had consensus as to the definitions, then we may be able to move forward in identifying problem cases, problem operators, and how to teach residents (and faculty) to avoid them.</p> <p>If there is a major hepatectomy, at what point is blood loss an iAE when we expect bleeding? &gt;500 cc? &gt;750 cc? Is losing that extra 50 cc over the threshold now an iAE?</p>
Unclear utility or perception of the utility of iAE reporting	<p>I think most iAEs are random events where you cannot make changes to prevent the next event.</p> <p>An iAE that is significant or clinically important needs to be reported to the patient/parents. It isn't clear to me why it needs to be reported elsewhere, unless it is caused by a systems issue, instrument malfunction, etc.</p> <p>We need to decide what we are trying to accomplish with reporting. Certainly in a roll out of a system, the benefits in aggregate and to the individual should be clearly spelled out.</p> <p>The trouble is that we had no good system for doing anything with the information; we don't really disseminate the information in my view. So it is just a lot of paperwork for not much benefit.</p>
Concern about the unintended consequences of inadequate risk adjustment and the misuse of transparent iAE data	<p>There is no way to make any record of iAEs free of bias or to risk adjust such reporting.</p> <p>Who's looking at the data besides whoever it's “reported to.” What are the consequences of various types of reporting? If benchmarked against others, how can one verify that there is uniform reporting?</p> <p>Who is using this information? Are people who actually do surgery and know what an expected outcome is looking at this? Under no circumstances would I agree with a system where anyone but the surgeon reports this.</p> <p>Worried about risk stratification, linking to pay for performance.</p> <p>Fear of litigation should be removed.</p> <p>Completely transparent reporting is likely to have the adverse consequence of punishing surgeons who are willing to assume care of the most difficult medical cases, influence some surgeons to cherry-pick “easier” cases, produce incentives to avoid providing care for the most needy challenging surgical problems.</p>

iAE, intraoperative adverse event.

who were less concerned or emotional about the topic of iAEs. Third, the project has not yet examined the attitude of a crucial part of the surgical workforce at teaching hospitals, the surgical trainees, regarding iAEs.

## CONCLUSIONS

Our study that observed iAEs through the surgeon's “lens” strongly suggests that iAEs occur more often than thought, that iAEs have a strong emotional impact on surgeons' well-being, that existing social support systems for

the “second victims” are suboptimal for surgeons, and that fear of litigation and absence of a clear iAE definition are 2 of the main barriers to reporting iAEs in a transparent fashion. Efforts should be made to peer-support surgeons and standardize reporting and quality benchmarking when iAEs occur.

## Author Contributions

Study conception and design: Han, Bohnen, Kaafarani  
Acquisition of data: Han, Bohnen, Peponis, Kaafarani

Analysis and interpretation of data: Han, Bohnen, Peponis, Martinez, Nandan, Yeh, Lee, Demoya, Velmahos, Kaafarani

Drafting of manuscript: Han, Bohnen, Peponis, Martinez, Nandan, Yeh, Lee, Demoya, Velmahos, Kaafarani

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## List of Tables and Figures

Table 1: Respondents Demographics, Surgical Specialty, and Clinical Experience

Table 2. Perceived Barriers to Reporting Intraoperative Adverse Events

Figure 1: Intraoperative adverse event (iAE) incidence. Surgeons' account of the incidence of intraoperative adverse events within the past 12 months.

Figure 2. Types of emotions experienced by surgeons after a patient has an intraoperative adverse event. Surgeons could choose more than 1 answer (select all that applies). Other responses: "annoyed"; "Concern over why it happened. Discuss all involved what happened how to avoid. Concern about dealing with pt and family"; "It is not an emotion, it is a get the patient fixed right"; "remorse for the patient"; "regret"; and "NA."

Figure 3. Years of experience and negative emotions felt by surgeons after an intraoperative adverse event. Surgeons experiencing (A) sadness; (B) anxiety; (C) guilt; (D) anger; (E) shame/embarrassment. iAE, intraoperative adverse event.

Figure 4. Most helpful existing support systems for surgeons to cope with intraoperative adverse events (iAEs).

Figure 5. Surgeons' perception of existing formal processes to report intraoperative adverse events. Surgeons could choose more than one answer (select all that applies). Other: notify CRICO (malpractice) representative; patient safety report; quality assurance/performance improvement meetings; and risk management.

Figure 6. Surgeons' views about whether the rates of intraoperative adverse events (iAEs) should be transparent.

Figure 7. Surgeons' perspective about the barriers to reporting intraoperative adverse events (iAEs). Surgeons could choose more than one answer (select all that applies).