Intraoperative Disruptive Behavior: The Medical Student's Perspective

Kristin L. Chrouser, MD, MPH, * *and Melissa R. Partin, PhD*†

*Department of Urology, University of Minnesota and University of Michigan, Minneapolis VA Health Care Center, Minneapolis, Minnesota; and †Department of Medicine, University of Minnesota, VA Center for Chronic Disease and Outcomes Research (CCDOR), Minneapolis, Minnesota

OBJECTIVE: Intraoperative disruptive behavior can reduce psychological safety and hinder teamwork and communication. Medical students may provide unique insights into how to prevent these adverse impacts. We sought to characterize medical student perspectives on the causes and consequences of intraoperative disruptive behavior and ideal intraoperative working environments.

DESIGN: In this retrospective qualitative analysis, authors coded de-identified field notes from residency interviews to identify themes and key insights and to explore gender differences in perspectives.

SETTING: A tertiary academic medical training center in the Midwestern United States.

PARTICIPANTS: Forty-two medical students applying for urology residency placement.

RESULTS: Students were 57% male with an average age of 26 years (range 23-34). Most students witnessed intraoperative disruptive behavior (usually by surgeons) such as yelling, throwing instruments, or blaming others. Students described frustration with missing instruments and incompetent assistants as the most common instigators of disruptive behavior. They noted undesirable effects of disruptive behavior, including decreased communication/teamwork, lack of learning, increased technical mistakes, and recalled feeling afraid and stressed by these situations. They described ideal intraoperative working environments as calm, efficient and collaborative environments where questioning and learning is encouraged.

CONCLUSIONS: Students provide a valuable perspective on the causes and consequences of disruptive behavior during surgery and point to potential pathways to improvement. Their experiences suggest prevention or reduction of surgeon frustration might be a fruitful target for intervention efforts to prevent intraoperative disruption. (J Surg Ed 76:1231−1240. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Stress, psychological, Problem behavior, Students, medical, Surgeons, Frustration

COMPETENCIES: Interpersonal and Communication Skills, Professionalism

INTRODUCTION

Disruptive behavior in perioperative settings is common and can reduce psychological safety, hinder teamwork and communication, and adversely affect patients.[1-3] The Joint Commission requires identification and management of disruptive behavior[4] but it is unclear whether these requirements have ameliorated behavioral issues in the operating room. Observational research during surgery can help shed light on this issue. Students spend much of their time witnessing the complex teamwork required to execute the intraoperative phase of care, and therefore possess a unique perspective that has rarely been explored to identify areas for improvement. In addition, although students commonly report being verbally abused during surgical clerkships,[5,6] their observation of disruptive behaviors during surgery has not been specifically explored in the literature. As medical educators, understanding the context in which intraoperative learning takes place helps us better understand how to ensure effective education of the next generation of physicians. Additionally, students' unique perspective may provide valuable insights on how to reduce disruptive behavior and its potentially harmful sequelae.

Aim: We sought to elicit student observations of intraoperative disruptive behavior and their perspectives regarding the ideal intraoperative working environment.

Funding: This work was supported by the VA Health Services Research and Development Research Career Scientist Award #RCS 10-185 (Partin).
Declarations of interest: None.
Correspondence: Inquiries to Kristin Chrouser MD, Department of Urology, University of Michigan, NCRC Building 16, 1st floor, 100S-202800 Plymouth Rd, Ann Arbor, MI 48109; e-mail: chrouser@med.umich.edu

  1931-7204/$30.00 https://doi.org/10.1016/j.jsurg.2019.04.002

Conceptual Framework: Surgical Stress Effects (SSE)

We used a recently published conceptual model, the surgical stress effects (SSE) framework[7] (see Fig. 1), to guide our analysis and interpretation. The literature supporting this framework is drawn from multiple disciplines and is consistent with the limited research specifically focused on intraoperative stress. According to this framework, an individual provider considers multiple factors (organizational, environmental/technical, patient, individual/team factors) when evaluating their job demands and resources. Their appraisal of the balance between job demands and resources can lead to a state of stress or challenge, with resulting emotional, physiological, and behavioral responses. When stressed, providers may experience negative emotions (e.g. frustration, anger), associated with physiological arousal (e.g. increased heart rate, blood pressure), and behavior (e.g. vocal and postural changes, outbursts). Some of these behaviors are disruptive. Such stress response behaviors can adversely impact team and provider performance and patient outcomes.

MATERIAL AND METHODS

We used qualitative interviewing techniques to assess medical student experiences with intraoperative disruptions during their surgery rotations and characterize their view of an ideal intraoperative working environment. We conducted 15 minute interviews in a private office with residency candidates in November 2016. Interviews ($n = 42$) were performed by one author (KC), an urologist with experience in interviewing medical students using open-ended questioning techniques. Student responses were recorded in field notes. Students had no prior relationship with the interviewer and data were not collected for research purposes but rather in the context of routine in-person residency interviews.

As part of these interviews, we first asked medical students to recall an incidence of disruptive behavior during surgery and describe the situation, including inciting factors and performance impact. We then asked students to describe the environment of their own "ideal" future operating room. This question was designed to explore areas of potential intraoperative improvement, particularly important if students were hesitant to discuss disruptive behavior with a surgeon. We read de-identified field notes from 42 interviews and developed a code book using a combination of inductive and deductive coding. For our first question, the surgical stress effects (SSE) framework[7] provided the preliminary codebook in terms of overarching categories. Text was initially coded using the framework codes, and an iterative process was utilized to devise new codes and subcodes as needed. For the second question ("ideal" OR environment) we developed codes directly from the data and then

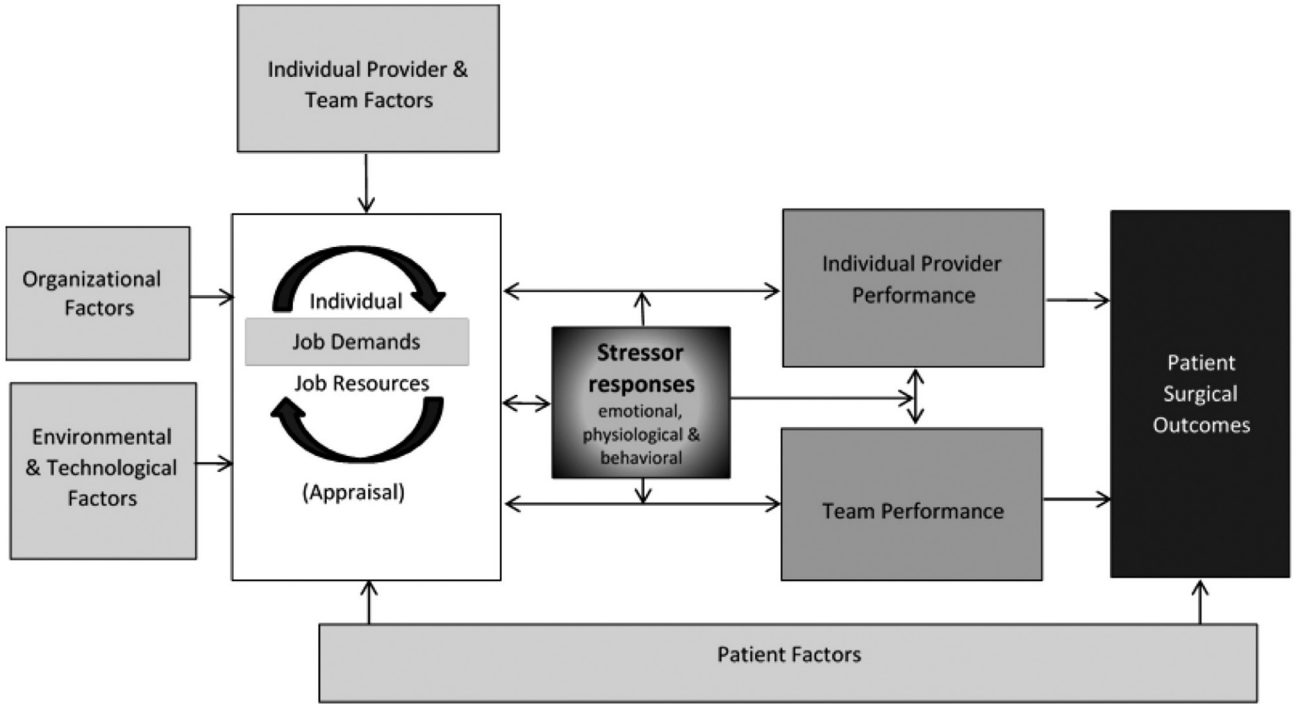

FIGURE 1. Surgical Stress Effects (SSE) Conceptual Framework. (Adapted from *American Journal of Surgery, Vol 216,* Chrouser KL, Xu J, Hallbeck S, Weinger MB, Partin MR. The influence of stress responses on surgical performance and outcomes: Literature review and the development of the SSE framework (2018) with permission from Elsevier).

identified relevant themes. Then, using the codebook, individual interviews were coded by 2 authors (KC and MP) until co-analysis agreement was consistently >80%. One author (KC) coded the remainder of the interviews and entered the codes into qualitative software (QRS International, NVivo version 11) to identify themes and key insights.

Given the interview questions analyzed here were part of interviews conducted for another purpose (residency applicant screening), we did not determine sample size by data saturation where data is collected until additional interviews provide no new insights. We analyzed all available interviews. Since prior studies have demonstrated that 90% of high frequency themes are noted within the first 6 interviews,[8] we expected the available sample size of 42 would be more than sufficient to identify high frequency themes and any differences in high frequency themes by gender. The IRB at the Minneapolis VA Health Care System reviewed the study and designated it exempt, as the data were de-identified. Research oversight was provided by the VA R&D per local regulations.

RESULTS

Students ($n = 42$) were 57% male with an average age of 26 years (range 23-34). Nearly all of the students interviewed (98%) described a situation where they witnessed intraoperative disruptive behavior, some of which was directed at them personally. The ubiquitous presence of disruptive behavior was concisely captured by one student whose response to the question of whether she had witnessed disruptive behavior was "Of course. It's an OR" (Subj#28, female).

Below we organize interview findings around 4 themes: characteristics of disruption, sources/causes of disruptive behavior, consequences of disruptive behavior, and ideal surgical environments.

Characteristics of Disruption

Types of Disruptors

Students more commonly mentioned surgeons as disruptive than nurses, anesthesia providers, or scrub technicians.

Types of Disruptive Behavior

The students described a range of disruptive behaviors which were categorized as physical and nonphysical/verbal (see Table 1). Nonphysical behaviors were more commonly mentioned than physical ones.

The most common nonphysical/verbal disruptive behaviors mentioned were yelling/cursing/barking and scolding/berating/criticizing.

> *He [the surgeon] was berating me, the resident, and the nurse. (Subj#22, female)*

> *There was a floating OR nurse – she would bark at students in the operating room and yell in the hall. (Subj#21, male)*

The most commonly described physical disruptive behavior was throwing things.

> *The scrub handed him [the surgeon] the wrong instrument and he threw it against the wall (Subj#8, male)*

> *He [the surgeon] was throwing tools on the ground (Subj#3, male)*

Behavioral categories were not mutually exclusive, as physical disruptive behaviors were commonly described in combination with verbal outbursts.

> *The attending [surgeon] was yelling and throwing things and stomping around. He was pacing and cursing and yelling at everyone. (Subj#7, female)*

> *The attending was slapping my hand and cussing (Subj#9, female)*

TABLE 1. Types of Disruptive Behavior

	Number of Students Mentioning
Nonphysical (Verbal)	
Yelling, cursing, cussing, barking, tantrum	25
Nasty comments, scolding, berating, demeaning, criticizing, belittling	10
Aggressive, short, rude, blunt, mean, inpatient	3
Passive aggressive stunts	3
Making staff leave room	2
Threatening	2
Complaining	1
Unwilling to take advice	1
Distracting others	1
Physical	
Throwing things	9
Banging, stomping, pacing	3
Bumping resident	1
Hitting, slapping	1
Eye rolling	1
Postural changes	1
Pouting	1

Perceived Sources/Causes of Disruptive Behavior

Students rarely attributed disruptive behavior solely to a nonacute cause (such as malignant personality). They commonly described the acute factors they perceived caused the disruption. We initially coded these factors into broad SSE conceptual framework categories (see Fig 1), and then grouped them into

subcategories. Students mentioned patient factors, such as challenging patient anatomy and intraoperative complications,

Disruption is usually caused by the difficulty of the case and is related to the stress of the situation (Subj#13, male)

People yell because of complications (Subj#28, female)

environmental and technological factors,

The patient was already asleep and there was no scope. . ..The attending was yelling. . .We had to wait 2.5 hours for the scope (Subj#7, female)

Attendings [surgeons] yell at the OR staff when there is missing or wrong equipment. (Subj#21, male)

and organizational factors.

Attendings [surgeons] are trying to get cases through the OR and staff are hourly so they won't rush. (Subj#18, male)

Patient [arrives] to the OR late which messes up the schedule (Subj#23, male)

Things often don't work and it's very frustrating—the root of the problem is that there are not enough resources (Subj#9, female)

individual (disruptor) characteristics

Disruption can be due to type A personality: they expect things to go well and when they don't then look for someone to blame (Subj#8, male)

individual/team behavioral responses to stressors

Surgeons in the operating room get annoyed with delays and with their assistants. (Subj#19, male)

Tension is often between surgery and anesthesia. . .for example, anesthesia is pushing pressers and didn't tell the surgeon (Subj#38, male)

Table 2 includes a complete list of perceived causes of disruption mentioned, along with the number of students mentioning each.

Students often described that disruptive behavior occurred in the context of strong emotions on the part of the disruptor. When describing specific emotions of the disruptive individual, students more commonly mentioned frustration in association with disruptive behavior

TABLE 2. Perceived Causes of Disruption

	Number of Students Mentioning
Team or Provider Factors	
Assistant (or unknown person) mistake or lack of competence	12
Team history/ interpersonal issues	6
Surgeon personality, temperament	7
Bad day or personal issues	5
Poor teamwork/ team communication	5
Long hours/ fatigue/hunger	4
Cleaning people take too long, slow turnover	3
Poor role understanding	2
Competing priorities of team members	2
Staff (not assistant) unprepared, staff mistake	2
Inexperience or mistake (of disruptor)	1
Not getting own way	1
Environmental/Technological Factors	
Equipment/instruments—wrong, missing, faulty	15
Intraoperative distractions/pages etc.	2
Organizational Factors	
Production pressure/delay (lack of efficiency)	5
High workload, overworked	4
Teaching something difficult	2
Insufficient resources	1
Patient Factors	
Unexpected event, adverse event, difficult case, patient anatomy	10
Surgeon concerned about patient	5
High profile patient	1

The surgeon was frustrated because the retractor wasn't his personal set. (Subj#3, male)

It was a long day in the operating room. . .Emotions were high, communication was poor, the surgeon was lashing out due to frustration (Subj#14, male)

than anger, stress, or other emotions.

The attending was furious because the set up wasn't what she wanted. She really let the scrub tech have it. (Subj#29, female)

Perceived Consequences of Disruptive Behavior

Students described (mostly negative) impacts of disruptive behavior on themselves and the surgical team (see Table 3).

Impact on student's emotion

I was afraid *he [the surgeon]) was going to throw something at me so I stepped back (Subj#3, male)*

TABLE 3. Impact/Consequences of Disruptive Behavior

	Number of Students Mentioning
Individual Consequences	
Emotional impact on individuals (including students)	
Fearful	6
Stressed	4
Flustered	3
Frustrated	2
Anxious/worried	1
Other negative emotions	6
Other impact on individuals	
Silenced/retreated	4
Distracted/lack of focus	3
Loss of respect for disruptor	2
Physiological (dripping sweat)	1
Injured (needlestick)	1
Individual performance impact	
Decreased quality of work/more mistakes	6
Learning worse	4
Faster/more efficient work	3
Learning better	1
Improved quality of work	1
Wastes time	1
Neutral impact on performance	1
Team Consequences	
Emotional impact on team	
Uncomfortable	2
Upset/shocked	2
Antsy/not calm	2
Fearful	2
Poor morale	2
Frustrated	1
Team performance impact	
Less communication/silence	4
Teamwork/cooperation reduced	4
Teamwork/cooperation improved	1
Distracted	1
Other impact on team	
Negative impact on team dynamics	3
Attempt to avoid disruptor	1
Obstructive/retaliatory behavior	1
Other negative team impact	2
Team interpersonal environment impact	
Tense environment	5
Unhealthy/unfriendly/negative environment	5
Hostile environment	1
Patient Consequences	
Negative impact on patient	5
Neutral impact on patient	3

*The attending was yelling and throwing things and stomping around. . .**I was scared** (Subj#7, female)*

Impact on team dynamics, team member emotion, environmental tension

*His negative attitude **killed morale in the OR** even when things were going OK" (Subj#12, male)*

*The attending was frustrated because he couldn't get the correct stapler. He threw the stapler against the wall. . . **The nurses were frustrated and scared.** . . .It didn't help him get what he wanted because the nurses didn't want to help him. (Subj#11, male)*

*Nurse scolded attending when it wasn't their place. . .caused **tension in the room** (Subj#43, male)*

Impact on intraoperative performance and learning

*The nurses/resident/med students are **less likely to bring up what they see** because no one wants to poke the beast (Subj#39, female)*

*The attending went off on the resident and yelled at him. The resident started **fumbling and making even more mistakes**. . . (Subj#1, female)*

*In some operating rooms you can cut the tension with a knife. This is **not conducive to learning** (Subj#10, male)*

*On one surgery rotation my partner cried every day. **We didn't learn anything** because we were just afraid of how our attending would react (Subj#33, male)*

A few students described positive effects of intraoperative disruptive behaviors, including increased performance, learning, and preparation.

*When there is swearing and postural changes —**everyone is more on their game** and the scrub tech is more responsive. (subj#24, female)*

***I perform better** when I get yelled out—probably because of sports. (Subj #11, male)*

Impact on quality of care/patient outcomes

*Yelling and belittling is not the best way to resolve anything and is **not conducive to quality care** (Subj#35, male)*

*She [scrub nurse] came in and distracted the other nurses. **Attention was not on the patient**. (Subj#37, male)*

Just walking into the room, I felt the tension. Even the other staff were abrupt when they would greet

*people. . . .**I think it affected the patient** . . .Tension impacts team's ability to be a team. (Subj#15, male)*

Student Reflections

Some students provided editorial comments related to their stories of disruption and among these, several recurrent themes were noted.

Some students felt surgeons' negative emotions/behaviors were justified or excusable although they never defended disruptive behavior in other team members (e.g. nurses, scrub techs).

Getting frustrated with equipment is common and understandable (Subj#27, female)

We were behind and he [the surgeon] wanted what was best for the patient (Subj#13, male)

I can't imagine the stress of complicated cases and I'm sure he [the surgeon] didn't mean it personally (Subj#7, female)

Interpersonal behavior was perceived to travel down the hierarchy within the operating room.

It starts at the top- how you treat staff influences how they treat the ones below them. (Subj#21, male)

Temper tantrums [create] downstream ripple effects (Subj#5, male)

Student's "Ideal" Future Operating Room

When students described their future operating rooms, several themes became apparent: interpersonal environment, team knowledge/attitude/behaviors, acoustic environment, personal activities/characteristics, and personal behavior towards their teams (see Table 4). Students mainly focused on their own behavior, especially in relation to their teams. They discussed their intention to build relationships and encourage their teams,

[I will] develop more than superficial working relationship. (Subj#15, male)

Each team member plays their role and deserves to be recognized and appreciated for their contribution. (Subj#8, male)

create calm, respectful environments

I want to be calm and collected (Subj#31, female)

TABLE 4. Characteristics of the Ideal Operating Room

	Number of Students Mentioning
Interpersonal environment	
Environment calm, laid-back, relaxed, not tense	8
Psychologically safe environment (ok to question)	8
Positive, fun, happy, healthy environment, jokes to break tension	6
Supportive environment	1
Team knowledge, attitude, behavior	
Teamwork/everyone helps each other/back up behavior/shared responsibility	11
Good communication	6
Patients interests come first/focus on what's important/focus on patient	7
People know roles/responsibilities	4
Acoustic environment	
Music	9
Avoid noncase related communication	1
Not quiet	1
Personal activities, characteristics	
Efficient/ keep on task/on schedule/I will come on time	8
Do good job/skilled/competent/ work hard	5
Organized/ check equipment before case	4
Pick a good team	2
Personal behavior directed toward team members	
Nice-good manners/etiquette/ respectful/friendly with staff/good rapport/get to know staff/ learn names/introductions	24
Willing to teach/let residents and students participate/learning	11
No scream, yell, or belittle/self-control/no temper/non-aggressive/not disruptive/no rants	10
Calm, patient, not frustrated	7
Express appreciation for staff/ encourage others	5
Approachable/adaptive/flexible/ ongoing improvement	4
Get buy-in from others/shared goals/ mental models	4
Constructive discussion	4
Good leadership/ I will be good assertive leader/lay down law	4
Set expectations (pre op)	4
Post op discussion-debrief	3
Willing to apologize/ego free	3

Not a tense atmosphere. If everyone around you is in fear of you they don't help each other out (Subj#20, male)

Create a teamwork-oriented and respectful environment (Subj#37, male)

focused on the patient's well-being

Our attitude should be that we are here to help the patient together (Subj#40, male)

where trainees can participate and learn.

[I will] involve medical students and talk through each step. . .let learners do part of case because practice is important (Subj#36, male)

Gender Similarities and Differences Among Themes

Interviews included 18 women and 24 men. The types of disruptor roles mentioned, the range in perceived disruptor causes and the language used to describe disruptor emotion/behavior were similar for male and female students. Both men and women reported physical and nonphysical/verbal disruption. Within the category of physical disruption, both genders discussed throwing instruments. However, men also mentioned pouting and bumping, while women discussed a wider range of physical disruptive behaviors, including banging, stomping, pacing, hitting, eye rolling, and postural changes. Further, when describing consequences of disruptive behavior, males mentioned impact on learning, but no females did. When asked about their ideal OR, the top 3 codes for women were interpersonal factors (being nice/good manners, calm, no screaming). The top 3 codes for men were being nice, teaching, and teamwork.

DISCUSSION

Intraoperative disruptive behavior, commonly attributed to surgeons, was reported by almost all students interviewed. They described a variety of acute causes of disruptive behavior and noted that surgeon frustration was a common emotion associated with disruption. In general students perceive such behavior had negative consequences on teamwork, communication, and patient outcomes, due to lack of psychological safety. Our findings are consistent with studies of nurses and physicians describing surgeons as common sources of disruptive behavior.[1] Prior work has also demonstrated a similar variety of personal, organization, and interpersonal factors are associated with disruptive behavior in the operating room.[2] Most of the disruptive behavior described in a recent review of the literature is verbal,[2] yet many of the students we interviewed also described physically disruptive behavior such as throwing instruments. A novel finding in our cohort was that female students described a much larger range of physically disruptive behaviors (e.g. banging, stomping, pacing, hitting) than males, perhaps indicating either a heightened awareness of potential physical threats to safety or better ability to "read" emotion using nonverbal cues.[9]

The connections between intraoperative stressors, surgeon disruptive behavior, negative student (and team member) emotions, performance, and/or patient care noted by students are consistent not only with the SSE framework,[7] but also with resident responses to a published survey of surgical stress where they noted that difficult working relationships with attending surgeons can become a source of additional intraoperative stress.[10] Although we did not specifically ask students to describe situations where disruptive behavior was directed towards them personally, many did relay such experiences. This is consistent with prior studies documenting medical student complaints about high rates of verbal abuse during training.[5,6] In addition, students in our study often described their own negative emotional reactions (e.g. fear, stress) to disruptive behavior. The limited literature assessing the impact of emotion on nonsurgical learning in medical students is conflicting, some studies suggest enhanced learning while others suggest emotions are detrimental.[11-13] A survey of 25 students after their 3rd year surgery clerkship was critical of the quality of learning in the operating room, where over half reported intimidation by surgeons and nurses.[14] Our findings are consistent with a recent review which found that high levels of intraoperative stress in medical students stem from various sources and can negatively impact performance and learning.[15] However, the authors also note that responses to stressors and coping skills vary between individuals. This is consistent with our findings that, although many students found that disruptive behavior negatively impacted their emotions, performance, and learning, others reported improved motivation and learning.

Although we did not specifically ask questions about learning, our students describe their ideal OR in a similar manner to that described by students surveyed about OR environments conducive to learning (friendly surgeon, positive staff interactions).[16] In addition, our students described the ideal of engaging all learners. This is consistent with recent qualitative work exploring student mistreatment on surgery clerkships where "passive mistreatment" by neglecting the student was particularly distressing.[17]

When asked about their future "ideal" operating rooms, students often discussed avoiding behaviors reflecting their desire not to cause emotional distress in others. Curry et al analyzed 263 reports written by medical students during

their anesthesia clerkship for exemplary provider behavior during surgery and noted themes of calmness, teamwork (communicative, collegial, and cooperative) and teaching (supportive and inclusive).[18] Rogers et al analyzed essays from 134 medical students where they were asked to describe behaviors they planned to adopt or avoid in the future as a result of their surgery clerkship experience. Themes included good communication, teamwork, calmness under stress, and avoiding staff mistreatment and failure to teach.[19] Both of these studies are consistent with how our students described their "ideal" future operating room. The reasons are unclear for gender differences in ideal OR descriptions where women were focused on positive personal and interpersonal behaviors (e.g. nice, calm, no screaming), while men also discussed teaching and teamwork. This could be attributed to common societal gender stereotypes where women are encouraged to be relational and men more goal-oriented.

Most of the students we interviewed noted negative effects of disruptive behavior on performance and patient care. This is consistent with prior work describing interviews of nonsurgeons (e.g. nurses, medical students, residents) where disruptive surgeon behavior shifted attention from patient to surgeon, increased team member mistakes, deterred students from surgical careers, and caused team members to lose respect for the surgeon.[20] Flin et al found that 86% of surgical trainees reported they were more likely to make errors in the presence of hostility or tension.[21] A large survey of perioperative team members noted that disruption decreases team communication and puts patient safety at risk.[22] This is consistent with reports from students in our sample.

The narratives recounted by the students fit within the SSE conceptual framework.[7] Students describe a wide variety of factors (e.g., difficult anatomy, missing equipment, time pressure) that lead to surgeon stress, which can be expressed as disruptive behavior, and result in negative downstream impacts on team function and patient safety. Students discussed the emotion/behavior moving down the hierarchy, suggesting that the strength of some relationships in the SSE framework might be dependent on the role of the "individual" in the framework.

From the individual perspective of the student, the disruptive behavior of the surgeon becomes a "team factor" (see Fig. 1) that can increase job demands on the student, often increasing stress, leading to emotions (e.g. fear, anxiety) with negative downstream impacts on performance and learning. The conceptual framework also can explain why some students report learning better in the context of disruptive behavior. Appraisal in those students apparently led to a state of challenge rather than stress, thus avoiding negative downstream effects on emotion and performance.

LIMITATIONS

Limitations of this study include that the interviews were done by an urologist for the purpose of residency selection, which might introduce bias by impacting the candor of student responses. Some students might not be comfortable criticizing the status quo of surgical culture or perhaps they were more likely to rationalize the behavior of other surgeons. If so, this would either lead to fewer mentions of such behavior or more tendency to downplay its impact. Despite this potential bias, almost all students described intraoperative disruptive behavior and most volunteered its negative downstream effects. Rarely students excused or justified negative emotion/behaviors of surgeons. In addition, the sequence of the questions asked might have "primed" students to discuss their "ideal OR" as being nondisruptive. Despite this potential bias, student descriptions of their "ideal OR" encompassed much more than a lack of disruption. They showed significant insight into the complex system required to achieve high quality and efficient surgery, describing the need for a wide breadth of environmental, interpersonal, mental, and technical characteristics in their future ORs. Finally, since the sample only included students interested in urology residency, results might not be generalizable to all medical students. Findings of some positive effects of disruption might not be replicated in a population of students not interested in pursuing surgical careers.

Implications/Future Research

A study assessing medical students' reflections on professionalism during surgical clerkships noted that "Clerks not only proved to be acutely aware of their interactions with patients and their colleagues but also of their own selves as learners and the bigger picture of the health care system."[23] Their perceptive observations in the context of complex systems and relationships are consistent with the content of our interviews and suggest that prospective engagement of students in efforts to improve surgical safety and quality has great potential.

The students we interviewed usually attributed disruptive behavior to an acute cause rather than solely due to static characteristics such as personality, suggesting improvement strategies focused on prevention (of the various factors noted in Fig. 1) could decrease the incidence of disruption. Practical operational interventions such as improving the accuracy of case cart preparation, equipment availability, and consistent surgical teams could potentially reduce surgeon and team frustration. Our analysis suggests students perceive frustration as a common cause of disruption. Even when faced with frustrating situations, enhanced surgeon coping skills might also help prevent disruptive behaviors. Future work should test this

hypothesis, and explore approaches to measure, prevent, and/or modify this potentially preventable response to intraoperative stressors. Finally, as surgical educators, this work should motivate us to improve our understanding of both the impact of surgeon disruptive behavior on learning as well as its influence on behavior under stress in the future surgeons we are training.

CONCLUSIONS

Students provide a valuable perspective on the causes and consequences of disruptive behavior during surgery and suggest potential pathways to improvement. Their experiences suggest prevention or reduction of surgeon frustration might be a fruitful target for intervention efforts to prevent intraoperative disruption.

DISCLAIMER

The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the U.S. Department of Veteran's Affairs or the United States Government.

ACKNOWLEDGMENTS

This material is the result of work supported with resources and use of facilities at the Minneapolis VA Health Care System and the Ann Arbor VA Health Care System.

REFERENCES

1. Rosenstein AH, O'Daniel M. Impact and implications of disruptive behavior in the perioperative arena. *J Am Coll Surg*. 2006;203:96–105.
2. Villafranca A, Hamlin C, Enns S, Jacobsohn E. Disruptive behaviour in the perioperative setting: a contemporary review. *Can J Anesth*. 2017;64:128–140.
3. Patel P, Robinson BS, Novicoff WM, Dunnington GL, Brenner MJ, Saleh KJ. The disruptive orthopaedic surgeon: implications for patient safety and malpractice liability. *JBJS*. 2011;93:e126.
4. Defusing Disruptive Behavior: A Workbook for Health Care Leaders. Oakbrook Terrace, Illinois: Joint Commission Resources. 2007. http://www.jointcommissioninternational.org/assets/1/14/DDB07_Sample_Pages2.pdf.
5. Fnais N, Soobiah C, Chen MH, et al. Harassment and discrimination in medical training: a systematic review and meta-analysis. *Acad Med*. 2014;89:817–827.
6. Oser TK, Haidet P, Lewis PR, Mauger DT, Gingrich DL, Leong SL. Frequency and negative impact of medical student mistreatment based on specialty choice: a longitudinal study. *Acad Med*. 2014;89:755–761.
7. Chrouser KL, Xu J, Hallbeck S, Weinger MB, Partin MR. The influence of stress responses on surgical performance and outcomes: Literature review and the development of the surgical stress effects (SSE) framework. *Am J Surg*. 2018;216:573–584.
8. Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation and variability. *Field Methods*. 2006;18:59–82.
9. Hall JA. Gender effects in decoding nonverbal cues. *Psychol Bull*. 1978;85:845.
10. Anton NE, Montero PN, Howley LD, Brown C, Stefanidis D. What stress coping strategies are surgeons relying upon during surgery? *Am J Surg*. 2015;210:846–851.
11. Fischer MA, Mazor KM, Baril J, Alper E, DeMarco D, Pugnaire M. Learning from mistakes. *J Gen Intern Med*. 2006;21:419–423.
12. Arráez–Aybar LA, Castaño–Collado G, Casado–Morales MI. Dissection as a modulator of emotional attitudes and reactions of future health professionals. *Med Educ*. 2008;42:563–571.
13. DeMaria Jr S, Bryson EO, Mooney TJ, et al. Adding emotional stressors to training in simulated cardiopulmonary arrest enhances participant performance. *Med Educ*. 2010;44:1006–1015.
14. O'Neill R, Shapiro M, Merchant A. The role of the operating room in medical student education: differing perspectives of learners and educators. *J Surg Educ*. 2018;75:14–28.
15. Ng R, Chahine S, Lanting B, Howard J. Unpacking the literature on stress and resiliency: a narrative review focused on learners in the operating room. *J Surg Educ*. 2018;76:343–353.
16. Schwind CJ, Boehler ML, Rogers DA, et al. Variables influencing medical student learning in the operating room. *Am J Surg*. 2004;187:198–200.
17. Castillo-Angeles M, Watkins AA, Acosta D, et al. Mistreatment and the learning environment for medical students on general surgery clerkship rotations:

What do key stakeholders think. *Am J Surg*. 2017;213:307–312.

18. Curry SE, Cortland CI, Graham MJ. Role—modelling in the operating room: medical student observations of exemplary behaviour. *Med Educ*. 2011;45:946–957.

19. Rogers DA, Boehler ML, Roberts NK, Johnson V. Using the hidden curriculum to teach professionalism during the surgery clerkship. *J Surg Educ*. 2012;69:423–427.

20. Cochran A, Elder WB. Effects of disruptive surgeon behavior in the operating room. *Am J Surg*. 2015; 209:65–70.

21. Flin R, Yule S, McKenzie L, Paterson-Brown S, Maran N. Attitudes to teamwork and safety in the operating theatre. *The Surgeon*. 2006;4:145–151.

22. Rosenstein AH, O'Daniel M. A survey of the impact of disruptive behaviors and communication defects on patient safety. *Joint Comm J Qual Patient Saf*. 2008;34:464–471.

23. Kittmer T, Hoogenes J, Pemberton J, Cameron BH. Exploring the hidden curriculum: a qualitative analysis of clerks' reflections on professionalism in surgical clerkship. *Am J Surg*. 2013; 205:426–433.