

Taking a Chance or Playing It Safe

Reframing Risk Assessment Within the Surgeon's Comfort Zone

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Objectives: The purpose of this study was to explore how risk is perceived and experienced by the surgeon and how risk is actively managed in individual practice.

Background: Risk in surgery has been examined from system-wide and personality perspectives. Although these are important, little is known about the perspective of the individual surgeon.

Methods: A constructivist grounded theory study was conducted to explore surgeons' perspectives on risk in the context of their personal "Comfort Zones." Semistructured, 60-minute interviews were conducted with 18 surgeons who were purposively sampled for sex and subspecialty with a snowballing strategy applied to sample for differences in reputation (conservative vs aggressive). Data were collected and analyzed in an iterative manner until thematic saturation was reached.

Results: Surgeons described cases that were inside or outside of their personal comfort zones. When considering cases at the boundary of their comfort zones, participants described a variety of factors that could make them feel more or less comfortable. Specific strategies used to modulate this border were also described. Two perspectives on risk taking became apparent: the procedure-centric perspective described how surgeons viewed their colleagues whereas the surgeon-centric perspective described how surgeons viewed themselves.

Conclusions: A framework for understanding surgeon's unique assessment of risk was elaborated. Increased awareness of the factors and strategies identified in this study can foster critical self-reflection by surgeons of their own risk assessments and those of their colleagues, and provide avenues for more explicit educational strategies for surgical training.

Keywords: comfort zone, risk taking, surgical decision making, surgical culture, surgical judgment

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The practice of surgery is associated with inherent risk and potential harm to patients, sometimes caused by poor decisions and errors.¹ As a result, regulatory bodies are increasingly being held accountable for ensuring adequate self-regulation among surgeons and placing increasing emphasis on system-wide analyses of quality-assurance and quality-improvement strategies.^{2–5} Although system-based understanding of error has evoked positive change in surgery,^{6–9} factors affecting self-regulation by individual surgeons and their effects on surgeon behavior and decision making have received less attention as a focus of research.^{10–12}

On an individual level, physicians monitor their own performance while continuously assessing the limits of their own competence.¹² In surgery, these assessments occur before surgery as surgeons decide which operative cases can be managed by themselves and which cases are outside of their own personal limits.¹³ The self-monitoring process also occurs during surgery when surgeons are confronted by the critical and sometimes unexpected moments of practice.^{13–15} These preoperative and intraoperative decisions are all associated with a degree of risk, and surgeons are expected to evaluate these risks and choose the appropriate course of action.¹⁶ An often unrecognized, yet substantial, part of this deliberation involves surgeons assessing their own contribution to the overall risk of any given operative procedure, or part thereof. For example, a surgeon deciding whether to operate on a particular patient must ask herself, "Am I skilled enough to do this procedure or should I refer to another surgeon?" or, if a tumor is found to be more locally advanced than expected, a surgeon must ask himself, "Is this tumor resectable in my hands, or should I ask for help?"^{12,15–17}

Previous studies have approached risk taking among medical professionals predominantly from a personality perspective. These studies have attempted to group physicians into different categories of risk-taking behavior—from risk averse to risk seeking—using a variety of scales assessing risk tolerance or comfort with uncertainty.^{18–21} Although these scales may provide general statements of overall risk-taking behaviors that can be compared across different groups (eg, sex, specialty, and age),^{20,22–24} they do not describe the experiences of the risk takers themselves. Despite all these studies, what remains poorly understood is how individual surgeons negotiate risk, how they perceive it, and how they make decisions in the moment to accept or reject risk. Although a range of risk-taking behaviors among surgeons has been described, including categories like "cowboys," "pioneers," or "timid,"²⁵ the surgeon's perspective on risk in their individual practices has yet to be explored.

A previous study by our group explored the factors that contribute to surgeons' decision making and identified the concept of a "comfort zone" unique to every surgeon.¹⁶ The purpose of this study was to explore how surgeons perceive and manage risk in the context of their unique comfort zones.

METHODS

The subjects for this study were surgeons working at tertiary referral academic centers affiliated with the University of Toronto. After obtaining appropriate research ethics board approval, surgeons were contacted by e-mail and their voluntary participation in this study was requested.

A constructivist grounded theory methodology was used to explore surgeon experiences of risk in their operative practices.^{26,27} In addition, data from 2 previous studies (40 interviews) exploring factors which influence surgical decision making were reviewed to inform this study and provided preliminary categories and ideas about risk taking in surgery.^{13,16} These prior studies led to a model for understanding the factors that contribute to surgical decision making; however, understanding how surgeons negotiate the risk implicit in

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these decisions in the moment of practice required further investigation. Purposive sampling was used to ensure that both sexes, a variety of subspecialties, and a range of experience levels were included in the sample. The goal of this sampling was not to compare responses between these groups (ie, men vs women or older vs younger) but rather to ensure that a wide enough cross-section of surgeons was included to fully understand the topic of interest. We used a snowballing strategy—asking participants to suggest possible subsequent participants²⁸—to identify surgeons whose reputations placed them along different points on a risk-taking continuum.²⁹ Saturation—the point at which concepts relevant to the research questions in this study were deemed to have stabilized despite additional interviews—ultimately determined the sample size.³⁰

All participants provided informed consent before their interview. One or 2 investigators conducted all interviews: a surgeon (C.A.M.) and/or a surgical resident (N.R.Z.). Because of the iterative nature of the data analysis and the semistructured nature of the interviews, the emphasis of each interview was different and not all questions were explored in as much detail from 1 interview to the next. The original question template (Table 1) was brought to all interviews and used as a guide, with emerging themes explored in subsequent interviews for the purposes of refinement, clarification, and elaboration. In the later interviews, the preliminary results and developing conceptual framework were shared with interview subjects in a process likened to “member checking.”²⁸

Notes and memos were kept during the interviews to document ideas about categories and relationships.³¹ These records served as the initial phase of analysis. Interview transcripts were initially read by 1 investigator (N.R.Z.) and preliminary impressions were noted. Subsequent meetings were then held to review each transcript with the surgical resident (N.R.Z.) and one of 2 surgeons, C.A.M. or M.L.M. Data were coded and organized into categories to facilitate the comparison of data within and between each category and to aid in the development of theoretical concepts.³¹ Initial coding was descriptive and focused on statements that seemed risk tolerant or risk adverse and statements describing clinical situations in the context of the comfort zone. Coded data were organized using NVivo software (2007; QSR International Pty Ltd.) for data management and facilitation of cross-referencing the large dataset.³² Emerging theoretical constructs were refined and elaborated through comparisons with new examples from ongoing data collection. The larger research team (which

included 3 surgeons, 1 surgical resident, and 1 cognitive psychologist) met during the analytic process to refine, build, and discuss the emergent thematic structure. Data from each interview were compared with data from previous and subsequent interviews to gain a rich understanding of surgeons’ perspectives on risk taking. The goal of the analysis process was not to find consensus between each interviewer’s findings or each interview subject’s comments, but rather to understand the phenomenon of interest and possible. A reflexive approach was adopted throughout. It was particularly important for the investigators with a surgical background (N.R.Z., M.L.M., S.G., and C.A.M.) to manage their own assumptions while analyzing the data derived from the opinions of their colleagues.

RESULTS

Eighteen semistructured interviews lasting approximately 60 minutes were conducted. Thirteen subjects were males. Our sample included 7 general surgeons (representing subspecialties including hepatobiliary surgery, transplantation, breast oncology, colorectal surgery, pediatric surgery, and bariatric surgery) 2 thoracic surgeons, 2 cardiac surgeons, 2 urologists, 2 orthopedic surgeons, 2 gynecologists, and 1 vascular surgeon. Three had been in practice less than 10 years, 13 had been in practice more than 10 years, and 2 were retired. Our sample included surgeons who demonstrated characteristics that might place them along various points of the risk taking spectrum as outlined in Table 2.

The Comfort Zone

The approach to surgeons’ decisions about risk in their practices was explored, as was surgeons’ perceptions of their own comfort zones. Being in one’s comfort zone was defined as a surgeon feeling competent and capable of managing the risk that was inherent to a particular case. There seemed to be certain operations that were clearly inside or clearly outside the participant surgeon’s comfort zone and operations that were at the boundary. One hepatopancreatobiliary surgeon said, “I’m comfortable with all general surgery and hepatopancreatobiliary surgery. Now, we haven’t gotten a gunshot through the liver into the vena cava. That would be interesting . . .” (N1).

This surgeon recognized that trauma surgery for the management of injuries to the liver and vena cava would be outside his

TABLE 1. Interview Question Template

1. How do you define “risk” in your practice?
2. Can you describe the last time you were outside of your comfort zone? What triggered it?
3. Can you describe the experience? What does it feel like? (eg, Physical sensation? Emotions?)
4. What do you think defines your comfort zone boundaries?
 - a. Can you describe the physical sensation of being in a risky situation in the OR.
5. Do you ever experience fear in the OR.
6. Do you ever push your boundaries? How do you keep safe in these situations?
7. Can you describe a time in your practice when you had to “weigh up risks”?
8. How do you know you are taking too much/too little/just right amount of risk?
9. There are many surgeons who are developing new techniques and procedures. What do you think motivates them? What makes them do it well (or not so well)?
10. Can you give examples of intraoperative risk versus risks in the outpatient setting? How are they different?
11. How do you manage referrals that will require a challenging operation.
 - a. In a case where you are on the fence about taking a patient to the OR what factors influence your decision?
12. How would you describe your own risk tolerance level?
 - a. Rank your own risk tolerance on a scale from 1 to 10.
13. Can you think of a colleague who is too risk averse or risk tolerant? Why?
14. What do you think accounts for the differences in surgeons’ risk tolerance?
15. Do you think the culture of surgery influences surgeon’s risk-taking behavior? If so, how? What are some of the social or cultural factors that come into play?

TABLE 2. Spectrum of Risk-taking Behavior

Type of Surgeon	Representative Quotation
Timid Surgeon	"It's that kind of obsessiveness on my side that's aging me at an incredible rate . . . affects my tolerance for taking chances . . . I think that the anxiety for me is, it's interesting, you ask about tolerance for cases and stuff. I get to a point where there are fewer and fewer cases that I get really excited about . . . like I see the very negative side of it or the negative is starting to outweigh the positive." (N9)
Pioneer Surgeon	"When I was learning how to do (type) surgery it was just a matter of going slowly and having really good help, and sometimes practicing. I mean, we practiced the (procedure) on the pig until we knew all the maneuvers . . ." (N13)
Cowboy Surgeon	"Yeah, I do (type) surgery. I was never trained to do it . . . the first time I did a (procedure) I just had the photos from the Journal in the room, in terms of where to make the incision and what to do, like a recipe in a cookbook; and I did the case. I never saw one or was taught one." (N4)

comfort zone, despite his comfort with elective hepatopancreatobiliary surgical oncology.

The concept of the comfort zone was used as a tool by the participants to guide decision making whether to perform certain operations independently. The operations clearly outside surgeons' comfort zones resulted in anxiety and distress. One surgeon said, "I did an inguinal hernia a couple years ago and I had no (expletive) clue what I was doing. I had to call a fellow back in. He said, 'Do I really have to come in?' I said, 'Damn right you're coming in.' Was I stressed out of my mind? Yes!" —N2.

In his routine practice, this surgeon performed complex surgical oncology procedures and had a local reputation that placed him high up on the risk-taking spectrum. Despite the lower complication rate and lower objective risk to the patient normally associated with an inguinal hernia repair, the surgeon experienced discomfort and anxiety during the procedure. This reinforces the concept that a surgeon's comfort zone is highly personal and contextual and seems to be related more to everyday experience than to baseline training.

Working at the Boundary of the Comfort Zone

Although each surgeon described procedures that were clearly perceived to be inside or outside of their personal comfort zone, it seemed to be cases at the boundary of their comfort zone where surgeons most often considered and negotiated risk. Surgeons described situations where they were prepared to work outside or at the boundary of their comfort zone. Some of these situations seemed to be driven by *patient factors*. One general surgeon described how the patient's perspective could influence his decision making regarding the use of a stoma, despite what might be the objectively safest option:

Yeah, I think because we're humans, and we are influenced . . . certainly myself, are influenced by that person who said, "I would rather be dead than have a stoma," because quite a few people say that . . . So yeah, we definitely are biased by that, into sometimes making a less than ideal decision." (N18).

This surgeon's acknowledgment that patient preferences have forced him to the edge of his comfort zone by making a high-risk bowel anastomosis is indicative of how such preferences might factor in to decisions about surgical risk.

Other factors were environmental. Specifically, the makeup of the surgical team was discussed, including assistants, nurses, and anesthesiologists. One surgeon described a case where he felt he had inadequate assistance:

Every single (attending) surgeon, every single (specialty) fellow was (out of town) and I'm there with a PGY-2 who's, like, never picked up a laparoscope and certainly never seen a (specialized) procedure before, and there are times when you need more help than that . . . those kind of situations definitely add risk. (N18)

Other participants who work primarily at one hospital but provide coverage at another indicated that working in the other hospital's operating room could also push them to the boundary of their comfort zone due to differences in familiarity and equipment.

Surgeons seemed to have a clear idea when they were functioning within or outside their comfort zone and described factors that influenced risk in their practice. These factors were not explored comprehensively to produce an exhaustive list, but rather contributed to our understanding that risk taking is a contextually embedded phenomenon that seems to be unique to each surgeon's experience and practice.

Strategies Used to Modulate the Boundary of the Comfort Zone

Surgeons described strategies they used to expand the boundaries of their comfort zone, making cases that might seem challenging initially, ultimately doable. These are summarized in Table 3.

Environmental and Personnel

With regard to the operating room team, 1 surgeon shared how she made decisions about which cases to do on the basis of who she would be working with:

If I've got a case to do, like, after hours, and it's not like an emergency that has to be done today, it's one of those things that just needs to get done but, you know, it could be done today or it could be done tomorrow . . . if I see a certain anesthesiologist on call at night I'd wait 'til the next day because I wouldn't feel they could manage it. (N16).

As this participant was describing, surgeons are cognizant of the team factors that influence their comfort zone and make decisions about the composition of the operating room team to ensure that they are within their comfort zone when possible. Similarly, another surgeon described requesting specialized assistance to be able to comfortably proceed with a procedure. Anticipating that an abscess in a patient with Crohn disease was involving the duodenum this general surgeon requested the help of a hepatobiliary surgeon. Without the specialized help, the participant stated he would not have felt comfortable proceeding (A9). Yet another surgeon, who provided coverage to multiple hospitals, described how she would not operate on patients at those other sites:

Sometimes we're asked to see patients at other hospitals in the neighborhood, and I generally won't operate on them in those other hospitals, I'll bring them (to her base hospital). And they talk about (how) the patient isn't supposed to move, the doctor's supposed to move. But it affects patient outcomes if you don't have the right team so . . . I bring them over here where I know that the team can handle it. (N15)

TABLE 3. Strategies Described by Surgeons When at the Border of Their Comfort Zone

Strategy	Representative Quotation
Optimize the OR team	"I start(ed) with a resident, . . . then one of the staff came to help me . . . so then after that I worked with the staff . . . so there was just the 2 of us. Then . . . we asked the urologist to come, and then shortly after . . . sort of at the same time we asked the vascular surgeon, and we made it very clear . . . I need the staff, I don't need a fellow, I don't need a resident." (N17)
Optimize the environment	"Most of my colleagues don't, but I wear loupes for open surgery . . . Personally, I think that reduces risk. I wear a headlight. I don't just wear any headlight, I wear the best illumination headlight. I go around and check them, put little marks in the headlights, good, not good, and so forth, because some are better than others. And the quality of your illumination reduces your risk." (N8)
Personal preoperative planning	"Most of time for me the elective cases are pretty straightforward. You know, I kind of see the patient, know I've got a plan, I think about the plan . . . we have (rounds) the week before the surgery date so it gives me an opportunity to kind of review the patient again. So you come to the operating room you're kind of pretty prepared, you're not anticipating any surprises" (N16)
Team-based preoperative planning	"We meet once a week for about an hour. We go over all of the cases that we're doing the following week and we go over them in great detail. We have a big mob here. We have surgeons and residents and fellows. We're all here. Every case is discussed in detail and we have a plan of how we're going to go through it. We identify the local risks and possible complications when we're doing our preoperative planning." (N6)
Mental rehearsal	"So, I do prepare for those (challenging) cases but I make sure that . . . like I go over everything all over again with the imaging. I imagine in my head. I just imagine all the different scenarios. So I prepare . . . that's how I deal with it." (N5)

All strategies of this group address environmental factors that can make cases at the border of a surgeon's comfort zone manageable.

Personal Preparation

Surgeons also described *personal* strategies they use in anticipation of a difficult case. One participant demonstrated active preoperative planning during his interview. There was a computed tomographic scan loaded on his computer, which he had been reviewing over several weeks in anticipation of performing a complex oncologic procedure. He related:

You break it into individual steps and each individual step is inevitably accomplishable. So, the whole therefore might be overwhelming if you look at it, but each individual step isn't because it's just something you do day in and day out . . . (N2)

Another surgeon described weekly preoperative planning rounds that occurred in his practice group. This allowed a team of colleagues to review all the relevant preoperative imaging together, and determine the case-specific challenges as a group (N6).

Another participant described how visual imagery can be used to deal with a challenging case:

If there's a procedure I'm doing that's complicated I . . . you know, you visualize it, right? You visualize how the incision's going to be . . . you know, maybe a different incision might give you better access. Okay, so think about the incision and how it's going to look when you open the chest, and what you're going to do first, and what are the impediments to progress. (N16)

These personal strategies made cases at the boundary of the surgeons' comfort zones doable.

Expanding or Contracting Comfort Zones

Some surgeons described how they felt the need to expand their comfort zones over time. One participant described his thought process as he approached what he perceived as a very demanding case. He said,

It is important to push yourself to work at the edge of your comfort zone. If I had given this case up because I thought it

was too big for me then the next time I might give up a smaller case and before you know it I am only doing small cases. (N1)

Other surgeons described reasons why their boundaries of their comfort zone have remained limited or have shrunk over time. One surgeon shared how his concern regarding poor patient outcomes affects the types of cases he takes on:

I have a very low tolerance for complications and it's not to boast, I can't stand complications. So I think that restricts my risk-taking, I can't stand it. And I know other people, and I don't say it in an insulting way, who are accepting and believe that a certain percentage of complications are acceptable or not surprising in your practice. So, I think your tolerance of complications plays into your ability to take risk. (N7)

Another described a pervasive anxiety that limits his tolerance for taking on cases that may be difficult or prone to a bad outcome:

It's that kind of obsessiveness on my side that's aging me at an incredible rate . . . affects my tolerance for taking chances . . . I think that the anxiety for me is, it's interesting, you ask about tolerance for cases and stuff. I get to a point where there are fewer and fewer cases that I get really excited about . . . like I see the very negative side of it or the negative is starting to outweigh the positive. (N9)

These surgeons have actively chosen to limit their practices to cases far from the border of their comfort zones. As 1 surgeon said:

We always joke in the department that I like only easy cases. But it's true. I am risk averse . . . Like for rectal cancer, if it looks like it's a big cancer, if it looks like it's maybe invading the bladder, if it looks like things that I don't do all the time I tend to refer it to somebody that does do it all the time. I'm not someone that really feels the need to do all the big cases. (A9)

These varied attitudes toward risk taking and personal interest in expanding or maintaining one's scope of practice are understandable using the comfort-zone framework.

Two Perspectives on Risk Taking

Although the focus of this study was on surgeons' personal views of risk, the interview discussions also included participants'

views on the risk assessments of their colleagues. When comparing surgeons' personal reflections to their discussions of others, 2 surgical perspectives on risk in surgery became apparent.

Procedure-centric Perspective

The "procedure-centric" perspective puts the procedure at the heart of the discussion when considering and assessing risk. In reference to the procedure, it is considered that a particular surgeon *should* be capable of performing this procedure. Fixed criteria such as training level, specialty, years of experience, and location of practice are considered in this assessment. It was the opinion of one of our participants that he frequently received referrals for a particular case that he felt should be within the scope of the referring surgeons practice. He described:

We have surgeons sending us cases. And we just say, "why are these cases here?" And it's just guys that don't want to tackle anything that they're not just totally 100% comfortable with . . . (those guys) shouldn't be surgeon(s), should never have gone to surgery in the first place. (N6)

This perspective seemed to make assumptions about the cases other surgeons should be able to perform. The participant considered these referred cases to be routine, therefore he felt others should also consider them routine. In a similar way, another participant discussed a new colleague who had been trained elsewhere and provided an opinion that this new surgeon had begun to perform complex laparoscopic procedures "much too quickly." The participant went on to say,

(This surgeon started to do) . . . radical and ultraradical MIS surgery . . . but he took it very far very quickly . . . So, for instance, periaortic lymphadenectomy is not a skill that I've acquired laparoscopically . . . We don't do them often (but) he was doing them from the beginning." (N15)

The participant's opinion of his colleague is referenced to his own expectations of appropriate practice. Our participant felt that, compared with him, his colleague was accepting too much risk. These examples demonstrate that this "procedure-centric" perspective defines (usually other) surgeons' riskiness using an implied hierarchy of procedure difficulty, and assigns risk tolerance based on which cases along this continuum the surgeon is willing to perform.

Surgeon-centric Perspective

The procedure-centric perspective stands in contrast to how surgeons usually described their own risk taking practice. Some of the surgeons interviewed were widely acknowledged by their peers for taking on complex operations not performed by others in their respective specialties, giving them the reputation in the surgical community as "risk takers." When interviewed, however, these surgeons did not perceive themselves as risk takers nor did they describe themselves as particularly risk tolerant. As one such discussion detailed the following:

Interviewer: "How would you describe your own risk tolerance level on a scale between 1 and 10?"

Participant: "2 out of 10."

Interviewer: "You do major surgery, so another surgeon would say you must have a high-risk tolerance, right?"

Participant: "Well, maybe on that basis my risk tolerance is 9." (N3)

These differences between surgeons' reputations and their own self-perceptions highlight the importance of considering surgeons'

decision making from the perspective of their own unique comfort zone. The fact that a surgeon takes on more or less complex cases does not seem to indicate that they feel more or less comfortable with risk. Rather it seems that what they view as risky is unique. A surgeon from a tertiary referral center, who described how colleagues practicing in a community setting had described his operative performance, highlighted this difference:

. . . if one of them was to watch me do a [procedure] and the speed I operate at and how I dissect around the vessels and technically how I do it they may feel that I'm taking some risks. But look at my outcomes. My patients don't get transfused. Short stay in hospital. Five year survival is excellent. (N8)

These 2 perspectives on risk taking provide a framework for understanding how surgeons evaluate risk assessment both for themselves and for others.

DISCUSSION

This study has demonstrated that surgeons' perspectives on their own risk taking are both highly personal and contextual. When surgeons perceived cases to be at the boundary of their own comfort zone, both patient and environmental factors seemed to modulate their decision making, often leading to modifications of the environment with the goal of bringing the case back within their comfort zone. Specific strategies used by participants to address some of these factors were outlined along with personal strategies used to address challenging cases.

Recognition of the distinction between the surgeon-centric and procedure-centric perspectives may provide an opportunity for improved understanding of how individual surgeons make clinical decisions regarding risk in their practice. The 2 perspectives can be used to consider a hypothetical case of a general surgeon on call who is uncomfortable performing a laparoscopic cholecystectomy. The procedure-centric perspective may argue that the general surgeon should be able to perform a laparoscopic cholecystectomy for acute cholecystitis because he has completed general surgery residency and this is a commonly performed general surgery procedure. Should the surgeon choose not to perform the operation, colleagues may label him risk averse. If, however, the general surgeon's elective practice is devoted exclusively to colorectal surgery and he performs only a handful of cholecystectomies a year, and if he finds himself working with a team he seldom collaborates with or in a location where he is less familiar with the environment, he may feel understandably uncomfortable performing this procedure, regardless how commonly it is performed by others. The surgeon-centric perspective would account for the surgeon's individual assessment, rather than an externally imposed, context-free hierarchy of procedural risk.

The comfort-zone framework places the assessment of risk pertaining to a particular procedure squarely in the context of the individual surgeon. Surgeons can learn and adopt strategies that modulate the boundary of their comfort zones to make procedures that initially were considered undoable in their hands ultimately achievable. We suggest that the surgeon-centric perspective, by incorporating the various factors that influence this boundary, is the more thoughtful approach to thinking about risk in surgery than the procedure-centric perspective.

The procedure-centric perspective, shared by the surgeon investigators before the data analysis for this study, suggests that there is a hierarchy of operations in a specialty. This assumption would suggest that if a surgeon is comfortable with the operations at the top of this perceived hierarchy she should be comfortable with the less complex procedures in her specialty. The data presented in the earlier text suggest that this assumption is erroneous. Recall surgeon N2 who was uncomfortable performing an inguinal hernia repair. This

surgeon routinely performs complex resections for intra-abdominal malignancies. For the majority of general surgeons, these major cancer operations would be far outside their personal comfort zones, whereas inguinal hernias are commonly performed and may be considered routine. For surgeon N2, an inguinal hernia repair is at the border of his comfort zone. He was trained to perform the procedure but now does it so infrequently that he was uncomfortable.

The strategies used to expand a surgeon's comfort zone outlined in this study are not intended to be exhaustive or complete. These were examples discussed by our participants, but one can imagine other strategies that other surgeons may find relevant. Similarly, for an individual surgeon considering any given case, the proportional influences of the various factors that modulate the boundary of their comfort zone will be unique and case specific. This was highlighted in an earlier study that noted the risks that surgeons' perceived when making intraoperative decisions.³³ Most related to patient factors or the operation being performed, however cultural and team factors were noted as well. Identifying the strategies that an individual surgeon believes can modulate the border of his or her comfort zone and recognizing the factors that can bring a surgeon out of his or her comfort zone should be encouraged. This will provide a personal framework that could foster improved self-regulatory behavior.

The comfort zone concept provides a framework for understanding the development of expertise and judgment. Not everyone recognized as an expert is truly engaging in expert practice.¹⁴ Bereiter and Scardamalia³⁴ distinguish between 2 categories of performance relevant to the trained surgeon: experienced nonexperts who solve routine problems with routine solutions and stay within their comfort zones, and experts who explicitly identify the subtle complexities of the situations they encounter, recognize inconsistencies that require deviation from routine, and work at the margins of their comfort zones. It is unreasonable to think that following postgraduate training a surgeon is "expert" in all aspects of their specialty. By acknowledging their comfort zone and recognizing where one lacks resources, a surgeon could actively work at expanding his comfort zone, if and when necessary.

The conclusions of this study are limited by the general limitations of all grounded theory studies. Such studies take place in a specific context; in this case, the study focused on academic surgeons from a breadth of subspecialties working at several hospitals affiliated with a single urban North American medical school. By defining this population in depth, the reader can determine how similar or different this context is to his or her own practice environment. Although the findings from studies such as this cannot be "generalizable" in the same sense as the findings from other research methodologies, they provide an in depth, contextual understanding of the topic being studied that may be transferable to other settings that are similar, whereas still being informative to those in settings that are different.³⁵

The aforementioned factors and strategies are rarely discussed among colleagues in formal quality-assurance rounds and are not usually addressed in the curricula of surgical residents. Residents can benefit from the comfort-zone framework and the surgeon-centric perspective on risk taking when working with their attending surgeons, as they will develop a better understanding of the risk-taking decisions of their teachers. More importantly, they will develop a better understanding of their own risk assessments when functioning independently in the teaching environment and ultimately when in practice. Increased awareness of these issues provides the opportunity to more publicly acknowledge them among surgeons and trainees. This has the potential to improve the culture of surgery and lead to a more thoughtful approach to clinical decision making.

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