

Thresholds of Principle and Preference: Exploring Procedural Variation in Postgraduate Surgical Education

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Abstract

Background—Expert physicians develop their own ways of doing things. The influence of such practice variation in clinical learning is insufficiently understood. Our grounded theory study explored how residents make sense of, and behave in relation to, the procedural variations of faculty surgeons.

Method—We sampled senior postgraduate surgical residents to construct a theoretical framework for how residents make sense of procedural variations. Using a constructivist grounded theory approach, we used marginal participant observation in the operating room across 56 surgical cases (146 hours), field interviews (38), and formal interviews (6) to develop a theoretical framework for residents' ways of dealing with procedural variations. Data analysis used constant comparison to iteratively refine the framework and data collection until theoretical saturation was reached.

Results—The core category of the constructed theory was called *thresholds of principle and preference* and it captured how faculty members position some procedural variations as negotiable and others not. The term *thresholding* was coined to describe residents' daily experiences of spotting, mapping, and negotiating their faculty members' thresholds and defending their own emerging thresholds.

Conclusions—Thresholds of principle and preference play a key role in workplace-based medical education. Postgraduate medical learners are occupied on a day-to-day level with thresholding and attempting to make sense of the procedural variations of faculty. Workplace-based teaching and assessment should include an understanding of the integral role of thresholding in shaping learners' development. Future research should explore the nature and impact of thresholding in workplace-based learning beyond the surgical context.

Traditional wisdom in medical education assumes that postgraduate learners acquire evidence-based best practices from their clinical supervisors.¹ This assumption seems straightforward enough, and it is the backbone of medicine's workplace-based training culture. However, we increasingly recognize that implementation of best practices is not such a straightforward process. Clinical research has shown that educators' beliefs about the relevance of best practices to their clinical work are not uniform and that significant practice

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variation can exist.²⁻⁵ In short, expert physicians develop their own ways of doing things and pass these on, explicitly or implicitly, to their trainees. Explicit acknowledgment of such variation and its role in training is rare,⁶ and research suggests that fear of faculty disapproval limits learners' attempts to ask questions around variations.⁷⁻⁹ Consequently, we understand little about how practice variation shapes workplace-based teaching,¹⁰ learning,¹¹ and assessment.^{12,13} The current study begins to address this knowledge gap with a grounded theory exploration of how senior residents in two tertiary care hospitals in Ontario, Canada make sense of the procedural variations of their faculty teachers.

Method

The study was approved by the research ethics board of Western University. We used marginal participant observation¹⁴ and active in-the-field interviews¹⁵ as a means of accessing how residents "enact"¹⁶(p119) learning in the context of procedural variations. Senior residents (n = 12) in their final or penultimate year of postgraduate surgical education were purposively sampled to recruit those with sufficient experience as primary surgeons to be rich informants. Observational data were collected using field notes and reflexive memoing across 146 hours of observation in 56 cases. The number of observed cases ranged per resident from 2 to 9 (mean = 4.8) and per surgeon from 1 to 12 (mean = 5.3) across 25 unique resident/surgeon pairings (mean = 2.1 per resident). Brief (4–5 minutes) focused field interviews (n = 38) were conducted with residents immediately after observed cases to explore one or two observed events related to practice variation and learning. We especially probed instances where residents asked questions or appeared to raise concerns about procedural choices during the case. Knowing the importance of silence in discussions across power hierarchies,¹⁷ we also asked residents about apparently awkward silences related to procedural decisions. Most observed cases contained such events (68%), and those cases that did not were not followed up with interviews. Audio-recording was not feasible for these "on-the-go" interviews, so standard "reconstruction"¹⁸(p96) techniques for field interviewing were used to capture residents' comments as close to verbatim as possible.¹⁹ Interview probes about procedural variations of faculty members, as identified by the residents in the interviews, were iteratively refined as the study progressed. Interviews increasingly asked about residents' thoughts on what procedural variations meant for their behavior and learning during surgical cases.

Data analysis followed the tenets of constructivist grounded theory.²⁰ Initial coding of field interviews and field notes used open, line-by-line coding to develop preliminary categories for a focused coding framework.^{20,21} Categories of social processes were constructed from constant comparative analysis,²² and a core category was identified.^{20,23} Following the construction of the categories, further theoretical sampling through formal interviews lasting an average of 34 minutes was conducted with senior residents (n = 6). Sampling aimed to redress gaps in the emerging theoretical framework and explore its early transferability. We purposefully sampled senior residents from additional teaching hospitals in Ontario, learners of different genders, and those in both their final and penultimate years of residency. These interviews were audio-recorded, transcribed, and analyzed for both emergent concepts and those already identified in the framework. NVivo 10 data management software supported

the analysis. Data collection and analysis ended when theoretical saturation was achieved and no further insights emerged regarding the core category.^{20,24,25}

Data collection and coding were conducted by T.A. (first author). Analysis of codes, constant comparison, and theoretical development were completed by the entire authorship group during iterative analysis meetings. Based on the tenets of constructivist grounded theory,²⁰ the analysis inherently carries with it the disciplinary perspectives of each member of the team: an MD/PhD student–researcher in medical education (T.A.), and four medical education researchers with disciplinary or specialty backgrounds in systems engineering (S.C.), neurology (C.W.), surgery (M.O.), and rhetoric (L.L.).

Results

We identified two key findings. The first is the core category itself—*thresholds of principle and preference*—as described below. The second is a grounded theoretical framework of how our participants responded to encountering these thresholds. Following recent calls to represent research findings more powerfully,^{26–28} we have elected to use core narratives that evoke the central theoretical constructs rather than outlining all categories and codes that led to their construction. The narratives are “thick descriptions”²⁹ of events encountered in the field, synthesized with direct quotes from field interviews (indicated by single quotation marks) conducted after the observed events. Identifying details have been changed to anonymize participants and programs.

Thresholds of principle and preference

Resident participants grappled daily with minor and major procedural variations. We observed residents navigating these variations and trying to ascertain which way to approach a particular procedural step for a particular surgeon. These attempts were variously praised, disparaged, accepted, rejected, or ignored by faculty. As we observed faculty responses to a resident over multiple surgical cases, it became evident that each surgeon possessed “a threshold”_(R11) of “surgical principles”_(R01) and “preference”_(R13) for each procedure. We characterized *principles* as surgeons’ rules regarding unequivocally acceptable or unacceptable procedural variations, and *preferences* as procedural variations that are perceived to be unlikely to have significant influence on the outcome of the procedure and are thus interchangeable. The threshold is the surgeon’s stance toward the possible variations for a given procedural step and is determined by his/her management of residents’ intraoperative choices.

The first narrative (Box 1) illustrates the core category, thresholds of principle and preference, by describing a final-year resident’s experience with variations between the surgeons he has worked with. In the narrative, the resident grapples with an approach to stapling.

Box 1**Narrative of Thresholds of Principle and Preference**

The resident pulls the stapler apart revealing a smooth line of gray staples across the tissue. Except at one end. At one end a final, and potentially superfluous, staple hangs slightly off the edge of the tissue. The resident, nearing the end of his training, pokes at the end staple before turning to talk to his junior resident. They agree together to move forward, leaving the staple in place. The surgeon, who has been standing in the doorway, says quietly, “might want to put clips across that.” Startled to know that she’s there, the resident turns quickly back toward the door. After seeing the surgeon he then turns back to the patient and flips the line of staples back and forth, examining it closely. “OK” he says, before saying “the staples do seem like they go all the way across.” “Seems like,” she replies from the doorway, drawing out the word “seems” as a way of making her point. He picks up the clips and approaches the line. “Fair enough,” he says as she walks out the door behind him.

He’s new to her team this week. After the case he reports that adjusting to the decisions she has been making has left him trying to decide whether they are ones he will hold, remember, and repeat, or ones he will exclude from his future practice: “I know there are some surgeons that have a reputation for having different orientations ... [but] I mean, it’s only been a week or so. So it isn’t really enough time to learn where that threshold lives. Our job as residents is to be adaptable, we basically spend a whole rotation trying to learn where that line is for the surgeon we’re working with. And then the next rotation we start all over again.” He laces his fingers together. “So here you’ll see a lot more of those miscommunications,” he says, pushing and pulling at his interlocked fingers to demonstrate. “But it is expected that someone at my level of training can handle that procedure. It is appropriate for me. And, like, we did that procedure yesterday, so she is comfortable with my skills.” (R10)

The resident in Box 1 suggests an approach to staples and is overruled. The next step for the resident is to decide whether the surgeon’s instruction is a rule about staples that he should always remember or a preference of an experienced surgeon. Residents in our study routinely projected the operative choices they encountered into the future to anticipate how they will act when they are “in the driver’s seat” (R09) holding “the steering wheel.” (R14) The resident in this narrative has the complex job of interpreting whether the instruction he has been given, for a procedure he perceives he can be trusted to complete, is an instruction he must always follow in the future.

Over the course of the study, residents interacted with many surgeons and, thus, with many thresholds of principle and preference. Thresholds are different for each surgeon; they are found anew for each step of each procedure residents are allowed to perform, and they are repositioned repeatedly as the resident develops over time.

Responding to thresholds

Residents appear to undergo a process of recognizing that procedural variations exist and then developing strategies for addressing the thresholds of principle and preference that they encounter. We constructed four categories of observed responses that vary in the degree of agency the resident appeared to have. The first two categories, *spotting* thresholds and *mapping* thresholds, characterize how learners recognize faculty thresholds as signposts to guide their behavior and facilitate smooth interactions with faculty surgeons. The second two categories, *negotiating* thresholds and *defending* thresholds, characterize those instances in which learners appear to engage more actively with a threshold and, in some cases, begin to articulate their own.

Processes: Spotting and mapping thresholds

Spotting thresholds and mapping thresholds are reactive processes during which residents recognize the presence of procedural variations. The existence of thresholds may not be clear to residents at the start of their training who felt that, “as juniors ... [they] didn’t *really* operate.”^(R01) What residents perceive it means to “really operate” is explored here in the second narrative. The narrative in Box 2 belongs to a resident halfway through the final year of her training. She considers the instructions she is being given for a procedure she may never perform again, while taking account of how and when the existence of thresholds became clear.

Box 2

Narrative of Spotting and Mapping Thresholds

Surgeon and resident are huddled over the surgical field. Despite the fact that she’s nearing the end of her specialty training, the procedure she’s working on now isn’t one she’ll be doing after she graduates. She would need subspecialty training for that. The surgeon holds the graspers and directs the resident where he wants her to use the cautery. He offers tissue to her to cauterize sometimes using only the movements of his tools and sometimes speaking to her in hushed tones as they bend over their task. Over and over he calmly and repeatedly adjusts small details: the angles of her hands, the plane she is cutting down.

Afterwards, she compares the kind of moment-to-moment directives he had been giving her to the simpler procedures she will be expected to do on her own. “It has to do with your training,” she says. “It’s not scientific. You just have to have faith in the way you do it. And the old guys are sticklers for technique. It’s actually useful. It’s not like there’s a really good study on those fine details. It’s like any sport I’ve ever played: You could be good, but don’t think for a second you can’t improve.” For her, being open to improving means not only relying on clinical guidelines; instead, it means allowing room for her surgeons’ suggestions on variations. That said, now, at this late stage of her training, she says she’s decided to mostly use “his way” for doing a common procedure and describes discovering that there are deeper and more finely grained procedural differences than she originally thought. “Finding a way is about respect. When you work with a surgeon you respect, until you start really working with them, you don’t see the difference. When I

was a junior everybody said he was the best, and I'm like: "Really? They all seem to do things the same way. But now I see it." (R11)

The resident in Box 2 retrospectively described the process of seeing variations between the surgeons and their thresholds of principle and preferences. At the earlier stages of her training there appeared to be procedural uniformity between the surgeons in her program. When she began to assume some responsibility for intraoperative decision making as a senior—what she describes as “*really* working with them” (R11)—the existence of a threshold started to become evident. Differences in technique came to signal more fundamental differences in “decision-making.” (R11) We call this process *spotting* thresholds. Residents who described this process remembered coming to “this kind of fatalistic view that it doesn't really matter what I do. What matters is doing what they want me to do, like thinking there's not much point deciding what I think is right or wrong yet because what I think at this point doesn't have much sway.” (R14)

The resident in the narrative described how spotting thresholds was followed by a process of recognizing that different surgeons have different thresholds. As one resident in our sample stated, “there's a slow uphill climb where eventually [some] staff are asking ... your opinion, but some staff not all. That's sort of a nice moment when all of a sudden they start deferring to your expertise or asking you what the way you prefer to do it is. That's sort of like an independence.” (R14) The residents come to see that not only is there more than one way to perform a procedure but also that the position of thresholds is “staff dependent” (R3): Two surgeons who make the same procedural decisions may differ on which parts of the procedure are alterable and which are not. We call this process of interpreting the multiple thresholds of different surgeons *mapping* thresholds.

Strategies: Negotiating and defending thresholds

Negotiating thresholds and defending thresholds are proactive strategies for responding to thresholds. The third and final narrative involves a senior resident who has just entered the second-to-last year of her training (Box 3). In the narrative, she describes the difference between negotiating thresholds and defending thresholds. She acknowledges her frustrations with the tacit nature of the thresholds she encounters, and she makes note of a strategy for recording individual surgeons' variations as a means of improving her ability to navigate these thresholds. But she also implies that keeping better track of the surgeons' thresholds might provide her with the agency to confidently defend her choices as she continues into her final years of training.

Box 3

Narrative of Negotiating and Defending Thresholds

They have reached a critical point in the procedure. Encompassed in a small bundle of tissue lies an artery and another vessel. As the primary surgeon at the moment, the resident's job is to peel away the fat and the fibrous tissue that enclose the two vessels without nicking or cutting either of them until the time is right to sever them both. She uses the cautery to pull away small pieces of the fat. The surgeon stands beside her, and if

he sees her waver for a moment he directs her where to go giving short but friendly stage directions—“let’s go up here for a bit,” he says. For the most part, she responds by wordlessly taking up the plane he suggests.

She comes to the area they’ve both been seeking for the last few minutes. After a minute or two of peeling, a new area of semitransparency appears—the hint of a potential window between the two vessels. Without asking first, she calls out for a new tool. The tool is a pair of graspers which, when used in reverse, can push light tissue like fat apart to open up windows. He watches, more silent than he has been up to now, as she touches down close to the point where she intends to make the window. She makes an attempt to push the graspers into the tissue and starts to open them. She pauses, adjusts her stance, and half turns her head toward him. “Let’s try the pusher,” he says before she has a chance to say something.

After he leaves, she describes how “some staff like to use the graspers, some the cautery, and some use pushing. With each [surgeon] you have to call [an instrument] out and then gauge if you’ve guessed the right one.” She looks temporarily exasperated. But, she says, “I should do a better job of taking notes about which each one likes. As a senior, when they’re more confident in your skills they might let you decide which way to go at it, but as a junior you’re more expected to do it their way.”^(R03)

After the resident in Box 3 called out her choice of instrument, she found herself wondering whether she had guessed the instrument he prefers. The surgeon’s silence confirmed for her that she had wrongly guessed his choice for this stage of the procedure. The surgeon did not openly condemn her for choosing a different one; instead, he waited for her to give him a small opening by looking at him before he guided her back toward his tool of choice. She expressed hope that in the future she might overcome the negotiating phase of thresholding and achieve the autonomy to use the way that feels most comfortable to her. “As you get more senior”^(R10) the residents perceived more latitude to ask probing questions or invoke the variations of a surgeon’s colleagues. The residents perceived questions as a way of negotiating thresholds, “not [as] asking to be rebellious or to resist”^(R7) but as a means of showing their knowledge of alternatives and because they were “genuinely interested in how [this surgeon’s] way works.”^(R7) This negotiating leads residents “to ask a lot of questions and make some tentative statements ... just sort of allowing [the surgeon] to guide you while not looking spineless. You make it clear that you’re not making a mistake, you’re just doing it the way that someone else has taught you. So, instead of them slaying you or thinking that you’re incompetent for not doing it the way they think is holy, you’re passing on that risk or responsibility to a previous preceptor.”^(R14) Negotiating these thresholds, therefore, is an important yet primarily indirect process.

Some residents also described strategies for defending thresholds. As they neared the end of their training, “it is about there being different ways to do the same thing, but by [the final] year you’ve usually got your own way ... [and] with the staff [surgeons] that really micromanage, I get passive aggressive and quiet cause there’s no point getting my back up ... sometimes they get it.”^(R12) Strategies for defending thresholds appeared limited to those that included this kind of intentionally unresponsive acquiescence. Although paying explicit

attention to variations encountered during procedural work might facilitate defending thresholds, “the question that’s not acceptable is asking *why* [a surgeon] do[es] it that way” (R03) while still in the confines of the operating room. Before considering explicitly asking why, residents felt that “you’re supposed to do what they do right? I mean, as soon as they leave the room you could do what you’re comfortable with. But, like, they’re still here. They’re just in the lounge. So you’re supposed to do what they want. It’s their case right?” (R13) Although strategies for defending their own evolving thresholds of principle and preference were described by residents, the surgeon’s ultimate responsibility for the patient led these strategies to be limited mostly to temporarily stepping out of a decision-making role in the procedure, to quiet acquiescence.

Discussion

A primary goal of workplace-based education is for learners to acquire and implement the best practices of their faculty supervisors.¹ Two issues complicate this goal. The first is practice and procedural variation, an important topic in both the clinical practice^{30,31} and medical education literatures.^{4,32,33} The second is the impact of these variations on workplace-based teaching and learning.³⁴ Exploring the pedagogical impact of practice variation can helpfully inform current efforts to formalize workplace-based assessment through new competency-based education frameworks.^{35–38} To encourage this exploration, we reflect here on the relationship between principles and preferences, the curious way in which they are both hidden and revealed, and the roles that learner thresholding may play in medical education.

What is the difference between a principle and a preference?

A principle is generally understood in medicine to be unchanging—a permanent fixture or inviolable rule that clarifies the decision-making process. Although the residents in our study did perceive their work of principle-finding necessary preparation to become safe surgeons, they also perceived principles to be subject to change. We deliberately did not focus on how residents decide what is safe or not, nor did we try to objectively ascertain which variations are based in principles and which are based in preferences. Instead, we asked residents how they made sense of being told to do the same thing different ways, regardless of whether they thought the difference was important or not. We found in their sense-making an interesting commonality: They struggled to explicitly describe what a principle *is*. They agreed that there were critical steps and decisions during a procedure that almost all surgeons would make. But they also spoke about how variably their surgeon supervisors would enact these principles. According to our resident participants, surgeons usually agree on what principle should be followed, but, at times, they have different interpretations of *how to follow it*. This variation noted by residents begs the question of whether their perception is a product of their level of expertise, or whether established surgeons would share their interpretation. Nevertheless, our findings suggest that residents learn to make sense of this phenomenon tacitly, without faculty input.

Why are thresholds opaque?

Residents discover thresholds of principle and preference despite a lack of transparency in the teaching they experience. In our study, as in others,^{39,40} faculty surgeons were rarely explicit about variations; they did not pause midprocedure for a detailed exegesis on the merits of a given procedural variation. Rather, the surgeons tacitly showed their thresholds—using the residents’ hands, directing them, cajoling them. Teaching about thresholds, then, was generally not what Ericsson and colleagues⁴¹ call “deliberate.” Instead, thresholds of principle and preference were opaque, largely because of the lack of explicit acknowledgment that procedural decisions could be enacted differently by different surgeons. The faculty surgeons in our sample were often explicit about what they wanted a resident to do in a given moment, but they tended to present their directives unequivocally as though they were principles. Residents, faced with a variety of such principles from different surgeons for a given procedure, come to realize that not all are principles—some are preferences—and through this process they come to see a threshold between principles and preferences. In some ways, their daily procedural work becomes centered on finding that threshold, for individual surgeons and, eventually, for themselves. The recognition of thresholds of principle and preference, then, is a powerful example of the tacit learning which permeates apprenticeships and workplace-based education.^{42,43}

Rarely did we observe a resident explicitly asking a surgeon *why* she or he prefers one variation over another. We heard residents freely ask surgeons *when* they would consider another option. We heard residents ask surgeons *where* they learned a variation. We heard residents ask *how* another variation would work. But *why* was a rare question. This begs the question, *Why don't residents ask why in the operating room?* The most straightforward explanation is that there isn't time in the busy surgical environment, but the findings of this study suggest a more complex answer. Thresholds are opaque not only because the normal flow of surgical work makes them so but also because the cultural expectations and social processes of surgical training can obscure why a surgeon's threshold is where it is. Contributing sociocultural factors likely include the ubiquity of scientific ambiguity in clinical evidence,^{3,7} the hierarchical nature of medicine's apprenticeship system,^{8,9,33} and an individualistic culture that prioritizes professional autonomy.^{44,45} We found that thresholds are rendered opaque thanks to a complex interweaving of such logistical and sociocultural factors. In response, residents use *thresholding* to navigate the opacity of thresholds and to learn to make decisions in the face of such ambiguity, rather than asking why.

Thresholding has both potentially positive and negative implications for medical education. On one hand, medical learners routinely navigate variations between faculty practices without iterative guidance³³ because medical education's rotational structure truncates the relationships between learners and faculty that develop in more longitudinal apprenticeships.^{46–48} Without continuity, a taboo against asking why may compound the phenomenon.⁴⁹ Unpacking this taboo should be a key concern for medical education researchers. The residents in our study reasoned that the credentials and social warrant given to surgeons and the surgeon's final responsibility for the patient's care explained why thresholding is restricted to such indirect means. It follows that a resident asking why may be perceived as a resident misunderstanding his/her place in the surgical workflow and hierarchy.^{17,40} On the

other hand, thresholding may help residents to prepare for independent practice by learning which parts of procedures are inviolable and which are not, especially in moments when common solutions have failed. Thresholding, then, may be an indicator of a problematically opaque learning system that reinforces traditional hierarchies. And, by forcing residents to rapidly process subtle and tacit social cues, thresholding may also be a promoter of necessarily adaptive expertise.⁵⁰

Is thresholding developmental or situational?

We have described four phases of thresholding: spotting, mapping, negotiating, and defending. The question remains: Are they developmental or situational? The residents in our sample described the initial phases of their training as not *really* operating: Their operative responsibilities appeared to be limited to acquiring basic technical skills, starting and finishing procedures, and significant time spent watching-while-retracting. When the time came to make major operative decisions, their thresholding strategies in the operating room were often limited to asking questions or temporarily stepping away from a decision-making role. If spotting, mapping, negotiating, and defending thresholds were indeed developmental phases, then we would expect to see that senior residents are not only better able to describe the variations for a given procedure but also that they become committed to a procedural variation and manage others around them to perform that variation.

Alternatively, though, if the thresholding phases are situational, we would see residents “return” to spotting thresholds and mapping thresholds when encountering new staff, new procedures, or new hospitals. The residents in our sample did tailor their thresholding to the faculty member with whom they were working. The residents described how some faculty members are amenable to residents negotiating thresholds with targeted questions and even to them presenting a case for thresholds of their own. But they also described faculty members with low thresholds for alternative variations, where negotiating was frowned upon and defending was out of the question. So thresholding must be at least partially situational. The answer, therefore, is likely a compromise: Thresholding is both developmental and situational. Adapting to new thresholds may lead to beneficial, situated learning, and an indicator of individual competence may be that residents know when to defend their personal thresholds and when to relinquish them.

What are the implications for teaching and assessing?

Thresholds of principle and preference provide medical education with a language to describe a powerful phenomenon that appears to happen largely without explicit discussion or recognition. However, at this point in our research, we cannot straightforwardly suggest that clinical teachers adopt this new language. It remains an open question whether every threshold should be explicated for every learner. The workplace-based education literature suggests that learning tacitly is an important element of professional development of expertise^{11,51,52} and that experts who attempt to render tacit knowledge explicit may sometimes distort it in the process.⁴³ We therefore advise cautious application of this language in workplace-based teaching settings. Advantages of its use include the possibility that expert teachers who explicitly show the logic of their thresholds may build stronger educational alliances¹ with learners and may assist learners in accurately interpreting the

role of principles and preferences in expert practice.⁵³ Potential disadvantages include oversimplification of the concepts at play^{54,55} leading to tension around the sensitive topic of individual practice variation and its relation to standards.^{7,43,56} In short, there is much left to explore here regarding thresholding in professional workplaces. Research about tacit learning that “does not suffer from any delusions about how far [clinical practice guidelines] will take us nor lose awareness of just how much interpretation of guidelines may be needed when making decisions about individual cases”⁴³(p125) will require significant further exploration of thresholds and thresholding in the future.

The new language of thresholds and thresholding also opens up new questions regarding workplace-based assessment. How, for instance, do thresholds of principle and preference influence surgeons’ judgments about residents’ competence? This question deserves scrutiny as medical education moves toward competency-based assessment and entrustment decisions.^{57–59} We speculate that defining the frame for entrusted units of work, described as a communal activity in the entrustable professional activity literature, might necessitate faculty conversations about thresholds of principle and preference.⁶⁰ Our findings regarding the opacity of thresholds suggest that such conversations may be a strong departure from surgery’s cultural norm. More inquiry into thresholding will assist our understanding of how faculty will make collective decisions about entrustment or even how their individual entrustment decisions may vary on the basis of their thresholds.^{61,62}

Limitations

Our study design necessarily shaped the nature and implications of our results. Asking residents about a potentially sensitive topic—their supervisors’ procedural variations—within the hospital setting might have led some participants to offer socially desirable answers.⁶³ We addressed this challenge by continuing our observational process over eight months and by triangulating indirect communication such as silences, body language, and humor with more private, retrospective interviews.⁶⁴ The potential for observer effects⁶⁵ was handled through triangulation, rigorous field note procedures, and longitudinal observations. Finally, the study design did not explore faculty perceptions of thresholds and thresholding; their insights will undoubtedly enrich the theoretical constructs described in this work, and they are the subject of our current research.

Conclusions

Postgraduate surgical learners make sense of procedural variations by coming to understand thresholds of principle and preference. Learner thresholding plays an important and previously unacknowledged role in workplace-based teaching and learning. The importance of thresholding to residents suggests that they may alter their performance to suit the thresholds of faculty members in day-to-day teaching situations. These initial exploratory findings raise important questions about the subjectivity of observations in workplace-based assessment which merit further investigation. For instance, to what degree are faculty aware of their thresholds of principle and preference? When are faculty assessments based on mimicry of preferences rather than a performance of principles? And how does the thresholding phenomenon manifest in clinical settings beyond surgery? Beginning to engage

with these challenging questions may help medical education to implement assessment strategies that account for the complexity of clinical practice and learning.

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