Factors Affecting the Development of Confidence Among Surgical Trainees

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OBJECTIVE: The objective of this study was to explore and better characterize the factors affecting confidence during surgical training.

DESIGN: This was a qualitative research study in which we conducted semistructured interviews with surgical residents to explore factors affecting their confidence.

SETTING: This study was conducted at the University of Alberta Hospital, a tertiary care center located in Edmonton, Alberta, Canada.

PARTICIPANTS: Residents from the University of Alberta General Surgery residency program were invited to participate from each postgraduate year (PGY) 2, 3, and 4 for a total of 7 participants (3 PGY-2, 3 PGY-3, and 1 PGY-4; 3 male, and 4 female). We excluded residents who had completed or were currently enrolled in dedicated research years.

RESULTS: Resident confidence was found to be influenced by internal and external factors operating before, during, and after a particular surgical task. Internal factors incorporated personal experiences (including operative experience), personal expectations, self-perception, and individual skill development. External factors involved feedback, patient outcomes, relationships with staff, and working within a supportive environment. Interestingly, residents discussed external social factors more than case volume, technical skills, or underlying knowledge. Residents did not feel that their personal lives (e.g. marital status or having children) directly affected their surgical confidence. Regardless of the factor itself, positive experiences helped build and maintain confidence by providing feelings of reassurance, encouragement, comfort, and acceptance.

CONCLUSIONS: Surgical confidence is influenced by a range of internal and external factors. Understanding these factors can help educators improve learning experiences for residents and accelerate their progress towards being confident, independent surgeons. (J Surg Ed 76:674–683. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Resident confidence, surgical education, general surgery residency, postgraduate education

COMPETENCIES: Practice-Based Learning and Improvement, Medical Knowledge, Interpersonal and Communication Skills

INTRODUCTION

North American survey results over the past 10 years suggest that more than 20% of residents have concerns about their surgical skills and ability to practice independently by the end of surgical training.[1–5] These studies imply there is a problem relating to the confidence and preparedness of residents to operate independently, a so-called "confidence crisis."[6] With links to education[7–9] and performance,[10,11] confidence is a highly important concept during surgical residency training.

To understand variances in trainee confidence, several studies have examined potential influencing factors using surveys and questionnaires. Binenbaum et al. found that independent decision-making opportunities and having good backup support were ranked among the highest contributors to the development of physician confidence.[12] Patient cases, professional interactions, and general learning of medical or surgical knowledge were also rated highly.[12] Interestingly, vacation time and personal time spent with family and friends were ranked within the top 15% of items that contributed to the development of physician confidence.[12] Another large study by Bucholz et al. found that being a senior resident, being married, and the type of

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residency program (community hospital, decreased number of residents in the program, and no fellows) were all independently associated with higher levels of confidence.[1] The importance of mentorship was also mentioned in Bucholz's study, as residents who were comfortable asking mentors for help reported increased levels of confidence.[1] Several additional studies report the association of increased procedural number[2,3,13,14] and male gender[1–3,13] with increased confidence levels.

In summary, the literature suggests that the development of confidence during surgical training is multifactorial and affected by both trainee-specific and program-specific factors. However, to date, researchers and not residents have generated the factors influencing confidence. The objective of this study was to prioritize resident's perspectives on the factors influencing their development of confidence during surgical residency training by using qualitative research methodology.

METHODS

Setting and Participants

This qualitative research study was carried out at the University of Alberta Hospital located within Edmonton, Alberta. Ethical approval was granted by the University of Alberta Health Research Ethics Board (Pro00066174). A descriptive approach was used to frame the study – we wanted to discover and better understand the factors affecting confidence, from the surgical resident's perspective. Using email, residents from the University of Alberta General Surgery program were invited from each postgraduate year (PGY) 2, 3, and 4. First-year residents, PGY-5 residents, and those who had completed or were currently enrolled in dedicated research years were excluded from our study.

The first year of General Surgery at the University of Alberta is largely spent on off-service rotations, including nonsurgical rotations, with little time spent operating. The PGY-5 year is a unique experience at our institution, as the last 3 blocks of the academic year are spent in preparation for the Royal College Exams, and during this time clinical activities are limited. Taking time off for research is optional at our institution and varies from 1-3 years, while residents work towards a Master's or Doctoral degree. Recent research has suggested a decline in confidence regarding both clinical knowledge and technical skills associated with dedicated research time.[15,16] Taking these issues into consideration, as a group (M.L., B.Z., L.D., and J.W.) we felt it would be difficult to compare PGY-1 and PGY-5 with the remainder of residents, and instead decided to concentrate on the confidence experiences of PGY-2 through PGY-4 residents who had not taken time off for dedicated research years.

At the time of this study, the University of Alberta General Surgery program had 43 residents. Participation in this study was completely voluntary and owing to exclusion criteria there were a limited number of residents to recruit. In total, we had 7 volunteer participants (3 PGY-2, 3 PGY-3, and 1 PGY-4; 3 male and 4 female).

Data Collection

Data for this study was collected through the completion of a preinterview activity, a semistructured interview, and a postinterview research brief/member check. The definition of confidence ("belief that you can do something well or succeed at something") was provided to all participants prior to beginning the research study. The purpose of the preinterview activity is to facilitate a participant's recollection and reflection[17] and often involve diagrams, drawings, and pictures. The relational map is also known as a "graphic elicitation technique." Complex feelings and perspectives are often difficult to describe in text and preinterview activities can help participants express or depict feelings and perspectives about the topic at hand. When these activities are given in advance of the actual interview, they also allow more time for the participant to analyze and reflect. Additionally, the preinterview activity can serve as an effective icebreaker, while also stimulating the participant to think "outside the box" therefore avoiding ready-made answers and encouraging a more holistic narration of self.[18] The preinterview activity was emailed to the participant approximately 1 week prior to the scheduled interview and consisted of a "fill-in-the-blank" diagram called a confidence relational map (Appendix A). Relational maps are frequently used in psychological/sociological studies and various types exist.[18,19] For the purposes of this study, a concentric circle model worked best and this was adapted by the lead researcher (M.L.) to reflect factors affecting confidence. The participant brought their diagram to the interview and subsequently discussed/explained it as part of their interview. The interview guide was developed by the lead researcher (M.L.) and designed to explore resident experiences with confidence during their surgical training (Appendix B). Confidence is a concept that can differ significantly among individuals and situations. To ensure that all participants were approaching confidence from a relatively shared definition, the researcher specifically asked them to define confidence (Appendix B). A single semistructured interview was conducted in person with each volunteer participant by the lead researcher (M.L.). Interviews varied in length; the shortest was 38 minutes and the longest interview lasted 77 minutes. Each interview was audio-recorded, transcribed verbatim, and deidentified. Each resident received a postinterview summary of their responses to review.

Data Analysis

We used thematic analysis within a constructivist paradigm to inductively analyze interview transcripts. Of note, the participant's discussion of their confidence relational map during the interview was analyzed, not the diagram itself. Data analysis was performed by the lead researcher (M.L.) and completed in groupings based on PGY, i.e., all the PGY-2 interviews were analyzed at the same time. Transcripts were read iteratively and each cycle was hand coded in a different color. Descriptive coding and in vivo coding were used to identify recurring phrases/words. Codes were organized into an excel spreadsheet and grouped into categories based on topic. Representative quotes were compiled for each category. From the categories, themes were developed. Data analysis was ongoing, repeatedly revisiting the results/transcripts to evaluate whether "the whole" represented "the parts" and vice versa. A second coder (J.W.) went through all transcripts and examined the data in a similar fashion. The second coder is a surgeon who also has experience with qualitative research and medical/surgical education, thus provided valuable insight during the data analysis process. Our group (M.L., J.W., L.D., and B.Z.) met several times to review the results and subsequently develop a conceptual framework.

RESULTS

Framework of Surgical Confidence

The conceptual framework that we developed considered internal and external factors that affected resident confidence before, during, and after any particular surgical task. Representative quotations of internal and external factors, relating to different task stages are provided in Table 1.

Internal Factors Affecting Confidence

Internal factors generally reflected a participant's personal traits, abilities, and feelings. Personal experiences, self-perception, personal expectations, and individual skill development were all classified as internal factors. Perception of self was an important intrinsic factor, as residents repeatedly expressed concerns about what others thought of them, what they thought of themselves, and how this impacted their training and confidence levels. Personal expectations also played a role, primarily in relation to the PGY-level of the resident. Residents expressed concerns about whether they were performing at the level they should be (i.e., am I doing what a PGY-X should be doing?) and this often lead to peer comparisons.

When reflecting on their surgical training, the notion of "not looking like an idiot" was brought up by several residents and reflected how they felt when making mistakes or errors. Not knowing the right answer when asked a question, making a clinical mistake/error, and not being able to perform an operation were all commonly described situations that made residents feel "like an idiot," thus lowering their confidence levels. Importantly, the fear of looking like an idiot made some residents hesitant to ask questions:

> *"...like you get asked 'why would you flush that drain?' and then you think, 'well I don't understand why I wouldn't have flushed that drain' but now I'm too scared to ask that question...that takes a step back from your confidence. When you're kind of treated like you're an idiot for not knowing, but then you're scared to ask because you don't want to look like more of an idiot."*

Stress, mental health, fatigue, and self-esteem/inherent self-confidence also had a role, although more indirect. Residents felt that these factors affected their happiness and overall mindset, which in turn made it easier for them to build confidence and resilience:

> *"...so that you're happy, then it's easier for you to build up your confidence and build up your sense of self, so that even setbacks don't affect you as much."*

Similarly, residents did not think elements of their personal life, e.g., marital status or having children, played a direct or significant role in their confidence at work:

> *"...I feel like it makes you feel more whole as a person, which makes you feel better at work, but I don't think it directly affects my confidence."*

Residents felt that experience was crucial to the development of confidence. Lack of experience leads to less confidence and being less comfortable completing a task or participating in a certain situation. More experience, whether with the same task/situation or a related one, resulted in more confidence and more comfort. One participant felt that personal experiences were initially more helpful than book knowledge:

> *"I think when you see something that you've seen before, it's kind of an obvious thing but it really, and you really do draw on personal experiences a lot. Because that, I think, tends to lead ahead of your book knowledge."*

Seeing their skills and abilities develop and improve throughout training greatly increased resident confidence. Recognizing their improvement when comparing their skills as a senior compared to a junior, completing their first independent appendectomy, or performing much better on the mock oral exams proved to residents that they were learning, getting better, and truly becoming a surgeon:

TABLE 1. Framework of Surgical Confidence — Internal and External Factors Affecting Confidence Before, During, and After a Surgical Task

Illustrative Quote	Internal	The Surgical Task	External	Illustrative Quote
"...past experience. Say if I do three appies in a day with Dr X...the first appy goes great-...you go on to your next appy having that confidence and it just becomes better...it's not that it is better or you are better, you could even be a little bit worse, but in your mind everything looks better because you did the last one really well, so you start the next one without any hesitancy or anything. So I think every past experience helps build that."	**Experience**	**BEFORE**	**Patient Factors**	*"So hernias, appies, choles, you're going to feel more confident vs a complicated procedure like...a subtotal colectomy for ischemic bowel in a sick patients...Kind of the same explanation for urgency of the procedure, if it's stat vs elective."*
"Other people's perception of you is one thing, but personal perception also matters. At the end of the day you probably think you're stupid...in your own mind, you always think you're way worse."	**Personal Expectations**		**Supportive Environment**	*"It's definitely the more controlled environments where you have the chance to shine and build confidence. It allows you to show them what you can do."*
"Someone who has no self-confidence whatsoever, you can't do anything to change that sometimes."	**Self-esteem**			
"If you're tired, you feel like crap and you're slower, so you think that you might not be doing things as well and that can affect your confidence."	**Stress**			
"I find talking through it or explaining myself makes me more confident in what I did and the decisions that I made."	**Confidence Boosters**	**DURING**	**Teacher Support**	*"The support you're provided by others, especially staff... if they provided you with that support to do it, without even having to ask, then that would help. The unsupportive ones don't help anything"*
"I definitely feel like the more you operate, the more you feel like you would be able to figure your way out of a procedure that you haven't necessarily done before."	**Experience**		**Rapport with Teacher**	*"...when I feel comfortable around them I can perform to the best of my ability, and even when they're quizzing me and I get things wrong, it's not a reflection of me, like how good of a resident am I, it's just a learning opportunity."*
"For me, confidence is all about experience. I've done it before, so I can picture myself doing it again."			**Senior Back-up**	*"If you have good mentorship, you have someone who encourages you, someone to ask questions of...and I think that helps build up confidence in yourself, your specialty, and your choices."*
			Feedback	*"Times that contribute to increased confidence would be good rotations where you felt like you learned a lot, contributed a lot, were valued and then validated with positive feedback and evals. This helps give a permanent boost to your confidence."*
"So momentarily devastating to my confidence, and then I went home and read about it, and	**Dealing with Failure**	**AFTER**	**Clinical Outcomes**	*"If they get complications or things don't go well...it ruins your day...when you have a case where the patient*

(continued on next page)

TABLE 1. *(continued)*

Illustrative Quote	Internal	The Surgical Task	External	Illustrative Quote
walked through it so I wouldn't look like an idiot again." *"The other thing…that also builds your confidence, is that you don't always see that you are better than you were…then you work with a fresh R1 and they are so inexperienced, and you think 'wow, that was me and now I'm here, so I guess I have learned some stuff'."*	**Skill Development**		**Feedback**	*does well, they're happy, go home and everything is good, then that really builds confidence a lot."* *"…feedback to me would be ongoing, either constructive criticism…just good or bad…they give you good feedback or tell you 'good job', that definitely boosts my confidence."*

"If you don't think you've gotten better at x, y, and z when you look at the beginning of the year compared to the end, then no matter what your eval says, or what your inherent sense of self-confidence is, or how many [cases] you've done…if you don't think you've done it any better or you think you're just as bad then you're not going to feel any more confident."

Overcoming challenges and successfully completing tasks that are above a certain level was also discussed as a significant confidence booster for residents. These moments' reassured residents that they were indeed learning and progressing well.

External Factors Affecting Confidence

External factors generally represented situational factors or outside forces that played a role in the development of confidence. Patient factors, feedback, relationship with staff surgeon, and working within a supportive environment were all identified as external factors. Patient factors included patient outcomes (i.e., whether they experienced a complication or not), patient acuity (i.e., unstable patient), and difficulty of the patient's case/operation. In some situations, residents felt that patient complications or failures reflected their abilities, thus causing them to feel less confident if things went poorly. When things go well with a patient's operation/admission/etc., residents described feeling more confident in their abilities and judgments. Similarly, residents expressed less confidence when dealing with unstable patients or participating in difficult operations.

Receiving useful feedback was highly important and this was reiterated multiple times by all participants. Staff surgeons, senior colleagues, or peers were sources of feedback. It can be informal or formal, but should be direct, useful, and occur on a regular basis. Positive feedback contributed the most to confidence levels by providing positive reinforcement/affirmation and encouragement. Negative feedback could be useful if given in a constructive manner. As 1 resident pointed out:

"...a lot of staff are very good at pointing out what you're doing wrong, and they're bad at saying what you're doing wrong and how to fix it."

Furthermore, residents felt that:

"Telling me that I'm doing something wrong isn't helpful, but telling me why I'm doing it wrong and how I can do it right makes a big difference."

A resident's rapport with the staff surgeon also has meaningful effect on confidence levels. Most residents

described a 'good' staff relationship as one in which they felt comfortable with the staff and not scared or intimidated by them. Feeling comfortable working with a staff surgeon made it easier for residents to ask questions, make clinical decisions, and attempt the unfamiliar without feeling dumb or belittled:

> *"If you're terrified of your staff, then your self-confidence is lower than it probably normally is, right from the get-go. If you make any errors or consequences in that staff's presence, it's going to be amplified and affect your self-confidence even more so."*

Knowing that a staff surgeon trusted you was also associated with increased resident confidence. Being given responsibility (e.g., allowed to start the case) or being independent and operating without the staff proved to residents that the staff trusted them and had confidence in their abilities, therefore making residents feel more confident themselves. Residents also appreciated when staff surgeons let them struggle and try to problem-solve when encountering a challenge:

> *"… if you're doing a chole, as soon as you put your instruments they say, 'oh – looks like a tough one, why don't you let me poke around' vs the staff that lets you struggle, and trusts that you won't make horrific errors and lets you battle through it, that really builds your confidence."*

Lastly, working within a supportive environment was described as increasing confidence. This feeling of support was described as coming from all colleagues, not just the staff surgeon. This included nursing staff, peers, senior residents, chiefs, physicians from other specialties, etc. Regardless of the setting, feeling supported and encouraged by those around you helped increase confidence levels. Having senior back-up also helped increase confidence – for example, knowing there was always someone around to ask questions provided reassurance, support, and encouragement:

> *"…having someone more experienced then yourself telling you that is exactly what they would do - that really helps move you along the ladder and you feel more confident and efficient and more competent. That is a huge one – just having someone say 'yup, you're okay there' – reassurance."*

Relationship to the Task

Residents described their confidence in relation to specific tasks, such as performing a surgery, making a clinical decision, or seeing a patient while on call. These descriptions were divided into those occurring in anticipation of the task (before), in the middle of task performance (during), and reflecting upon the task (afterwards).

Before a surgical task, certain internal factors play a role in developing resident confidence and contribute to a positive mindset. These include previous experience, personal expectations, inherent self-esteem, and underlying levels of stress. External factors that are important before the task include patient factors (case difficulty, "sick" patient, and emergent operation) and working within a supportive and encouraging environment.

During the task, confidence boosters and prior experience were described as significant factors. For example, residents described talking out loud while operating as a personal way to make themselves feel more confident in a difficult situation. Personal experience also played a role during the task as residents think of previous similar cases to help them during novel situations. External factors that help with confidence during the task included teacher support, rapport with the teacher, and having senior back-up (being able to ask for help). Residents also felt that it was helpful to have direct and immediate feedback, whether negative or positive, while actively doing a task, particularly if the task requires technical skill.

After the task, residents were able to appreciate any errors or mistakes that might have been made, their own personal improvement, and their ability to see whether they have overcome a challenge (dealing with failure and skill development). Feedback after task completion was also important for developing confidence. Working within a supportive environment and relationship with the staff surgeon seemed to have the biggest effect on resident confidence while performing the task, whereas feedback regarding completion of the task appeared most important afterwards.

Using the study findings, one can picture the scenarios or circumstances that create a confident resident vs the scenarios that contribute to an uncertain resident. When comparing our conceptual framework to the hypothetical situations of a high-confidence resident and low-confidence resident, the framework resonated with our findings (Table 2).

DISCUSSION AND IMPLICATIONS

Confidence is influenced by a range of several factors, both internal and external. Internal factors included categories such as personal perception and expectations, previous experiences (i.e., operative), and seeing personal skill development. External factors reflected outside forces that affected confidence, such as feedback from teachers, patient factors, rapport with staff surgeons, and being able to work within a supportive environment. Our study confirms that the development of confidence is multifactorial,

TABLE 2. Hypothetical Characteristics of Trainees With "High-confidence" Vs "Low-confidence"

High-confidence	Low-confidence
• Seen and done as many operations, consults, and patients as possible and thus has considerable experience • Senior resident closer towards the end of their residency • Solid knowledge base and comfortable asking/answering questions without fear of judgment or ridicule from other residents, staff, or colleagues, especially if they answer incorrectly • Operative experience would be mostly elective cases done on stable patients, and in operating rooms without time constraints therefore avoiding feelings of being rushed and flustered • Trusted by staff to start the case independently and continue as appropriate for their postgraduate level of training • When encountering challenges, the resident would be allowed to struggle, within reason, to learn how to problem solve on their own • The resident feels supported and encouraged by their educators • Mistakes or errors would be viewed as learning opportunities, and not occasions where they are belittled • Receives constructive, direct, and specific feedback on a regular basis	• Minimal experience, operative, and otherwise, which could be due to decreased case volume and/or junior level of training • The resident might feel that their knowledge base is lacking and they can't seem to ever answer questions correctly, for which they think they are "the stupid one" • The resident often feels rushed in the operating room, clinic, or while doing consults and subsequently get flustered • When they make mistakes, they are notified they are wrong, but not taught *why* they were wrong or how to improve/correct upon their mistake • The resident might get belittled and beaten down for not knowing the answer, and thus are afraid to ask questions • While operating, the resident does not receive much autonomy, they aren't allowed to start a case or complete portions of the surgery appropriate for their postgraduate level of training

with influences from both trainee-specific and program-specific elements. The following paragraphs highlight several ways that our results support or diverge from existing quantitative studies examining the factors related to surgical confidence.

Our results contrast with a number of other studies which have examined surgical confidence. While others have previously reported the importance of surgical case volume and operative autonomy as being important for confidence, our results clearly show that other factors play a substantial role. Bucholz et al. also established that PGY-level, mentor's perception, and being comfortable to ask for help affected confidence.[1] Binenbaum found that being able to make decisions independently and having good back-up support largely contributed to the development of resident confidence,[12] findings reiterated in this study. Surgical case volume and operative autonomy are often cited in the literature and mentioned anecdotally as key elements for developing confidence (and competence) among surgical trainees.[2,3,12,14,20] Our participants focused on the importance of surgical experience and repetition of those experiences for the development of their confidence, not necessarily 'case volume' alone. Our study findings particularly resonate with an article from a nursing journal that outlines the antecedents of confidence.[21] In her article, the author lists several factors that overlap with our findings, including knowledge, past experiences, personal goals, instructor influence, external stimuli, and self-esteem, to name just a few. The author believes that promoting these factors and culturing them in the clinical setting is important for development of confidence with benefits seen for students, staff, and patients as well,[21] a sentiment that we share as well.

However, several of the factors that have been focused on in existing research were not important to residents when asked directly. For example, residents in our study reported that spending time with family and friends contributed to their overall happiness, but did not feel that their personal lives (i.e., marriage, children) played a direct role in their surgical confidence. This is in comparison to Binenbaum's study, in which resident's ranked personal time (including vacation time and time spent out of hospital with family and friends) as having a large contribution to developing confidence.[12] Similarly, Bucholz et al. found that married residents with children felt more confident compared to their counterparts.[1] In several studies, male gender was associated with increased confidence.[1-3,13] Only 1 participant during our study brought up the notion of gender differences, although this was not specific to surgery or a recurring theme throughout that participant's interview and thus was not retained in our analysis. Additionally, our interview questions were not specifically developed to bring out gender influences. It is possible that the impacts of gender on confidence may have been more noticeable if our participants were asked more directly about it.

In addition to building up confidence, residents mentioned several factors that negatively affected confidence. They described these factors as inciting feelings of inferior intelligence, inadequacy, and frustration, and participants focused on these negative elements during their interviews more than the positive contributors. Individually, each of the negative experiences may not seem damaging, but in repeated combination, they create the perfect storm to undermine confidence. In this vicious cycle negative experiences cause declines in confidence levels and can leave the

resident in the "confidence gutter" making it much harder for a resident to resume their previous level of confidence. In essence, residents described feeling that confidence often took 2 steps back for each step forward. Our study findings can increase educator awareness of factors that could be negatively affecting resident confidence levels. Program directors and residency training programs can use the knowledge gleaned from this study to provide better educational experiences for residents, with the goal of maximizing resident confidence. By focusing on factors positively associated with confidence and decreasing/changing factors with negative associations, educators can improve resident learning experiences and accelerate their progress towards becoming confident and independent surgeons. For example, knowing that constructive feedback has a large impact on resident confidence, program directors, and staff surgeons could implement changes to improve the quality and frequency of feedback that residents receive throughout their training.

Limitations

To limit the potential for researcher bias during our study, interview questions were open-ended and specifically worded to avoid positive or negative connotations. During the interview, feedback was provided using verbal and nonverbal cues that remained as neutral as possible. Furthermore, the lead researcher (M.L. —responsible for study design, data collection, and analysis) remained transparent and reflexive throughout the entirety of the research process. Our participants were only interviewed once and it's possible that recent experiences and their level of confidence biased their responses at the time of their interview. The use of a preinterview activity helped us to combat the need for multiple interviews, as it facilitated participant's recollection and reflection prior to the actual interview. Additionally, our sample size was small and participants were residents from a single surgical program at a single institution, a limitation easily addressed by repeating the study with more residents from general surgery, another surgical specialty, and/or another university.

CONCLUSION

Being able to encounter difficult situations and self-doubts throughout training requires residents to maintain and increase their confidence over time. This study suggests that multiple factors play a role in building confidence through the development of skills and knowledge. While we cannot not confirm nor deny the existence of a 'confidence crisis', this study advances our understanding of the factors that affect the development of confidence in surgical residency training.

STUDY DESCRIPTION

This was a qualitative research study in which we conducted semistructured interviews with 7 general surgery residents to explore factors affecting their confidence levels.

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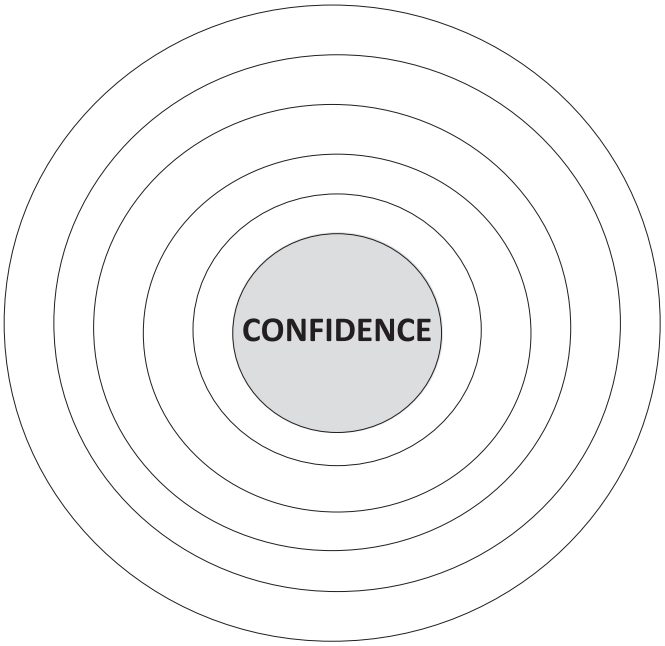
SUPPLEMENTARY INFORMATION

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jsurg.2018.10.016.

APPENDIX A: CONFIDENCE RELATIONAL MAP



INSTRUCTIONS:

Confidence is the center of these circles. This represents your confidence during your surgical residency training. Think of the factors that affect your confidence (neutral, positive or negative). These factors can be anything you can think of (social, academic, emotional, technical, values, etc).

Arrange these factors in order of importance within the concentric circles. Factors placed CLOSEST to the center imply the most importance, i.e. the further from the center, the less importance of that factor on your confidence.

APPENDIX B: INTERVIEW QUESTIONS

Group 1: Getting to know you questions

- If you could pick one thing that you wouldn't have to worry about anymore, what would it be?
- If you had one week off a month (or 2 days per week), what are some of the things you would like to do with your extra time?
- What are some of the things you like about being your age? What are some of things that you don't like so well?
- Is there anyone (real or fictional) that you admire and would like to be like?
- When you were younger, what were some of the difficult things you can recall doing? How did you approach such things?

Group 2: Questions about surgical residency

- Before you began your surgical residency training, what did you think would be the more interesting parts of the experience?
- Have you changed some of your ideas about the interesting aspects of surgical residency or which aspects are more interesting?
- What did you think would be the more difficult aspects of a surgical residency? Did you have any surprises with regards to what is or is not more difficult?
- If you could make any changes to the surgical residency training program, what are some of the things you would change so that it could be a better experience for someone like you?

Group 3: Questions about developing operative confidence during surgical residency training

- During residency, what kinds of circumstances make it easier to feel confident?
- Would you say there are particular kinds of surgical experiences that make it more difficult to feel confident?
- In a surgical situation in which it is difficult to feel confident, what are some good things to do that help boost your confidence?
- How would you say your confidence in doing surgery during has changed over time during your surgical training?
- What are some of the hospital experiences that help boost your confidence the most? (i.e., clinic, OR, and emergency room)
- What are some elements outside of the hospital that helps boost your confidence?
- Can you say more about the kinds of experiences or events that contributed to any of your changes in confidence?
- Any words of advice to someone just starting surgical residency training?

Group 4: Close-ended questions about confidence

- What does the term confidence mean to you? How would you define it?
- Why do you think confidence is important during residency?
- What do you think is the most important factor for developing confidence during residency?